

# Spatial Design Recommendations for Inclusive Early Childhood Learning Spaces

## Major Research Project

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for the degree of Master of Design in Inclusive Design, Toronto,  
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# Abstract

Effective design of an inclusive early childhood learning facility can foster learning for children with special cognitive needs. Inclusive early childhood learning facilities are integral in supporting children aged 2.5- 5 years by providing them with a space that offers flexible and adaptable programming to meet their individual needs.

Data collection methods employed in this study include a literature review and semi-structured interviews. The intent of the study was to include and capture perspectives of built environment designers, educators, and other experts in this area of study, by exploring existing knowledge and literature on learning needs of children with special cognitive needs, impact of learning space design on child development, principles of learning space design and ways to include perspectives of multiple groups of stakeholders in the process of design. Semi structured interviews were conducted with educators who are involved in the process of inclusive learning in early childhood learning facilities and school board therapists who understand the learning needs of children with special cognitive needs. Data collected using above mentioned methods was amalgamated and analyzed using thematic analysis to propose spatial design principles, strategies, and recommendations to design and create effective and inclusive early childhood learning spaces that address the needs of children with special cognitive needs. This study attempts to make the first step towards creating design recommendations for inclusive early childhood learning spaces that capture perspectives and opinions of included stakeholders. Next steps in this process could be, including advice, perspectives and solutions proposed by children and their parents on the generated recommendations to iterate, test, and verify them. This study also provides insights and strategies to support the potential next steps. This study is grounded in inclusive research methodologies.

**Abstract:** Learning Spaces, Inclusive Design, Early Childhood.

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# Chapter 1: - Introduction

## ***Chapter Overview***

Inclusive early childhood learning facilities allow children with diverse abilities to learn and grow together. Factoring special cognitive needs into learning space design and the built environment could promote the ability of children to understand, accept differences, and eventually reduce stigma.

This chapter outlines the context of this study elaborating on the role and importance of inclusive early learning spaces followed by children with special cognitive needs and policies on inclusive early childhood education in Canada. It also defines the target population and various categories of learning spaces present in an early childhood learning facility.

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## 1.1 Problem Statement:

Spatial Design interventions that foster inclusive learning in early childhood learning facilities have the potential to inculcate the concept of inclusion in a child's early life. Introducing the concept of Inclusion through physical spaces and learning programs in early learning facilities can certainly be the first step towards fulfilling the dream of sustainable inclusion and a future where inclusivity as a notion is embedded in the roots of our society. Inclusive early childhood learning spaces embrace diversity and foster participation of all children.

Previous research on inclusive early learning environments highlights the lack of involvement of users and stakeholders in the process of innovation, making the design outcomes to be for the user but not with the users. Understanding the diverse learning needs of children along with special needs is crucial to creating an inclusive learning environment.

Despite federal enforcement of building codes and policies on accessibility and inclusion in early childhood learning spaces, the gap that exists between theories of inclusion and its practical onsite implementation creates barriers for users with special needs to experience inclusion in their everyday lives.

Early childhood is a critical time for brain development, and children with special cognitive needs require a learning environment that accommodates their unique learning styles, abilities, and challenges. Designing learning spaces that address special cognitive needs can help children with learning disabilities, attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), and other special needs to better engage with learning activities and achieve their full potential.

The complexity of unique user abilities poses a challenge to establishing spatial design norms and guidelines to create equitable learning spaces, this study attempts to explore the process of proposing design recommendations for inclusive learning spaces along with some stakeholders promoting a context specific approach to enhance inclusion.

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## 1.2 Research Objective:

This study aims to explore ways to identify and intervene early childhood learning spaces to foster the process of learning by documenting and capturing the perspectives of some stakeholders involved in the process of inclusive learning at early childhood learning facilities. This is an attempt to narrow the existing gap between theories of inclusion in terms of spatial design and its application by proposing potential design recommendations. Spatial design recommendations for early childhood learning spaces will address the learning needs of children with special cognitive needs.

### Defining an early learning facility:

CCEYA 2014, identifies daycare, preschools, and kindergartens as early learning facilities. This study focuses on the children aged 2.5 - 5 years as the target users of early learning facilities, establishing prime focus on the design of preschools and kindergartens.

Categories of learning spaces in an early learning facility.

### Indoor learning spaces:

Common spaces: Activity spaces that are used for congregation, learning, or play of children with diverse learning needs. These spaces include hallways, gross motor room and gym.

### Outdoor learning spaces:

It comprises of spaces like playgrounds, engaging diverse users in play and inquiry-based learning. These spaces house numerous kinds of slides and equipment that offer multimodal sensory affordances to play.

### Other design areas to consider:

Wayfinding and Navigation: Wayfinding is “the cognitive and corporeal process of locating, following or discovering a route through and to a given space” (Symonds et al., 2017). This deals with signages, maps, information boards, spatial navigation strategies used in an early learning facility.

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## 1.3 Research Question:

How might we empirically develop the concept of inclusion through exploring accessible and playful learning spaces?

How might we provide spatial guidance for early childhood learning facilities to cater to the needs of children with special cognitive needs and foster inclusive education?

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## 1.4 Key Contextual Definitions

### Children with Special Cognitive Needs

Individuals with Disabilities Education Act (IDEA) is the federal policy that defines various categories of disabilities that may entitle students to special education services or other educational accommodations. Some of the disabilities identified in the Individuals with Disabilities Education Act (IDEA) constitute barriers to access to education or limitations on the students' ability to participate in certain activities (Betsy Hill, Roger Stark). Inclusive educational policies are formed to support inclusion of users with mild and moderate disabilities (Peng et al., 2018).

Specific learning disabilities are defined as deficits in underlying psychological processes involved in learning. Such deficits may affect visual working memory, verbal working memory, processing speed, short-term memory, and other cognitive processes (Betsy Hill).

Special cognitive needs refer to any condition or disorder that affects a child's ability to process and use information. These conditions can include learning disabilities, attention deficit,

hyperactivity disorder (ADHD), autism spectrum disorder, and intellectual disabilities.

Children with special cognitive needs may have difficulty with reading, writing, math, memory, attention, communication, and social skills. It is important for parents, teachers, and caregivers to understand these challenges so that they can provide the necessary support and accommodations.

Intellectual disability (ID), referred to as special cognitive need in this paper, also directly impairs the brain's learning capacity. The limitation on learning impedes the development of children, and they tend to learn more slowly than a typical child (Burack, 2012). ID can range from mild-high or severe (Gargiulo & Bouck, 2017). It is identified with the help of an IQ test score. APA states that a score between 70-75 indicates mild ID and as the score goes lower, the severity of ID is indicated to be higher. A median 2% prevalence rate and Canadian census data suggests that there are an estimated 686,000 Canadians with intellectual disabilities.



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Children with special cognitive needs (intellectual disability) might have a tough time letting others know their wants and needs and taking care of themselves. It could cause a child to learn and develop more slowly than other children of the same age. It could

take longer for a child with special cognitive needs to learn to speak, walk, dress, or eat without help, and they could have trouble learning in school (CDC).

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## Early Childhood Education and Care in Canada:

ECEC services in Canada fall under the authority of the provinces/territories. Every province has a program for childcare that involves regulation systems and policies, with a separate program for kindergarten. Policies on early childhood education concern quality and access. Every program that falls under ECE (Early Childhood Education) aims for child development.

Quality early childhood education (ECE) is all about providing young children with a well-rounded curriculum. This will nurture and foster their growth and learning at an early age. It is about encouraging children to communicate, create, cooperate, and think critically. These are skills that children need to develop over

time to prepare themselves as they grow up. In June 2015, under the authority of the CCEYA, the Minister of Education issued a policy statement on programming and pedagogy that names *How Does Learning Happen? Ontario's Pedagogy for the Early Years, 2014 (HDLH)* as the document to guide early childcare programs.

Preschool serves as an introduction to school, playing with others and listening to the rules and is conventionally for a child aged 2-4 years. It is usually located in an isolated facility away from other kinds of school environments and offers a flexible learning structure for child development catering to the varied pace of child development.

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## Inclusion

Equity in ECE means more than inclusion, it may also mean access to specialized support known as early interventions for children's development. Early intervention programs are targeted programs that aim to improve cognitive, emotional, and physical development to prevent or ameliorate existing disabilities (Odom et al, 2003; Guralnick, 2004).

Since the ECE learning programs are viewed as an opportunity to prepare children for entry into the formal school system and emphasized the development of school-related skills they can also be viewed as opportunities to inculcate the notion of inclusion through the practice of inclusive education.

Inclusive education is about ensuring access to quality education for all students by effectively meeting their diverse needs in a way that is responsive, accepting, respectful and supportive. Students participate in the education program in a common learning environment with support to diminish and remove barriers and obstacles that may lead to exclusion (Inclusive Education Canada, 2020). This practice helps atypical users achieve a sense of empathy while learning with users with different abilities and skills that can foster their ability to mingle in society.

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## Chapter 2: - Literature Review

### ***Chapter Overview***

This data collection method focused on existing knowledge produced by experts like built environment designers, educators, and psychologists to explore theories on learning needs of children with special cognitive needs, effect of learning space design on child development, design principles for early learning spaces, and ways to include diverse stakeholders in the process of design.

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## 2.1 Understanding Special Cognitive Needs

Cognitive skills enable a child to understand, analyze, remember, cause, effect, and process sensory input. It is believed that most cognitive skills can be learned. The four stages of cognitive development- reasoning, intelligence, language, and memory, start when the child is 18 months (about 1 and a half years) of age. (What Is Piaget's Theory of Cognitive Development? n.d.)

Studies suggest that development of cognitive skills involves using procedural memory, following a schedule, physical & mental exercises and indulging in creative activities.

Children with special cognitive needs require a better learning space/environment to tackle the barriers one comes across in an environment. Researcher Krutzinna points out that the ability to learn is often the only thing being considered from the school's perspectives, ignoring the learning experience within an environment where it occurs such as a learning space. There is no justification for the general exclusion of a group of kids without considering each kid's unique learning challenges (Krutzinna, 2016).

