# Pre Braille Implementation into Early Education: Tactile Activities to Introduce Braille Concepts to Kindergartners

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## Abstract

This study investigates the importance and affordances of implementing pre braille activities in a kindergarten classroom, regardless of whether students have sight or have sight loss. We question what tools and/or support are needed to conduct greater, inclusive-based lessons in the classroom, and how awareness about the braille writing system could be introduced.

Semi-structured interviews and co-creation sessions were the methods used to gather information, in addition to the traditional literature review. Sessions were conducted with thirteen participants. Through listening and learning from a community of experts, teachers and parents, noted areas of support and needs were incorporated into the design process and discovery of design opportunities. The designed objects foster inclusive teachings, collaboration, and communication between students with all abilities.

Our analysis shows a strong correlation between pre braille activities and kindergarten classroom teaching. Pre braille activities work to build two-handed coordination, finger sensitivity, light touch, dexterity and mobility, all important for reading braille, a tactile writing system.

We propose that integrating multiple modes of tactile engagement in the kindergarten classroom will increase interest in pre braille and the braille writing system. This is especially important for those who later need to learn formal braille. The designed objects, a pouch fostering multiple modes of tactile engagement and an activity prompt system, act as inspiration pieces, allowing students and teachers to co-create activities in the classroom.

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# Chapter 1: Introduction

In early education, a period when development is at its highest and most significant, building foundational literacy skills is important for success, whether personal or academic (Iman, Danisman, Demircan & Yaya, 2019). During the early grades in school, children will develop literacy skills by reading and writing. Students with sight loss develop these skills in the form of braille. Braille is a writing system for blind and partially sighted individuals (BPSI). It gained its first recognition in 1852 after Louis Braille's death (Tobin and Hill, 2015, p. 240). Obtaining a strong understanding of what braille is and how to use it can help an individual excel in school, work and their personal life, overall, increasing confidence and independence. With technological advancements, students are using audio books and assistive technology to learn and complete assignments. Unfortunately, this does not assist the retention of braille writing and reading. Given the importance of braille writing skills for BPSI, and the connection of pre braille to kindergarten classroom learning, this research aims to introduce braille concepts and emphasize pre braille learning in kindergarten classrooms, regardless of whether students have sight loss or not.

My interest in the braille writing system stemmed from a project in my graduate studies focused on creating feasible braille signage in a university setting. Our team consisted of three researchers/designers, and two individuals who are blind. Working directly with the two BPSI, we were provided with the insights of support and needs people in the vision community require when navigating indoors. This fruitful experience in combination with the creation of a children's story and activity book during my undergraduate studies, led to topic areas: braille, pre braille, and early education.

Pre braille, or more recently referred to as early tactile strategies and exploration, work to develop fine motor skills and concept development. Motor skills such as two-handed coordination, finger mobility, dexterity and sensitivity, are explored naturally while discussing concepts such as physical weight, i.e., heavy and light. We see examples of pre braille-like teachings in Montessori and Waldorf schools. The Casa program in Montessori education includes practical life and sensorial exercises to help train the hand (The Casa Program OMS Montessori).

CASA, JK and SK in Montessori (ages 2.5 years to 6 years), cost more than an undergraduate University degree for Canadian students in Ontario (Montessori The Place to Grow). Because Montessori and Waldorf education include sensory teachings but are not accessible to all (cost), I am researching the kindergarten classroom. Unlike Montessori or Waldorf education, the kindergarten classroom at public preschools is free to attend (paid for by taxes) (People for Education, 2021). Kindergarten holds an array of opportunities. It is a time when children first leave their home to learn, work and play with kids of all abilities. The Ontario Kindergarten Program uses a play-based structure, incorporating processes of inquiry. Students will explore and question using an array of materials found in the classroom and outdoors (The Kindergarten Program, 2016, p.23).

I myself am not teaching braille. Braille education requires qualifications of which I do not possess. My purpose is to work directly with kindergarten teachers and teachers of the visually impaired and respond to the following research questions:

By questioning sensory practices currently in place in the school environment,

- What tools and/or support might teachers need to conduct greater inclusive-based lessons in the classroom?
- How can we increase engagement in pre braille and awareness about the braille writing system?