As a result, the focus of this discussion is not on a child's best interests, but rather on their learning potential and cognitively enhanced children. Children with special cognitive needs, a group that is a minority, should have their learning needs addressed. Even while it may not be possible to provide every child with the best educational accommodation, the researcher promotes the thought that no one group is excluded from inclusive learning environment.

Furthermore, studies state that children with special cognitive needs do demand equal attention from their teachers. It also reports that, few educators often give excuses for ignoring a students' condition and development while teaching students with special educational needs (SEN), (Anderson et al., 2004). As practitioners, researchers, and theorists, decide and fight classic texts on child development which certainly have a lot to offer, but lack the ability to offer inclusive and thorough accounts of important aspects of development unless they are interpreted in a way that can take atypical patterns into account (Anderson et al., 2004).

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Some of the existing literature on this topic also suggest that a child with special cognitive needs, usually struggles with numeracy, and have problems with directional confusion, sequencing problems, poor short-term working memory, speed of working, cognitive style, anxiety, stress, and self-image issues.

Sensory processing challenges may coexist in students with other special needs. Children with ADHD often tend to seek out sensory experiences. These conditions make it more challenging for students to find their place in a physical classroom.

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## 2.2 Learning Environment and Child Development

Learning process is facilitated by the environment. Studies suggest that the design of a learning environment acts as a powerful tool, supporting a child's potential to respond creatively and meaningfully or to detract from it. Often the understanding of learning space is limited to physical space design, but it is crucial to understand that a social space in which learning occurs happens to be more important. Co-existence of adequate physical and social space design is the crux for effective learning. (The Kindergarten Program 2016: 1.3 The Learning Environment | Ontario.ca, n.d.)

Below are some ways in which the learning environment can impact child development:

**Physical environment:** The physical environment includes factors such as lighting, temperature, and classroom layout. A well-designed physical environment can support learning and promote engagement.

**Social environment:** The social environment refers to the interaction children have with teachers and peers. Positive relationships with teachers and peers can promote social and

emotional development, while negative interactions can lead to behavioral problems and social isolation.

**Curriculum:** The curriculum refers to the content and activities that children engage in during the school day. A developmentally appropriate curriculum can help children acquire new skills and knowledge, while an inappropriate curriculum can lead to boredom or frustration.

**Instructional methods:** The instructional methods used by teachers can also impact child development. Research shows that effective instructional methods include active engagement, hands-on activities, and opportunities for collaboration.

**Inclusivity:** Inclusive environments that support diversity can foster a sense of belonging and promote positive social interactions among children from diverse backgrounds.

It is important for educators and caregivers to create a positive learning environment that supports children's development. This can be achieved through intentional planning, creating thoughtful interactions, and continuous assessment of the learning progress.

---

The environment as a third teacher plays a key role in ensuring the quality of children’s play. Materials, and furnishings for indoor and outdoor learning spaces (including how they are positioned), should be carefully picked to ensure equitable learning opportunities for participation of children with special needs. The general design of the space, and the organization of time, have a major influence on children’s level of engagement and the possibilities for in-depth exploration and learning (How Does Learning Happen? Ontario’s Pedagogy for the Early Years, 2014)

Guidelines from: (How Does Learning Happen? Ontario’s Pedagogy for the Early Years, n.d.), (Early Learning for Every Child Today, a framework for Ontario Early Childhood Settings, n.d.) ELECT are co-created to support early years childcare in Ontario. These are crafted through individual dialogue, local focus group discussions, and various provincial forums, including perspectives of various partners, system leaders, experts, professionals, and practitioners from all segments of the early years learning sector.

Reflecting with children, families, and educators in the context of the early year’s environment is a starting point for developing programs and practices to support learning (How Does Learning Happen? Ontario’s Pedagogy for the Early Years, 2014)

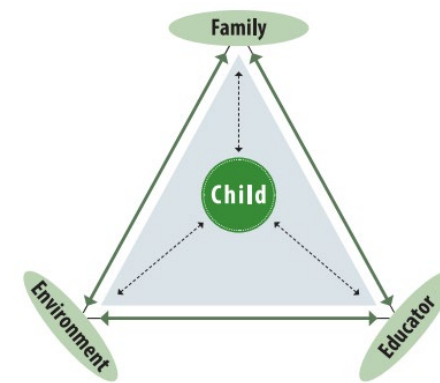


Figure 1. Learning and development happens within the context of relationships among children, families, educators, and their environments.

Pedagogical approaches that nurture learning and development in the early years include,

- Establishing positive, responsive adult-child relationships.
- Facilitating inclusive experiences for learning environments that encourage exploration, play, and inquiry.
- Engaging with the learning space as co-learners along with children, families/caregivers, and others.
- Planning and creating environments as a “third teacher” using pedagogical documentation as a means to value.
- Discussing and making learning visible.



- Participating in ongoing reflective practice and collaborative inquiry with others.

(How Does Learning Happen? Ontario's Pedagogy for the Early Years, n.d.).

Studies also state that design of a learning space and environment will contribute to almost 25% of a student's achievement over their progress in their whole academic year (Muhamad Nadhir Abdul Nasir & Alfa Nur Aini Erman Efendi, 2016).

Thus, environment becomes the third teacher to facilitate learning for differently abled children to discover variety materials while actively exploring, investigating, and solving problems as one way in accomplishing active learning through play experiences (Strong-Wilson & Ellis, 2007).

The environment absolutely impacts how children move about the environment, how children navigate the environment, how they interact with the environment, what they do in that environment, and the emotional social connection to the environment (Editors, Dr. Sandra Duncan, 2019).

Children need authentic things to play with. Not the plastic teapot, not the plastic shovel, but real honest to goodness tools and honest to goodness objects that come from real life (Editors, Dr. Sandra Duncan, 2019).

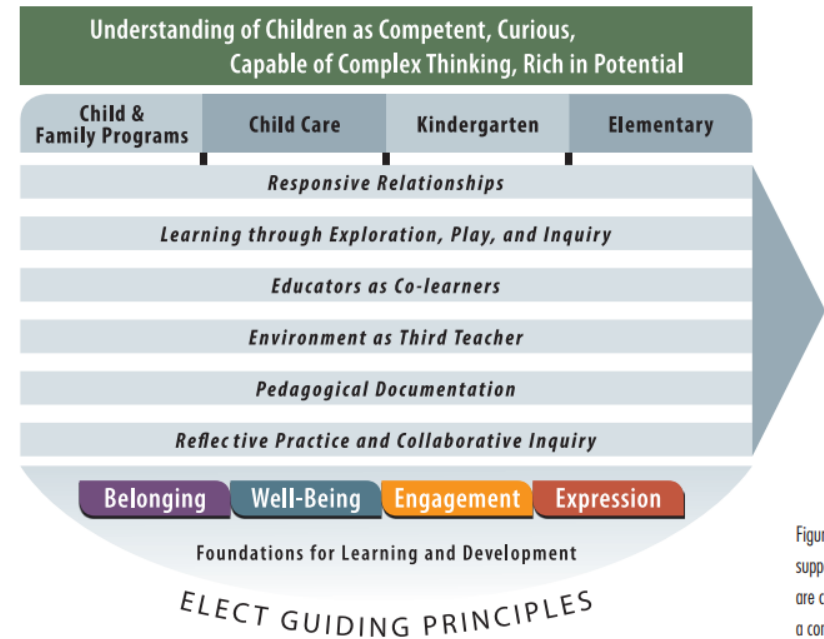


Figure 2. Pedagogical approaches to support the key foundations for learning are common across settings and ages for a continuum of learning.

Figure 2. Pedagogical approaches to support the key foundations for learning are common across settings and ages for a continuum of learning.

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## 2.3 Design for Inclusion

Universal Design principles are relied upon to ensure that designs are usable to the greatest extent possible by individuals of all ages and abilities, without requiring adaptation or specialized design (Story et al., 1998). Inclusive learning is based on the principles of acceptance and inclusion of all students. Students see themselves reflected in their curriculum, their physical surroundings, and the broader environment, in which diversity is honored and all individuals are respected (Ontario's Equity and Inclusive Education Strategy, 2009 | Ontario.Ca, n.d.).

This practice helps atypical users achieve a sense of empathy while learning with users with different abilities and skills that can foster their ability to mingle in society. Studies state that inclusive learning benefits the progress of children with intellectual disabilities within academic achievement, the sense of belonging, participation, socio-emotional and cognitive development, and behavioral outcomes.

An educational space that responds towards the needs of students with learning disabilities is conducive of learning environment (Ismail & Zulkurnain, 2019). Few factors that contribute to the learning process and development of learning disabilities are non-physical elements comprised of visual cues, auditory, tactile, and kinesthetic approaches as well as physical elements that encompass the density and size including spatial layout and arrangement of furniture.

The physical arrangement of a teaching space can bring people together, encouraging collaboration and discussion, or can enforce isolation and silence. Environments that promote social collaboration, stimulate the senses, encourage the exchange of information, and offer opportunities for rehearsal, feedback, application, and transfer are likely to support active learning (Bam, 2008).



Figure 3. Showing four essential steps in creating an inclusive classroom.

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## 2.4 Seven Principles of Learning Space Design

Creating a learning space that intrigues , invites and simulates the senses of a child requires infusing key design principles for learning space design (DeViney, 2010). This resource suggests that an effective learning space interaction of a child can be ensured by implementing the following seven principles:

1. **Nature inspires beauty:** Incorporating natural elements inside the four walls of your classroom can effortlessly transport children into a world of beauty. As children interact with nature their appreciation and understanding of their physical surroundings deepens through interacting and experiencing natural elements, develop tactile, visual, olfactory, cognitive, and auditory skills.
2. **Color generates interest:** Proper use of color can define space, induce mood, and foster the ability to recognize and remember. Design use of color without a rationale can be overwhelming. It is important to acknowledge its positive and negative potential before incorporating it in a learning space.
3. **Furnishings define space:** Adequately sized, shaped, and placed furniture. These define the nature of space and could strengthen spatial quality and depth.
4. **Textures add depth:** Textures provide children with unique tactile and visual experiences enabling them to improve observation and fine motor skills.
5. **Displays enhance the environment:** They reflect value. Eliminating clutter, highlighting children’s work, the learning space / classroom becomes a backdrop to honor all who occupy the space inducing a sense of belonging.
6. **Elements heighten the ambiance:** Elements like light, sound, temperature create an ambiance of relaxation. These elements can be used in innovative and supportive ways to enable children to interact with the environment.
7. **Focal points attract attention:** These features invite children to actively engage and participate in the environment. Informal and non-intimidating settings like carpet areas for gross-motor play within a classroom can be used to engage children in learning activities and socializing.

The above-mentioned principles provide a breakdown of various steps required to incorporate in the design of an effective learning space and elaborates on strategies to make it happen. This

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supports the idea of enabling a learning space to motivate its users to interact with it, and inquiry-based learning approach for various early childhood learning curriculum.

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## 2.5 Collaborative Participation:

Participatory design is all about involving potential users in the process of design to achieve a more appropriate, efficient solution. Wider participation can provide access to lived experiences, and knowledge. Studies suggest that despite the positive and uplifting benefits of collaborative methods of design, complexity involved, and time consumed become barriers to use age and implementation of these practices. Designing for learning spaces benefits from partnering with educators. One-way flow of information, from the users to designers, can be altered using innovative means of interacting in the context of learning space design. Participatory process must not only ensure adequate level of inputs from each participant but also must organize the order of the interactions of their inputs (Woolner, 2010).

People involved in the community of a school includes educators, support staff, students, parents, management, and the wider community. Woolner suggests that the validity of participatory design process will depend upon who is involved and where their involvement rates on a ladder of participation. Figure (6) illustrates another dimension to the ladder. Participation can

happen at any phase of the design process, and it is essential to consider it as an iterative process rather than an isolated instance.

It is essential to acknowledge that each user group will bring in their unique perspectives and ideas to shape the design in inclusive and effective ways. The perspective of educators and support staff like occupational therapists can be used to understand the nature of early learning activities and impact of spatial design on development of a child with special cognitive needs.

Involving diverse groups of participants in the process of design requires sensible approaches. It involves engaging them in adequate design brainstorming sessions to obtain and understand their needs and requirements.

Following strategies can be used to involve the wider communities:

1. Focus group discussions and semi-structured interviews.
2. Assign design committees to involve certain users in certain stages of the design process.

- 
3. Create platforms are means of communication for collaboration and exchange of dialogue.

<b>Levels of Participation</b>	<b>partnership</b>							
	<b>collaboration</b>							
	<b>involvement</b>							
	<b>consultation</b>							
		senior management	teachers	learning support	other staff	students	parents	others
		People involved						

Figure 4. A two-dimensional ladder of participation in school design from (Woolner, 2010).

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# Chapter 3: - Methodology

## *Chapter Overview*

### **Approach to Research Design**

Since it is extremely important to understand the perspective of users with special needs and abilities, qualitative research methodologies and strategies are chosen for this study. These have proved to be effective to understand and deduce subjective inputs from diverse groups of participants. This study supports the viewpoint that preferences and needs are unique to individuals and are subjective overall. Employing multiple methods for data collection will allow overcoming limitations, a single method provides. Researchers believe that biases inherent in any single method could neutralize or cancel the biases of other methods as mentioned by Creswell (2008), and it will also help reinforce the strength of research validity. Comparison of results generated using different methods can be useful to cross verify and ensure that the findings generated are valid and reliable. Hence, validity is strengthened.

Data collection methods involved in this study are literature review, and semi structured interviews. Data collected during interviews with educators and school board therapists by principal researchers is backed up with literature on design for learning spaces by (Pamela Woolner et al., 2012) to generate design guidelines for inclusive early learning spaces. OCAD University's REB (Research Ethics Board) reviewed and approved this study. All participant data collected during the semi structured interviews is anonymized in this report to ensure participant confidentiality. Interview guide is included in Appendix A.

#### Research Stages:

1. Literature Review
2. Semi-Structured Interviews
3. Participant Feedback / Verification



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## 3.1 Semi-Structured Interviews

This stage of the study is a series of semi-structured interviews. The intent behind performing this method of data collection was to understand and document perspectives of educators and occupational therapists on the influence of spatial design on the learning process of children and ways to address special cognitive needs.

Overall, there were 3 interviews, which included 2 occupational therapists, 1 educator with experience in early childhood education and sound knowledge of learning needs of children with diverse cognitive needs. Participants were recruited from the professional network of principal advisors based on their expertise and interest in the subject of study. The length of each interview ranged from 60-90 minutes (about 1 and a half hours).

The interviews focused on understanding learning needs, behavioral patterns, and the role of learning space design to achieve cognitive inclusion. This process allowed the researchers to document participants' experience of early childhood learning spaces, environmental barriers to learning, inclusive learning activities and spatial design features that support the activities and their thoughts on the impact of inclusion and solutions to

achieve cognitive inclusion. The interview questions can be found in Appendix A. The data was collected through audio recording, note taking and in the form of Word Document and sketches illustrating participants ideas.

### **Educator:**

The interview focused on barriers to inclusion in terms of space and systematic procedures involved in implementation of physical redesign of existing spaces. Major themes that arose from the discussions included, implications of inadequate staff to student ratio, ergonomics of furniture, artefacts and stationery used, environment as a third teacher, visual cues as nonverbal instructional aids and nature as a teaching tool.

### **Occupational Therapists:**

The interview focused on the role of occupational therapists in the process of early learning, the power social piece in the process of inclusion over environment, various features of space that contribute to the development of fine motor and sensory skills. Data collected through this method was fused with findings

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collected from literature review and virtual case studies to generate design recommendations for early childhood learning spaces.

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## 3.2 Participant Feedback / Verification

This step was conducted to understand and document participants' satisfaction, feedback on the generated design recommendations and the design process. An evaluation matrix was created as a tool to assess the activities employed and the results generated. The data gathered from this process highlighted further possibilities in this area of study and has provided the researchers with feedback on methods chosen for

the study. It has also provided the researchers with a direction to enhance inclusive research activities in further studies.

Questions included in the Participation Satisfaction Form can be found in Appendix B. Data filled out by the participants in the forms allowed a participant to provide objective and subjective inputs. The session happened a few days later after the interview as the researchers needed to analyze the data collected and develop a solution based on community needs and demands.

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## Chapter 4: Discussion of Findings

### ***Chapter Overview***

This chapter elaborates on analysis of amalgamated data collected using various methods mentioned in previous chapters that include literature review, semi structured interviews, virtual case study and participant verification. The data collected captured perspectives, experience, and thoughts on spatial design opportunities available throughout the early childhood learning facility to foster the inclusive learning process. Data analysis aimed to highlight insights focused on design on learning spaces perspectives of stakeholders on catering to special cognitive needs of early users.

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## 4.1 The Principles for Understanding Efficiency of An Early Learning Facility

The data collected from various resources mentioned in Literature review supports the positive impact of efficient space design on child development and inclusive learning process. Design of Learning spaces by (Woolner, 2010) suggests the use of a framework to measure efficiency of a school. A similar framework can be used to measure efficiency of inclusive early childhood learning facilities. This framework focuses on three principles:

### 1. Value of community recognition:

Participation or shared understanding of objectives benefits a newly built environment or renovation of an existing facility. Studies suggest that long-term pride in achievement of the school's architects often is connected to the locality. Drawing in community and encouraging them to see the product of design as a singular solution to their needs is likely to foster a sense of belonging.

The design of learning spaces suggests that contributory factor plays a huge role in continued satisfaction with a school.

Hence, involving learners, educators, parents, and care givers during various phases of design should lead to a more appropriate design.

### 2. Importance of good design:

It is notable to understand that the design of each facility is unique, and a successful design implemented might not prove to be effective when recreated in a different context. There might be some generalization to be made, at principle and value level, which can be applied. Small child height windows and the design use of natural light are some ideas which can be implemented everywhere.

Application of community/ stakeholder generated principles, objectives to design of various categories of space in an early childhood learning facility can contribute to the creation of context specific solutions and guidelines for implementation.

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### 3. Evaluation continues over time:

Efficiency of a learning space / facility cannot be absolute but as something that is continuously developing and evolving. A design process that is in constant progress with a focus on meeting the

Iterating and reiterating design principles, objectives, and guidelines to meet with the needs of a wider community/ user group can contribute to the process of continuous design evolution.

changing needs of its users is essential to improve the efficiency of a learning space. In the case of newly constructed or renovated facilities, evaluations of their design are to be done from architectural, educational and user centric perspectives that keep changing over time.

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## 4.2 Learning Space Design and Participant Perspectives

Cognitive development is one of the major learning and developmental goals of early childhood learning curriculums and deals with the phenomenon of a child making sense of the world around them and their experiences. The data collected highlights the user experiences with spatial design and its impact on developing skills like problem solving, memory, attention, and thinking of an early user. From the responses collected from all participants, prominent themes that arose were,

- In an early childhood classroom, social space that exists with physical space plays an important role in the learning process of a child. A design that aims to cater to the well-being of a child along with accommodating accessible opportunities for social engagement through the design of physical spaces, can effectively provide solutions to foster inclusive learning for early users with special needs.
- Lack of resources, shortage of support staff and budget constraints are some active barriers to practicing inclusive learning practices and strategies in a classroom.
- Existing facilities are of two types:

- i) Old Buildings renovated to meet the standards for an early learning facility.
- ii) New constructions in compliance with building codes.

These facilities usually exist individually secluded, or as a part shared campus.

Lack of space, and subjugations to share a space with other institutions or grades limit the possibilities of exploring and implementing inclusive learning principles.