Through co-creation with teacher participants, we found design opportunities that led to the creation of an object (pouch) with multiple modes of tactile engagement, and an activity prompt system. Both outputs can be used on their own or together by kindergarten students in collaboration with teachers in the classroom. The outputs foster inclusive teachings, engage early tactile strategies, and allow for collaboration and further communication between students with sight and students with sight loss.

## Chapter 1.1: Terminology

**Blind and Partially Sighted Individual (BPSI)**
I will be using the term BPSI, as well as student(s) with sight and student(s) with sight loss. This is the terminology commonly used by the Canadian National Institute for the Blind (CNIB).

**COVID-19 Pandemic**
A global COVID-19 pandemic beginning in December of 2019. COVID-19 is an infectious disease causing mild-serious respiratory illnesses. While finalizing this paper (April 2021) the world is continuing to practice social distancing, face covering and sanitization to help prevent the spread of disease. In Canada, vaccines were approved in December 2020 and distribution began one month later.

**Curriculum**
An outline of requirements and learning expectations for each grade in elementary and secondary schools. I am specifically looking at Ontario elementary education. This being said, all discussion surrounding the kindergarten curriculum is based on The Kindergarten Program 2016, outlined by the Ministry of Education in Ontario.

**Early Education**
The formative years leading up to grade schooling. These early years build the foundation of spelling, reading, writing and grammar skills.

**Montessori**
An alternative education model that incorporates physical movement and art into all subjects. Montessori education exposes children to cultural, sensory and practical exercises, encouraging discovery and play at all times.

**Multisensory**
Multisensory means involving multiple sensory experiences at once, i.e., audio, visual, smell, touch.

**Pedagogy**
The unique way in which educators choose to teach and apply the curriculum. Activities in the classroom would be categorized as pedagogy, not curriculum. Pedagogy is always morphing and varies from teacher to teacher.

**Pre Braille**
Activities done before learning the formal braille writing system (grades one and two braille). These activities work to build two-handed coordination, finger sensitivity, grasp and release, light touch, finger dexterity and mobility, all important for reading formal braille.

### Tactile Strategies and Exploration

Tactile strategies and exploration is a more recent phrase used to describe pre braille activities. I use both tactile strategies and exploration, and pre braille within this paper.

# Chapter 2: Literature Review

## 2.1 Braille: A Tactile Writing System

In order to understand pre braille, we must first discuss braille. Braille is a tactile writing system used for individuals who are blind or partially sighted (BPSI). Braille is made up of the cell, constructed of two columns and three rows; a total of six raised dots. Each number and letter share similarities as they're all created using the same cell format. Michael J Tobin, a professor of Special Education at the University of Birmingham says braille is successful due to its consistent formation, even with slight alterations such as the addition of contractions and a sign to indicate a capital letter (2015, p. 240). There are two grades within the braille writing system, grade one and grade two. Grade one is typically used by those who are new to the writing system, and grade two is more advanced (Tennessee Council of the Blind, 2008). "Braille permits the exploration of a whole page of text, scanning of a sentence backwards and forwards, up and down the page" (Tobin & Hill, 2015, p. 246).

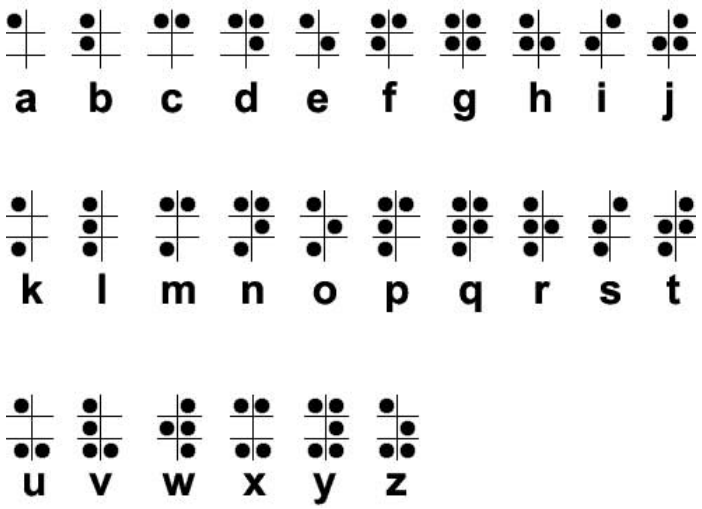



**Figure 1. The Braille Alphabet**
Idee, G. (n.d.). Braille Alphabet [Graphic]. Wikimedia. https://commons.wikimedia.org/wiki/File:Braille_alfabet.jpg