- Learning space design should promote inquiry-based learning by providing spatial features with connection to nature. Opportunities to interact with environment using multiple senses are essential to transfer physical strength into fine motor skills.
- Design of various learning activity spaces should facilitate accessible silent zones to help a child calm down when subjected to sensory overload.

These themes were raised during individual, semi-structured interviews with an educator, and two occupational therapists which were conducted to capture thoughts and perspectives of

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diverse participant groups on the impact of spatial design on inclusive early learning activities for children with special cognitive needs and their experience in the area.



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# Chapter 5: Guiding Design Principles

## ***Chapter Overview***

This chapter elaborates upon the findings from data analysis to propose guiding design principles for creating early learning spaces that caters to diverse cognitive needs of children. Prominent themes that arose from the analysis of data collected using methods mentioned in the above chapters transpired the guiding design principles to propose spatial design recommendations for inclusive early learning spaces.

It presents both principles and strategies that can be applied to design various categories of learning spaces.

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## 5.1 Principles:

### Create space for all users.

Effective learning space design should cater for competency and comfort of all its users. Design should advocate for physical, contextual, ergonomically, anthropometrical and usability needs of student, educator, parent, therapist, and administrative staff users. These needs can be addressed through designing adequate furniture, space, fixtures, and space allocation as per to the changing needs of class rather than merely complying with design standards.

### Engage all senses.

Sensory cues are crucial to the learning of children at an early age. They enable children to understand their experiences and the world environment around them. Hence it is important to consider multi-modal approach to user space/object interactions to enable them to interact with sensory experiences that please their needs and abilities.

### Create safe spaces that also promote autonomy.

Early childhood education aims to help children develop fundamental skills required during the formative years using inquiry-based learning approaches. Hence spatial design that promotes independence along with ensuring user safety is essential.

### Promote adaptability and flexibility.

The complexity of addressing diverse users' learning needs to create inclusive early learning spaces can be catered by rationing for adaptability and flexibility. Space's ability to adapt, integrate and bounce back to normal gives a user more control over the experience

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Extensibility of a design also enables its use for a longer duration, increasing its reach (*Design for Adaptability and Flexibility | The Inclusive Design Guide The Inclusive Design Guide*, (2023, March)). In the essence of facilitating versatile nature of early learning activities, an effective learning space will require to cater to multiple activities and allow its users to reconfigure as required with minimal effort.

### **Incorporate repetitive learning incorporated into building elements.**

Repetition is an early learning strategy that is used to improve speed, increase confidence, and strengthen the connections in brain that helps a child to learn (Let's Do It Again . . . and Again! Why Is Repetition Important to Learning? n.d.). Incorporating repetition of numbers, colors, word use with multi modal interaction affordances into building elements like walls, steps, doors, signage can not only help a child learn but also strengthen cognitive skills like landmarking, recognition and segregation of spaces based on visual character and foster social wellbeing by kindling a sense of belonging. Employing this strategy could enable a user to engage with built spaces, educate a build relationship with spaces.

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## 5.2 Strategies:

### Facilitate placemaking.

Placemaking is both a philosophy and a practical process for transforming public spaces. It is centered on observing, listening to, and asking questions of the people who live, work, and play in a particular space to understand their needs and aspirations for that space and for their community. The placemaking process can be used either in retrofitting an existing space or planning a new space. Because every situation is different, the steps are not always exactly the same, nor do they always happen in the same order (The Placemaking Process, 2023, March).

Steps involved in this process include,

- Defining place and Identifying stakeholders.
- Evaluating space and identifying issues.
- Placing a vision.
- Conducting short term experiments.
- Reevaluating to facilitate long term improvements.

Applying this strategy to design an early learning facility would require an architect to collaborate with potential users of the facility enabling them with power to communicate their requirements and continue customizing it with their changing abilities, likes and needs. This process also demonstrates an idealistic way of addressing a balance between both the social and spatial inclusion needs of its users.

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## 5.3 Design Recommendations Based On Principles:

This section builds upon providing design recommendations for various phases of design process, categories and subcategories of spaces and aspects of design present in an early childhood learning facility along with further steps to explore:

Phases of design process

- Program-site analysis
  - Schematic layout and zoning
  - Design development
  - Construction documents
  - Construction administration
- ii) Washroom
  - iii) Sensory quiet areas
2. Common spaces
    - a) Transition spaces/ hallways
    - b) Multi-purpose rooms

Categories, Sub-categories of spaces and design areas:

### Indoor learning spaces

1. Classroom
  - a) Carpet area
  - b) Storage
  - c) Furniture
  - d) Electrical fixtures
  - e) Support spaces
    - i) Meal area

### Outdoor learning spaces

1. Playgrounds

### Wayfinding and Navigation

1. Information finding

### Non-Physical Aspects

1. Lighting
2. Air and ventilation
3. Heating and cooling

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Recommendations proposed in this section suggest the application of principles and strategies for of various phases of design process and categories of spaces as mentioned above. Some of the recommendations proposed are also supported with visual aids to support the ideas.

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### 5.3.1 Phases of Design Process:

User consultation and participatory design approaches offer an opportunity for experts with professional and lived experiences to collaborate during various phases of the design process. While addressing accessibility concerns related to the design of learning facilities it is important to assess various phases of the design process involved in building a facility from scratch and in renovating an existing one. Though the newly constructed and extensively renovated facilities are obligated to follow accessibility standards, it is observed that only mere compliance to design standards oversees the potential of learning spaces to facilitate physical, cultural, contextual and user ability centric inclusion.

*“The best way to achieve this aim must be through genuine collaboration, where the difficulties, as well as the successes, are seen as the shared responsibility of all parties, rather than as the result of individual power-play or willfulness. To conclude, we have seen how the potential benefits of participatory design encompass influencing the altered environment itself, for good or ill, and the participants, over the short and, perhaps, the longer term. Importantly, it seems that the potential for longer term influence is bound up with recognizing and understanding the inextricable linking of actor and setting, as this applies to the wide range of school users throughout and beyond the period of change..” (Woolner, n.d.)*

Designing inclusive early learning facilities would require involvement of stakeholders like educators, and children and consultation of stakeholders like parents and administrative staff. The recommendations proposed here are put together through data collected from literature on collaborative design practices from (Woolner, 2010) and input collected from semi structured interviews of educators, and school board therapist.

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## Program-site analysis:

This process requires establishing clear goals and objectives for the learning facility. It involves reflecting on space and activity requirements for the facility to estimate approximate cost. By using the input from students, staff and the wider local community, architects can seed a sense of involvement. Site selection, analysis and space program design can benefit from:

- Candid inputs from stakeholders
- Negotiation of user requirements and practical feasibilities on chosen site
- Establishing performance goals for the facility

## Schematic layout and zoning:

After determining space program needs to be accommodated in a chosen site, collaborative efforts can be put into place by producing series of rough sketches and zoning layouts to highlight required functional and spatial needs to be met on site. Collaborative design activities can prove effective in collecting inputs from educators, children, and support staff. Choosing a user- group appropriate brainstorming activity plays a crucial role in the process of understanding user needs and extracting their inputs.

## Design development:

Refining schematic design layout leads to design development of a project. This phase of design requires technical expertise to translate conceptual layouts to fit practical standards and support mechanical service systems like electrical, heating, cooling, and materials for construction. The responsibility of shaping this process can be left to architects, engineers MEP experts. Verification of design output from this process with stakeholders could be instrumental in ensuring translation of ideas generated in previous phases of design to a proposal for implementation.

## Construction documents:

This phase of design process like design development involves major efforts from architects to create detailed drawings which can later be referred to by the contractor to estimate the cost and span of construction and implementation.

## Construction administration:

Compliance verification of construction or renovation documents to implementation on site as per the visions and specifications detailed by specialist from diverse fields would require constant supervision of architects and engineers during the construction.



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This phase of design would also involve review of disbursement of funds along with progress made by contractors and their team.

The scope of involving user group/stakeholders in the process of design dominantly exists in the early phases of the process. Effective strategies to collaborate and consult with students, educators, parents, and support/administrative staff respectively during these phases can potentially ensure creation of inclusive early learning facilities.

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## 5.3.2 Indoor Learning Spaces

In an early childhood learning facility, children spend most of their time indoors learning in their classrooms. A classroom for early years is one that facilitates numerous activities allowing a child to engage with peers, and physical environment around, that is supported by various types of furniture and its arrangement.

Though early learning classrooms are led by a class teacher, taking support from special educators is essential to ensure implementation of inclusive strategies for learning. Hence, an early childhood classroom design should address the teaching needs of educators and diverse learning needs of children and the spatial needs of the curriculum.

*“Primary teachers teach almost everything except music and gym. If we have. A music and gym teacher because sometimes we are left to teach that if we. Don’t have coverage for that”. - Educator participant*

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The following are a few features with design recommendations of an indoor early learning environment that are believed to be effective, to enhance learning for children with special cognitive needs:

### **Classroom:**

Planning classroom spaces requires consideration to:

- shape of the space
- establishing a balance between structured and flexible spaces
- ensuring that the blind corners are avoided.

Inclusive early learning classrooms facilitate diverse learning activities. Activities performed and facilitated are chosen based on the curriculum followed and learning goals of its users. The following are some of the activity spaces with design recommendations:

### **Carpet area:**

It facilitates unobstructed exploration opportunities for users. This can be used as an effective teaching tool and a spatial feature to provide children with a flexible alternative to semi structured play and learning activities.



Figure 5. Two children play toys on the carpet area.

### **Storage:**

Educators and early users should be provided with designated, fixed storage areas that are appropriate for the educator and early users ergonomically. A balance of open and close cubbies would help to establish a balance between easy access and regulated access. Colors, symbols, pictures on the cubbies can help early users to identify their storage and support user autonomy.