Developing braille literacy skills requires repetitive reading and writing practice, as well as linguistic and haptic skills (Oshima, K., Aria, T., Ichihara, S., & Nakano, Y., 2014). The repetition further enhances muscle memory and information retention. Because braille requires different skills than reading visually, it is crucial for individuals with sight loss to learn braille as early as possible. This

tactile writing system can be both read and written by people with sight (Tobin & Hill, 2015, 246). This allows opportunities for teachers, classmates and parents to become familiar with braille in order to teach or assist those who are new to the writing system.

## 2.2 Pre Braille: Strategies and Exploration of the Hands

Pre braille, as it sounds, occurs before learning the formal braille writing system. Lynn Rollings and Darlene Urban, teachers at the W. Ross Macdonald School in Brantford Ontario, describe braille as read with the sense of touch (Rollings, L., & Urban, D). Therefore, one must first develop finger sensitivity, mobility, dexterity, two-handed coordination, and other strategies helpful to becoming attuned to tactile perception. Well-known in the deafblind community, Lilli Nielsen, a former preschool teacher, psychologist and teacher of the blind, outlines examples of pre braille activities: sorting and stacking, distinguishing between a variety of textures, completing tracking worksheets, stringing buttons or beads, crumpling pieces of paper, manipulating clay, and winding up toys or timers (Nielsen, 1994).

Both 'Paths To Literacy,' a resource site for students with sight loss, and an interview with a manager of a Blind-Low Vision Interventionist Program, discussed the importance of concept development in pre-braille. Working on tactual awareness and fine motor skills are more easily understood through concept teaching. Without sight, concepts have to be taught deliberately (Knight, 2014). Example activities to teach concept development are as follows: creating a nature basket, a story box, and stacking or nesting. A story box includes a number of objects in a bag or box that are used during the appropriate time when telling a story. This creates a more exciting and interactive story time experience (Knight, 2014).

Storytelling is also a valuable method for learning, especially when learning literacy skills. Storybooks allow for periods of creativity and imagination, collaborative reading between the teacher and student, and encourage exploration (Beginning Literacy Development at Home). Stories can help articulate concepts, and are therefore a reason we see the creation of the story box. Unfortunately, this powerful learning tool is not always available to families of BPSI, and braille books are much larger and longer than those without braille. Given the importance of concept building and storytelling, I brought the explorative and sensory features of story boxes to the proposed design outcomes (seen in Chapters 4 and 5).

**Figure 2. Storybox Example**
Image by the Author (2021)

## 2.3 Montessori Education: Tactile Activities in Use

Montessori and Waldorf-style education models emphasize hands-on learning and collaborative play. Maria Montessori, an Italian physician in the early nineteen hundreds, worked to create a new approach to education, one that would allow children to reach their full potential. Angeline Stoll Lillard, a professor of Psychology at the University of Virginia, describes Maria Montessori's hope for this alternative type of education. "Montessori would help children develop into wise and caring adults" (2018, p. 396). This would hopefully be the case for all children, so how is Montessori different? The Casa program in Montessori, referring to the age bracket of two and a half to six years old, develops practical life skills, contains sensorial and cultural activities, and incorporates movement and art into every subject.

The following are examples of practical, sensorial and cultural activities, as outlined in a Montessori School, located in Chatham Ontario (Montessori The Place to Grow).

- Practical: Pouring liquids, polishing, sweeping, dusting, and washing tables, all introduce independence and self-confidence to students.
- Sensorial: Taking things apart and putting them back together helps develop curiosity and discovery.
- Cultural: Exercises in geography, history and sciences help students understand the world they inhabit.

The artistic expression and display in Montessori and Waldorf schools are typically visually focused. Children without sight are not able to learn incidentally like their classmates with sight. Incidental learning, or learning through observation and repetition, is a large part of how we learn, especially at a young age. Langley, a teacher of students with profound visual and multiple handicapping states, "Visually impaired children rarely used objects that deviated from day-to-day experiences" (1985, p. 103). The first time a child with sight loss is presented an object, it is the first time they're experiencing it. This was especially helpful to remember during the design process as the outcome benefits both students with sight and with sight loss. The objects used in the designed outcome have a sense of familiarity to students with sight loss.