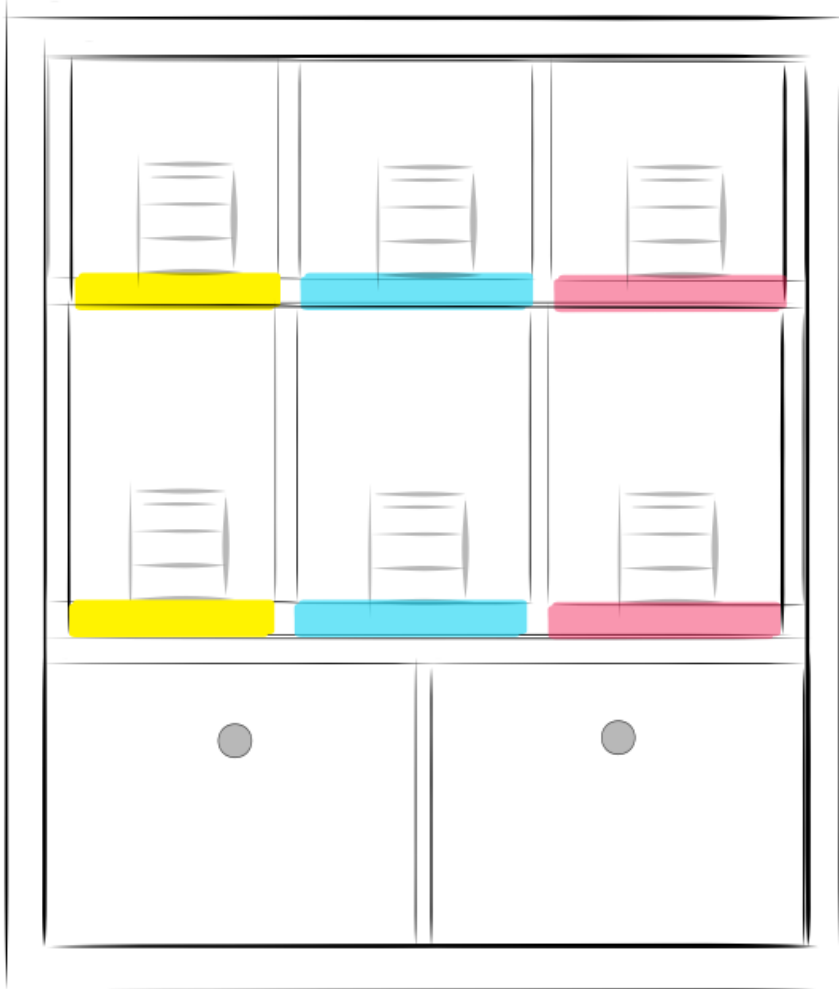


Figure 6. Student cubbies with open and closed storage spaces.

## Furniture

Design of furniture should consider mobility and accessibility addressing the user requirement to adjust and move and rearrange in various clusters. It should also be appropriately sized and shaped with alternative options to engage with different learning activities. Strategic use of colors and textures can help simulate the senses and support learning. Round edges, durable material and non-toxic finishes/ materials should be provided to ensure user safety.

## Electrical fixtures:

Strategic placement of outlets at levels accessible to educators will keep the curious little fingers away from them and allow facilitation of electrical devices like projectors and echo monitors.

## Support Spaces

### Accessory kitchen and Dining:

These spaces aim to teach social interaction, self-regulation and problem solving. The design of these spaces should primarily consider user safety and sized to meet dimensional accessibility for the user group. Integration of multi-sensory affordances like texture and smell of various elements can help users learn

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effectively from their surroundings. Round tables and group cluster facilitation can be used to help users engage socially with their peers and learn from each other. An educator monitor station should be strategically located to ensure safety and accessible assistance.

### Bathroom

- The design of bathroom spaces should aim to support a child support user autonomy of a child and support their use of the space to ensure minimal to no supervision is required. It can be achieved using flexible and user dimension appropriate fixtures.
- Contrast in the floor material can help a user differentiate bathroom spaces from other.
- Signage and icons used must be located at eye level of the users. Accompanying signage icons with drawings of the activity created by a user could help them recognize the space.
- Early childhood classrooms should ideally be designed with a private bathroom to allow easy access for user mobility and supervision for educators.

### Silent zones:

These are the spaces that provide a break from learning when subjected to sensory overload for children with special cognitive needs. It should provide early users with a quiet space to calm down within a learning space. This should be strategically designated to a space that is secluded yet can be monitored by educators. Achieving this can be supported using soft lights and, pastel color walls.

Planning classroom spaces requires consideration to shape of the space, establishing a balance between structured and flexible spaces, and ensuring that the blind corners are avoided.

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## Common Spaces

Common spaces are used by different user groups for the facility to socialize, engage, learn, and gather. Accommodating learning needs of children with diverse needs can be achieved by creating a warm and welcoming environment with soft lights and comfortable furniture. Fusing principles of universal design with user specific needs can help a designer to create a context specific list of recommendations for various kinds of activity spaces. Interview with our participants, highlighted the importance of flexibility and adaptability in the design of a common space as it is often observed that large open spaces in early learning facilities are used for multiple purposes like gym room for assembly and performances when required due to space constraints. It is also important to cater escape / quiet spaces around congregation areas to provide a user with an opportunity to calm when subjected to sensory overload. Common spaces in an early learning facility usually include:

- Transition spaces / Hallways
- Multi-purpose spaces

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### Transition spaces:

An effective hallway design can be a great wayfinding tool, enabling users to move from one destination to the other with minimum cognitive effort as well as offer the flexibility to turn it into an extended classroom to accommodate learning activities that are less formal. Though they comprise 20-25% of total built space, they often end up being monotonous, long, and dull with minimum attention given to design detail. Walls of hallways can be used to display student work to facilitate user engagement and inculcate a sense of belonging. Design interventions like theming for different levels of building, representing age-appropriate learning activity offering a sense of relatability for the users could enable them to remember and recognize learning spaces and enhance user autonomy. Multisensory interaction opportunities

with the environment, and participatory, placemaking approaches could help designers understand and incorporate the likes of the users into the design.

### Gross motor rooms/ Multipurpose spaces:

Gross motor rooms are indoor play areas that usually facilitate multiple activities. These spaces are often open and empty and require abundant storage as they accommodate storage of furniture and play artefacts that support diverse age groups and activities. It is essential to ensure that the storage in these rooms supports staff ergonomics as they are responsible for regulating the activities and that the space caters to diverse activity and student needs changing each hour.

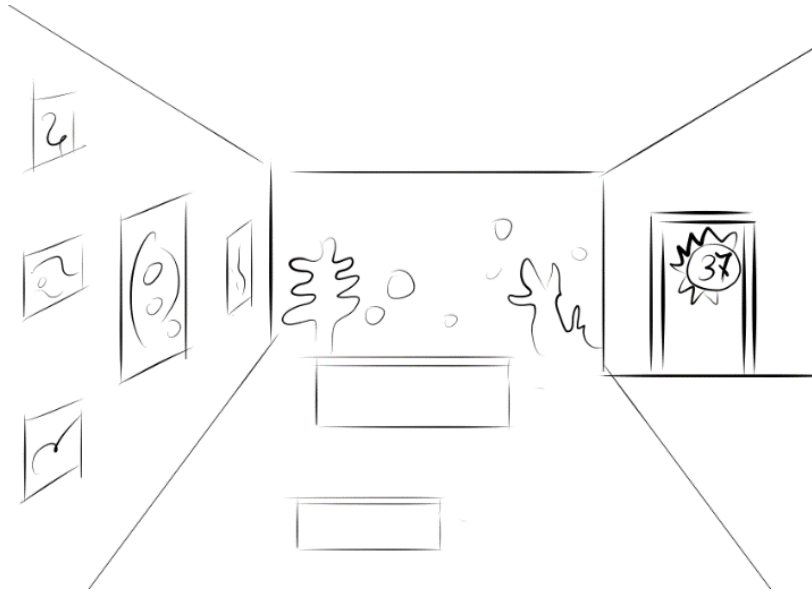


Figure 7. Display of student work to foster sense of belonging.

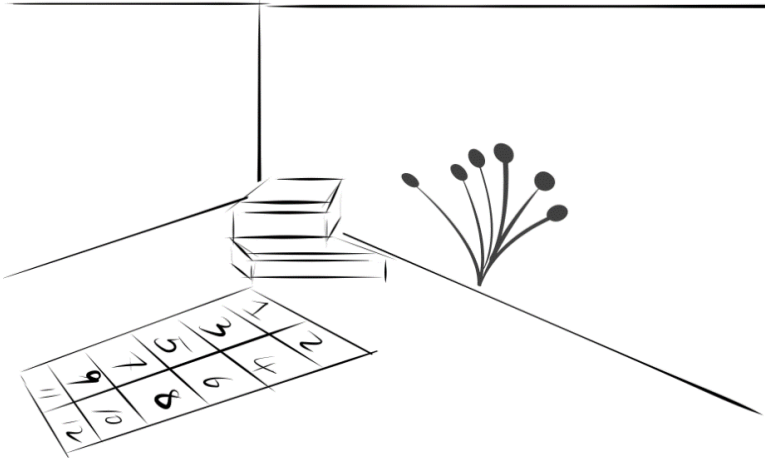


Figure 8. Open multipurpose room offering opportunity for flexible indoor play.



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### 5.3.3 Outdoor Learning Spaces

Early learning activities support inquiry-based learning. It is believed that play based learning activities provide children with opportunities to develop cognitive, social, physical, and emotional skills in ways that engage a child.

Nature infused play-based learning activities offer children with opportunities to use their imagination and explore various ideas and concepts by engaging with the environment around them. Outdoor plays spaces in an early learning facility are obliged to be secured with a fence and not to be shared by any other groups of kids from higher grades.

Effectively designed outdoor play environment can foster motor, social communication, cognitive and collaborative skills in a child.

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***Design Recommendations for outdoor play can be categorized into:***

**Inclusive play equipment:**

Play components should be individually accessible with minimal transfer work. Users should have the opportunity to self-select activities that match their abilities and likes. It is essential to establish user group priorities related to balance between opportunity to explore and safety before designing / providing play equipment.

**Shaded spaces:**

Strategically located shaded silent zones could prove to be effective to calm down a user in case of sensory overload. Provision of unstructured play areas could help a child to learn to engage in creative, spontaneous play fostering meaning making skills.

**Multi modal sensory affordances:**

Design of outdoor play spaces should address multisensory needs of users by providing play opportunities that engage visual, auditory, and olfactory senses through landscape and choice of materials for pathways, equipment, furniture, and vegetation

while play equipment and terrain should provide opportunities to engage vestibular, proprioceptor and interceptor senses.

*Astroturf provides areas where there's a variety of different heights where there's sensory play. It's nice to have them at different levels. – Occupational Therapist participant 1*

**Spatial Layout and Navigation:**

It is essential to strategically locate different play activities. It requires incorporating pre-determined usage patterns into the design.

User autonomy and ability to differentiate between different nature of spaces can developed among users by providing them with barrier free, pavements for pathways and play areas that offer multi modal sensory interactions.



Figure 9. Play equipment to strengthen fine motor skills.



Figure 10. Shaded sensory quiet zone.



Figure 11. A child plays on terrain mounds.

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### **5.3.4 Non-Physical Aspects:**

Designing for these requires prioritizing user well-being and health. The concept of well-being in early childhood sets focus on cognitive, social, physical, and emotional development of early users. Effective design of natural daylighting, comfortable room temperature, Multisensory experiences, and air quality control is essential to ensure wellbeing of its users.

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## Lighting:

Sources and control of light play a crucial role in defining the quality of a physical environment. Lighting design, both natural and artificial, requires planning that is well thought of to address special cognitive needs of its users. While interview participants and studies state that natural light enhances learning, sensitivity to light is also said to be one of the most common sensory needs amongst children in their early childhood. Hence, the design of lighting elements must cater to adaptability needs. Regulation and control of different sources of light is essential.

## Natural light:

Learning spaces must have plenty of windows to bring in natural light at a child's height and close to the floor, allowing them to enjoy an unobstructive view of the outdoors. Blinds, curtains, and colorful glazing systems can be supportive design elements to control and regulate natural light. Building elements like sunshades, and adjustable overhands can be used to regulate sunlight entering the building. (2005\_cick\_guide\_vol2\_designing.Pdf, n.d.)

*I love the idea of having natural sunlight or natural light in place so that you have, like large windows. So,*

*kids can see what's happening outside. – Educator*

*Participant*

## Artificial light:

This impacts the character of an interior space and allows the possibility of adapting to user needs. Spatial flexibility without excessive expenditure can be achieved by using artificial lighting considering, requirement of light for different users and activities and providing educators with power to adjust it to suit the needs of an activity and its user. It is important to keep in mind that lighting equipment is evolving rapidly, working closely with experts in this area would allow one to ensure an appropriate choice that fits the user's needs along with budget.

The recommendations provided in this section are generic and are inspired by findings from similar studies performed. Collaborating with light design experts to brain-storm lighting solutions with stakeholder groups would allow one to obtain context specific results.

## Fresh Air and Ventilation:

Facilitating fresh air movement throughout the facility strengthens the indoor air quality of the facility. It is essential to consider aspects of safety while opening the window. Provision of outward opening windows could be an effective solution.

## Heating and Cooling:

Central air conditioning and heating systems are critical building components in an early childhood facility in Canada. Studies state that heat blowing systems from the top are problematic for children considering their reach and so are radiators as they pose burn hazards to a child exploring the physical environment

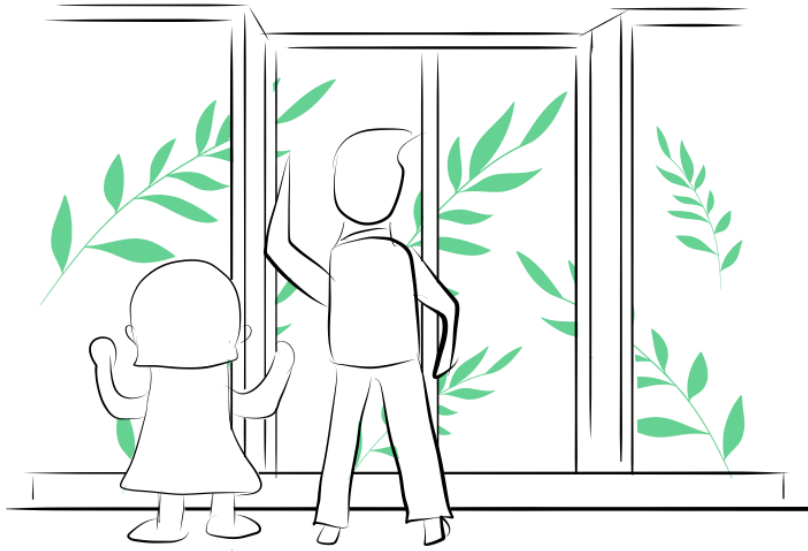


Figure 12. Large windows offer an unobstructed visual connection with the outdoors.

around them. In the essence of that, a radiant floor distribution system of heat could be an ideal solution for both educators and children. Discussions with educators brought up economic constraints involved in installation of an effective radiant flooring system (*2005\_cick\_guide\_vol2\_designing.Pdf*, n.d.).

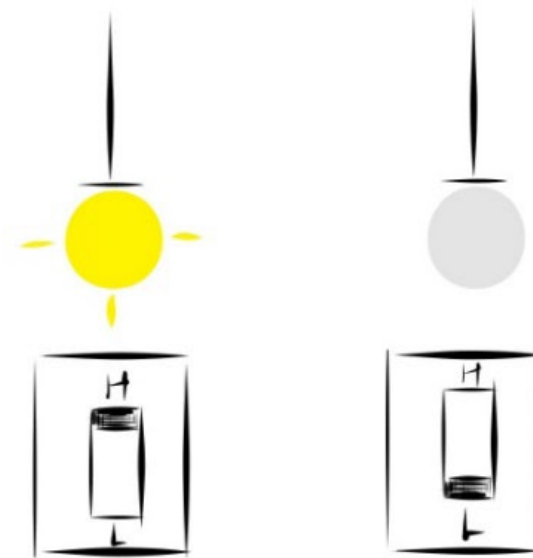


Figure 13. Artificial light with adjustable light control.

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## 5.3.5 Wayfinding and Navigation

Wayfinding is “the cognitive and corporeal process and experience of locating, following or discovering a route through and to a given space” (Symonds et al., 2017). Studies on wayfinding states that children depend on landmarks to recall or learn a route. ((Heth et al., 1997)). Environmental elements such as landmarks can help distinguish an environment, entrance, exit, destination, or path and make it easily recognizable.

Children with special cognitive needs appear to lack the ability to link landmarks and paths when looked at it from a bird’s-eye view of their everyday environment (Antonakos, 2004), and show little independence when facing a complex situation (Lemoncello et al., 2010).

One possibility for wayfinding research lies in semiotics, the study of signs and their meanings. ((Mandel, 2018)). This approach requires understanding behaviours, perceptions of children with special cognitive needs specifically in the context of wayfinding and placemaking as a strategy to understand and address user needs can be an effective solution.

Wayfinding design can be categorized into two: based on user cognition:

1. **Intuitive wayfinding** is when user mobility depends on spatial design of a space. E.g., wide space and scale of entrance invokes a sense of invitation guiding a user to move safely in a certain direction.
2. **Supportive wayfinding** is when a user takes help of communication systems like signage, landmarks, murals, and maps to navigate.

Inclusive and effective wayfinding and navigation systems can be designed for children with special cognitive needs by fusing,

- User requirements (special cognitive needs): contextual, and individualistic.
- Principles of Universal Design.
- Principles of wayfinding design for learning spaces.

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## Information Finding:

### Intuitive Design:

- Well-lit spaces with natural light offer clear and legible information for a user to process and perform an action. Natural light directed movement promotes user confidence and autonomy.
- Colors, icons, and educational signage featuring real-world facts related to grade-level theming integrated in the wayfinding design collectively transforms wayfinding features into creative learning opportunities.

### Supportive Design:

- Offering multiple sensory experiences to wayfinding features can improve access to navigation for users with diverse abilities and promote user autonomy.

- Minimizing details by eliminating unnecessary articulations and effects should be avoided by reducing the background sensory simulation to a minimum. Simplicity and legibility are crucial to communication. This applies for multi modal communication systems like, Icons, arrows, announcements, audio, tactile and olfactory aids.
- Strategically locating information systems strategically considering usability patterns of user groups in high traffic areas like entrance, exit and complying to conventional standards.
- All information systems providing interactive opportunities should be placed at eye level of prime users with flexibility to adapt to diverse ergonomic needs.
- Pictorial communication icons can support generating a context specific picture exchange communication system with the users allowing them to link visual aids to activities supporting navigation and decision making.