## 2.4 Ontario's Kindergarten Classroom: Play-Based and Student-Led Learning

The kindergarten classroom takes a play-based learning approach. It is found that this type of education has "lasting benefits for children's reading, writing, numeracy, self-regulation and social skills" (Building Better Schools, 2019). A number of centres in the classroom allow for small groups, large groups, and one-on-one learning time. The classroom centres include materials for all types of collaboration, such as, whiteboards and markers, sand, and playdough. The Ontario Kindergarten model benefits from two types of educators in one classroom at a time. One, a certified teacher has knowledge of the elementary curriculum outlined by the Ministry of Education, and two, a designated early childhood educator (DECE) brings knowledge of learning needs for children ages birth to five years old (Building Better Schools, 2019). Two educators allow for more time getting to know each student and their unique way of learning.

The Ontario Kindergarten Program 2016, describes the child and teacher as co-learners. A child will engage in inquiry when supported by the teacher. Example acts of inquiry are: "exploring objects and events, making observations using all five senses and generating questions, gathering, comparing, sorting, and notice patterns" (The Kindergarten Program, 2016, p. 23). This is supported through the educator posing open-ended questions, providing a variety of materials, modeling how to plan, and asking questions which expand upon the child's thinking. Already, I have noted a strong correlation between kindergarten's acts of inquiry (exploring objects using all five senses), and pre braille activities (sorting, stacking, manipulating clay, etc.). The connection between pre braille and kindergarten learning were only made possible through literature review and discussions with kindergarten teachers. Literacy learning in kindergarten, is in fact, very similar to pre braille. Many teachers noted in interviews, that pre braille could be referred to as pre reading for children with sight.

Young students are growing up in a very digital time, and therefore develop digital literacy at a young age. With the rise of technology, BPSI are beginning to read acoustically, i.e., listening to audio textbooks instead of writing and/or reading braille. Some students in higher education say there is limited time to complete homework, so reading acoustically has become a staple practice, says Vassilios Argyropoulous, a member of the Department of Special Education at the University of

Thessaly, and Aineias Martos, who works at the Centre of Education and Rehabilitation for the Blind. (2006, p. 3). This poses an issue because without frequent literacy practice such as reading and writing braille, braille retention may be lost. This is especially unfortunate because it is known that developing braille literacy skills can assist with employment, schooling, independence and overall happiness (Argypopoul & Martos, 2006). It is therefore crucial that we integrate pre braille activities into early education, hoping students without sight, or those who lose sight later on, will be more apt to continue reading braille moving into higher education.

## 2.5 Toys as Learning Tools

A team in India, including individuals with design and vision rehabilitation knowledge, describe the impact of play-based learning as, "promoting social skills, emotional development, sensory awareness, and communication, along with helping children develop fine and gross motor skills" (Jain et al., 2018, p. 902). There are many types of toys promoting learning and play simultaneously, examples can be seen in Montessori classrooms. There are wooden and plastic toys made to practice stacking and sorting, matching like-shapes, counting and connecting. These types of toys are durable and effective teaching methods.

Concepts in mathematics can be more clearly described through 3D objects, which help visualize concepts related to counting and space. The second semester of kindergarten introduces 3D shapes to explore relationships and properties (Kinzer, Gerhardt & Coca, 2015). Fittle, a 3D-printed puzzle created in India, recognizes that blocks are accessible thinking tools, and effective modes for reasoning, modeling and constructing. The Fittle puzzles contain a number of blocks, each embossed with English Braille. Once adjoined, the pieces create an object with the object name included on top. A child with sight loss is then able to read, for example, fish in English Braille, while feeling the shape of a fish.