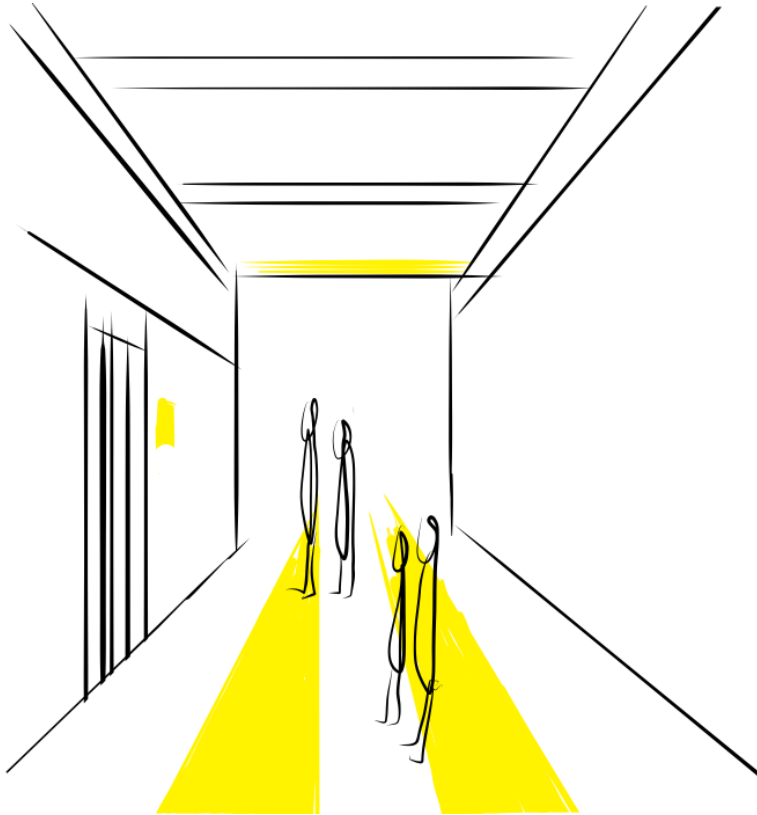


Figure 14. Visual aids to wayfinding.

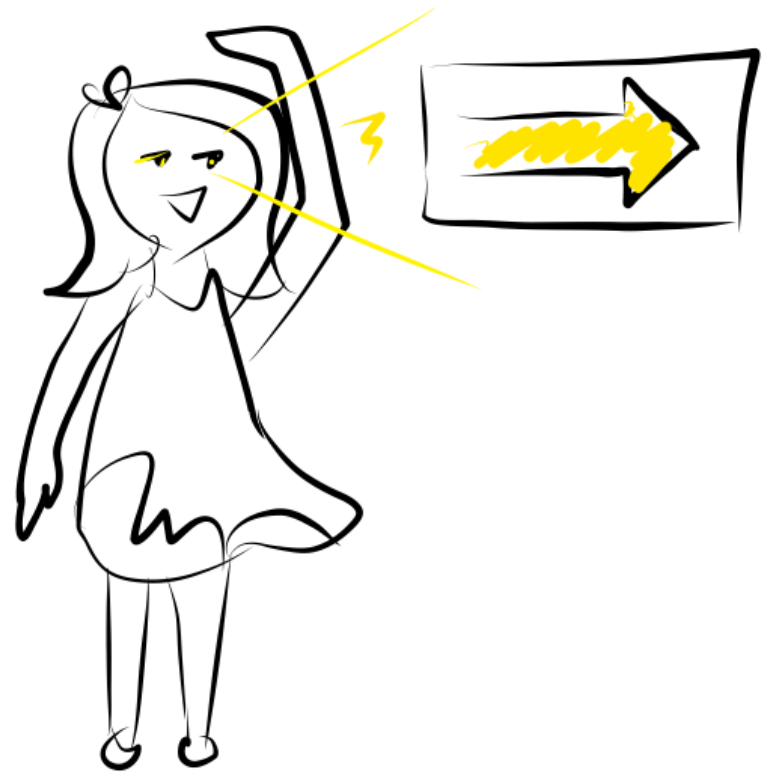


Figure 15. Children's eye level proportions.

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## Chapter 6: Conclusion:

### *Chapter Overview*

This study's intent to generate spatial design recommendations that support special cognitive needs of children and foster inclusive learning in early childhood learning facilities was to identify potential areas for improvement, and foster user experience by capturing stakeholder's expert advice in this area. Generating spatial design recommendations using primary and secondary input from users and stakeholders allowed us to capture ideas that facilitate changing learning needs of its diverse users. Ensuring equity of opinion in the design process requires consideration of believed opinions and deducing the learning needs through empathetic design practice. The data collection methods used suggest the use of generated design recommendations and strategies to make progress towards creating inclusive early learning spaces that address special cognitive needs.

The study also acknowledges that design is a cyclic process and working towards adapting to changing needs is essential to create efficient spaces. In the essence of that, the study also suggests testing, generated recommendations by capturing ideas and perspectives of children and parents as next steps in the process, opening doors for further research possibilities.

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## 6.1 Limitations:

It is a small qualitative study and only represents perspectives of few users, stakeholders and evidence from literature reviews representing few of many special need's scenarios concerning learning needs of children with special cognitive needs. Voices represented in this study were recruited based on their voluntary decision and feasibility concerns respecting the time limit for this academic project. Data collection methods that involved participants, were met with various conflicts around scheduling, security and privacy of organization and the individuals. Recommendations generated are an amalgamation of findings from literature review of existing knowledge on the subject and semi structured interviews with the participants. While the literature review allowed to understand the theories behind idealistic spatial qualities to support inclusion of children with special cognitive needs, the interviews helped to understand the practical onsite barriers to implementing a design strategy and the thought process behind it. Further, due to limitations in scheduling and recruitment, only one educator and two school board therapists participated in the semi structured interview. This study would have benefited from involvement of more

educators with experience in different early childhood educational programs, speech therapists, and direct observation study of an early childhood educational facility. The data gathered documents the perspectives of an educator, occupational therapist, and a physiotherapist.

Additional limitations include lack of perspectives from children, parents, caregivers, and testing of design recommendations on site.

The attempt of this study to focus on supporting learning and development of children with special cognitive needs allows us to incorporate learning activity affordances strategically into built space based on user experience. It also permits us to adapt to the changing learning needs of its users. An inclusive early learning space design promotes accessible learning opportunities for a diverse group of children. It can be achieved by incorporating appropriate spatial design principles while designing various activity/learning spaces in a facility. This requires identifying opportunities for engagement, play and development. (*Individuals with Disabilities Education Act (IDEA)*, n.d.)

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## 6.2 Future Possibilities

Achieving early childhood learning space inclusion at the fullest is a continuous process. In the spirit of that, this study suggests testing the proposed recommendations with children and parents following the principles of Placemaking as next steps to this study. Iterations to design recommendations will help to address and accommodate the needs of all the individuals involved in the process of early learning and the groups they represent. It is also important to acknowledge that involving a wider community in this process would lead to disagreements. In such situations, prioritizing thoughts that benefit the early learners could help designers to stay on track in the process of design.

Conducting a second study involving children, parents, and caregivers to test the recommendations generated from this study will require time, resources, funding, and co-operation from an early childhood learning facility to participate.

Implementation and systemic barriers are prime areas of concern that can affect the effectiveness of any strategy recommended by this study or in general. Considering the complexities involved in the systemic flow of implementation starting from creation of policies by a body representing a government to concerns related to economic feasibility and implementation in individual facilities can itself be an independent study. This study believes that the effectiveness of its findings will depend on their implementation. Hence, exploring ways to cater economic, systemic and implementation barriers to assure effectiveness of recommendations proposed is essential.

Further iterations might efficiently capture the spirit of inclusion with more time, efforts, and creative ways of including diverse groups of users in the process of inclusive early childhood learning facilities and might prove successful to achieve progressive results capturing the spirit of inclusion.

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## References

*2002005\_cick\_guide\_vol2\_designing.pdf*. (n.d.).

Anderson, A., Gerrish, R., Layton, L., Morgan, J., Tilstone, C., & Williams, A. (2004). *Child Development and Teaching Pupils with Special Educational Needs*. Routledge. Visit [link](#) to article here.

*Design for Adaptability and Flexibility | The Inclusive Design Guide the Inclusive Design Guide*. (2023, March). Retrieved 31 March 2023, visit [link](#) to article here.

DeViney, J. (2010). *Inspiring Spaces for Young Children*. Gryphon House. Visit [link](#) to article here.

Editors, Dr. Sandra Duncan, T. (2019, November 21). Dr. Sandra Duncan: How to Design Inspiring Early Learning Spaces. *Early Learning Nation*. Visit [link](#) to article here.

Heth, C. D., Cornell, E. H., & Alberts, D. M. (1997). DIFFERENTIAL USE OF LANDMARKS BY 8- AND 12-YEAR-OLD CHILDREN DURING ROUTE REVERSAL NAVIGATION. *Journal of Environmental Psychology*, 17(3), 199–213. Visit [link](#) to article here.

*How Does Learning Happen? Ontario's Pedagogy for the Early Years*. (n.d.).

---

*Individuals with Disabilities Education Act (IDEA)*. (n.d.). Individuals with Disabilities Education Act. Retrieved 19 March 2023, visit [link](#) to article here.

Ismail, A. S., & Zulkurnain, N. S. Z. (2019). The Role of Environment as Third Teacher Towards The Development Of Educational Space For Dyslexic Children. *International Journal of Built Environment and Sustainability*, 6(2), Article 2. Visit [link](#) to article here.

Krutzinna, J. I. (2016). Cognitively enhanced children: The case for special needs and special regulatory attention. *Law, Innovation and Technology*, 8(2), 177–206. Visit [link](#) to article here.

*Let's Do It Again. . . And Again! Why is Repetition Important to Learning?* (n.d.). Nemours Reading BrightStart! Retrieved 31 March 2023, visit [link](#) to article here.

Mandel, L. H. (2018). Understanding and describing users' wayfinding behavior in public library facilities. *Journal of Librarianship and Information Science*, 50(1), 23–33. Visit [link](#) to article here.

Muhamad Nadhir Abdul Nasir, & Alfa Nur Aini Erman Efendi. (2016). Special education for children with disabilities in Malaysia: Progress and obstacles. *Geografia: Malaysian Journal of Society and Space*, 12(10), Article 10.

*Ontario's equity and inclusive education strategy, 2009 | ontario.ca*. (n.d.). Retrieved 19 March 2023, visit [link](#) to article here.

Pamela Woolner, Jill Clark, Karen Laing, Ulrike Thomas, & Lucy Tiplady. (2012). Changing Spaces: Preparing Students and Teachers for a New Learning Environment. *Children, Youth and Environments*, 22(1), 52. Visit [link](#) to article here.

---

Story, M. F., Mueller, J. L., & Mace, R. L. (1998). *The Universal Design File: Designing for People of All Ages and Abilities. Revised Edition*. Center for Universal Design, NC State University, Box 8613, Raleigh, NC 27695-8613 (\$24). Visit [link](#) to article here.

Symonds, P., Brown, D. H. K., & Lo Iacono, V. (2017). Exploring an Absent Presence: Wayfinding as an Embodied Sociocultural Experience. *Sociological Research Online*, 22(1), 48–67. Visit [link](#) to article here.

*The Kindergarten Program 2016: 1.3 The learning environment* | Ontario.ca. (n.d.). Retrieved 19 March 2023, visit [link](#) to article here.

*The Placemaking Process*. (n.d.). Retrieved 31 March 2023, visit [link](#) to article here.

*What Is Piaget's Theory of Cognitive Development?* (n.d.). Verywell Mind. Retrieved 10 April 2023, visit [link](#) to article here.

Woolner, P. (n.d.). Building Schools for the Future through a participatory design process: Exploring the issues and investigating ways forward. 2009.

Woolner, P. (2010). *The Design of Learning Spaces*. A&C Black.

*5\_cick\_guide\_vol2\_designing.pdf*. (n.d.).

Anderson, A., Gerrish, R., Layton, L., Morgan, J., Tilstone, C., & Williams, A. (2004). *Child Development and Teaching Pupils with Special Educational Needs*. Routledge. Visit [link](#) to article here.

---

*Design for Adaptability and Flexibility | The Inclusive Design Guide The Inclusive Design Guide*. (2023, March). Retrieved 31 March 2023, visit [link](#) to article here.

DeViney, J. (2010). *Inspiring Spaces for Young Children*. Gryphon House. Visit [link](#) to article here.

Editors, Dr. Sandra Duncan, T. (2019, November 21). Dr. Sandra Duncan: How to Design Inspiring Early Learning Spaces. *Early Learning Nation*. Visit [link](#) to article here.

Heth, C. D., Cornell, E. H., & Alberts, D. M. (1997). DIFFERENTIAL USE OF LANDMARKS BY 8- AND 12-YEAR-OLD CHILDREN DURING ROUTE REVERSAL NAVIGATION. *Journal of Environmental Psychology*, 17(3), 199–213. Visit [link](#) to article here.

*How Does Learning Happen? Ontario's Pedagogy for the Early Years*. (n.d.).

*Individuals with Disabilities Education Act (IDEA)*. (n.d.). Individuals with Disabilities Education Act. Retrieved 19 March 2023, visit [link](#) to article here.

Ismail, A. S., & Zulkurnain, N. S. Z. (2019). The Role of Environment As Third Teacher Towards The Development Of Educational Space For Dyslexic Children. *International Journal of Built Environment and Sustainability*, 6(2), Article 2. Visit [link](#) to article here.

Krutzinna, J. I. (2016). Cognitively enhanced children: The case for special needs and special regulatory attention. *Law, Innovation and Technology*, 8(2), 177–206. Visit [link](#) to article here.



---

*Let's Do It Again. . . And Again! Why is Repetition Important to Learning?* (n.d.). Nemours Reading BrightStart! Retrieved 31 March 2023, visit [link](#) to article here.

Mandel, L. H. (2018). Understanding and describing users' wayfinding behavior in public library facilities. *Journal of Librarianship and Information Science*, 50(1), 23–33. Visit [link](#) to article here.

Muhamad Nadhir Abdul Nasir, & Alfa Nur Aini Erman Efendi. (2016). Special education for children with disabilities in Malaysia: Progress and obstacles. *Geografia : Malaysian Journal of Society and Space*, 12(10), Article 10.

*Ontario's equity and inclusive education strategy, 2009* | *ontario.ca*. (n.d.). Retrieved 19 March 2023, visit [link](#) to article here.

Pamela Woolner, Jill Clark, Karen Laing, Ulrike Thomas, & Lucy Tiplady. (2012). Changing Spaces: Preparing Students and Teachers for a New Learning Environment. *Children, Youth and Environments*, 22(1), 52. Visit [link](#) to article here.

Story, M. F., Mueller, J. L., & Mace, R. L. (1998). *The Universal Design File: Designing for People of All Ages and Abilities. Revised Edition*. Center for Universal Design, NC State University, Box 8613, Raleigh, NC 27695-8613 (\$24). Visit [link](#) to article here.

Symonds, P., Brown, D. H. K., & Lo Iacono, V. (2017). Exploring an Absent Presence: Wayfinding as an Embodied Sociocultural Experience. *Sociological Research Online*, 22(1), 48–67. Visit [link](#) to article here.

*The Kindergarten Program 2016: 1.3 The learning environment* | *Ontario.ca*. (n.d.). Retrieved 19 March 2023, visit [link](#) to article here.

---

*The Placemaking Process.* (n.d.). Retrieved 31 March 2023, visit [link](#) to article here.

*What Is Piaget's Theory of Cognitive Development?* (n.d.). Verywell Mind. Retrieved 10 April 2023, visit [link](#) to article here.

Woolner, P. (n.d.). Building Schools for the Future through a participatory design process: Exploring the issues and investigating ways forward. 2009.

Woolner, P. (2010). *The Design of Learning Spaces*. A&C Black.

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## Appendix A:

### Semi-Structured Interview with Educator

1. Well, let us begin. Let us find out some more about you. Tell us your name and where you live.
2. Can you tell us something about the nature of early childhood learning and teaching practices?
3. Can you walk us through teaching/learning activities that you usually perform every day at work?
4. What are your thoughts on integrating children with diverse abilities in a classroom?
5. How do you engage a child in a study-related activity and what significant barriers are to learning for a child in this process?

Break: 10 minutes

Note: For questions in this section, feel free to support your answers with sketches/line drawings.

6. What are your thoughts on space layout and its influence on learning?
7. How would you describe an ideal spatial layout to perform an everyday learning activity with children?
8. Can you think of some places where a child prefers to perform a learning activity at work and why?
9. Playful learning often involves artifacts like stationery/ toys. Do you find these artifacts helpful? What does your experience say about this?

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10. After our discussion so far, can you think of some spaces / spatial design features that can be crucial to the learning process?

11. The aim of this discussion was to understand the users and their learning needs. Have we missed anything?



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## Semi-Structured Interview with Occupational Therapists

1. Well, let us begin. Let us find out some more about you. Tell us your name and where you live.
2. How would you define occupational therapy/PT?
3. Can you tell us about your experience working with children with special cognitive needs?
4. Your thoughts on Occupational therapy's role in a child's development?
5. Can you walk us through teaching/learning activities that you usually perform every day at work?
6. What are your thoughts on integrating children with diverse abilities in a facility and the considerations one should keep in mind to achieve the same?
7. How do you engage a child in a study-related activity and what significant barriers are to learning for a child in this process?
8. What are your thoughts on space layout and its influence on learning?

Break: 10 minutes

Note: For questions in this section, feel free to support your answers with sketches/line drawings.

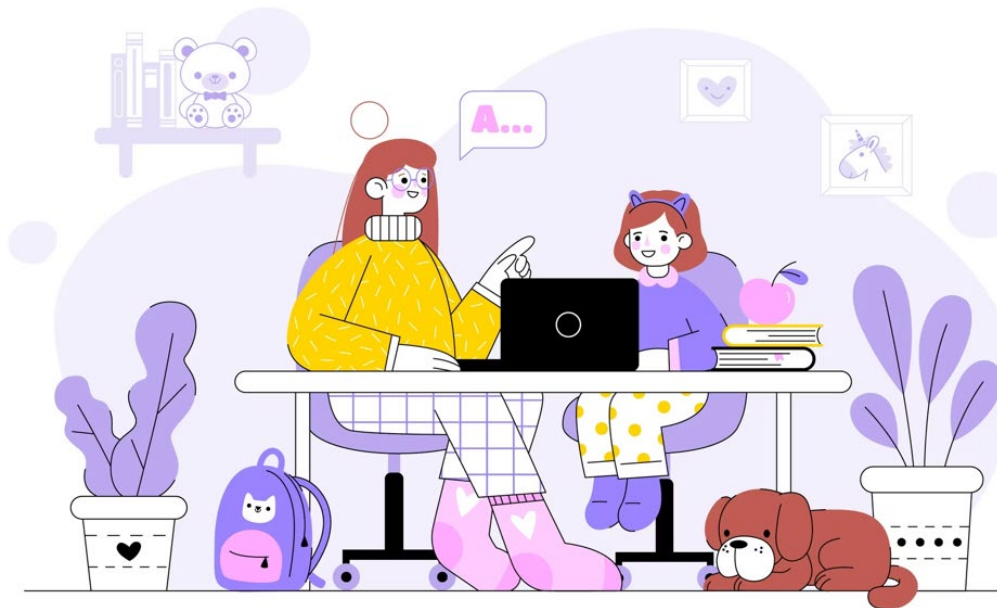
9. Can you think of some places where a child prefers to perform a learning activity at work and why?
10. Learning often involves artifacts like stationery/ toys. Do you find these artifacts helpful? What does your experience say about this?

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11. Is typical way-finding helpful in common spaces in early learning spaces for a child to learn navigation?

12. After our discussion so far, can you think of some spaces / spatial design features that can be crucial to the learning process?

13. The aim of this discussion was to understand the users and their learning needs. Have we missed anything?



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## Appendix B:

### Participation Satisfaction Evaluation Form

Process evaluation matrix:

1. Do you think you were engaged in conversations with enough opportunity to speak?
2. Did you feel a sense of cooperation throughout the experience?
3. Do you think this process has helped to develop possible solutions?

Outcome evaluation matrix:

1. Have your hopes and goals for learning space design been addressed?
2. Do you think the study results will have a positive result on the inclusive learning process of children?
3. Do you feel that this has been a worthwhile experience?
4. Do you think this outcome was a group collective rather than an individual's work?
5. Have you learned from this experience?

Additional Comments:

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Thank you for your assistance with this project.