"The expansion of literacy options through multimodal pedagogy is a pillar of inclusive curriculum" (Heydon, Zhang & Bocazar, 2017, p. 193). Children don't always learn in the same manner. There are many modes of learning, i.e., visual, kinesthetic, auditory. Recognizing and implementing a multimodal pedagogy allows for variation of learning. This might include using objects or toys to communicate. 3D models, say of a familiar story, can lead to new meanings and interpretations (Heydon, Zhang & Bocazar, 2017). The collection of objects for a 3D story also provide moments of critical thinking and questioning 'I chose this material because…'

## 2.6 Empathy and Simulations

I would like to briefly point to simulations, as they are widely controversial as a tool for cultivating empathy. It is very common to conduct disability simulations or experience simulations in a school or workplace in an attempt to gain empathy and awareness for those with a disability. The most common disability simulation is using a blindfold to conduct sight loss or blindness (Silverman, A. M., Gwinn,

J. D., & Van Boven, L., 2015). Unfortunately, these seemingly positive intentions have negative results such as stigmatization or further isolation. Instead of focusing on what an individual is capable of, the simulation highlights the challenges that individuals face, when in most cases, it is environmental and social barriers that limit an individual with a disability. Disabilities are complex and can not therefore be generalized. Simulations do not address human rights, and often an aspect of a disability, i.e., a wheelchair, can be seen as a limitation and not the liberation that it is. Zara Todd, disability activist living in the UK explains in section four of Nine Reasons why Simulations of Disability Doesn't work in HRE, "My chair enables me to live life, to travel, to work and to socialize" (2017).

## 2.7 Review and Next Steps

The following bullet points started out as a quick reminder to myself when reflecting on what the literature review taught me and how it informs the design. I've left the bullet points allowing for a cursory overview and reflection period.

- Braille is a tactile writing system, typically used for those who are blind or partially sighted (BPSI). This writing system helps empower individuals, as they are often more successful in work and school with knowledge of braille.
- Pre braille, more recently referred to as early tactile strategies and exploration, is typically learned before formal braille, grade one and two. It allows individuals to build strength in their fingers and hands (the tools they'll be reading and writing with).
- Both Montessori or Waldorf education (private sector) and Ontario's kindergartens (public sector) implement tactile activities in their teachings, Montessori and Waldorf maybe more so. But these alternative education models are not accessible (cost wise) to all.
- From observation and research of toys present in kindergarten classrooms, I've noted they are often one-dimension, meaning, one toy will allow for stacking, but not other activities like stringing, crumpling, zipping and further manipulating.
- Play-based learning and toys promote social skills, emotional development, communication, etc. important for future learning and growth.
- Simulations, i.e., placing a blindfold over the eyes to simulate a vision impairment, is used as a teaching method in schools. Research shows this may not be the best way to increase empathy and understanding. Actually, it may increase "otherness" and power bias.

# Chapter 3: Methodology and Methods

I conducted qualitative and participatory research methodologies. Qualitative research involves collecting and analyzing non-numerical data to gather in-depth insights (Bhandari, 2020). Participatory research emphasizes the perspectives and priorities of participants. It can be defined as "systematic inquiry in direct collaboration with those affected by the issue being studied" (Vaughn, L. M., & Jacquez, F., 2020). Both methodologies were chosen as they align well with inclusive design practices. Inclusive design assesses and evaluates the needs and barriers of participants often not acknowledged in current systems. The methods used included semi-structured interviews, co-design and feedback sessions with teacher participants.

## 3.1 Participants and Recruitment

Because I would be working directly with individuals, research ethics (REB) needed to be completed. I gained REB approval (#101812) on June 26th, 2020. This meant I was able to prepare for interviews fairly early. Just three months before REB approval, our world entered a global COVID-19 pandemic resulting in lockdowns and isolation practices. Participant recruiting was deemed more difficult than initially expected. Teachers were finding creative solutions to conduct their lessons digitally, and parents, in many cases, became their child's primary teacher. As to not burden early educators with further stress, I looked to retired kindergarten teachers and those on maternity leave. These participants held immense knowledge and practice teaching. As of October 2020, some teachers who were teaching kindergarten during the COVID-19 pandemic and learning how to adjust to teaching online, indicated their availability to participate in research. I was then able to interview not only retired kindergarten teachers, but current practicing teachers. Conversations with Teachers of the Visually Impaired (TVIs) and Mobility and Orientation (O&M) specialists occurred later in the research process, March and April 2021.

In the following sections, 3.2, 3.3 and 3.4, I will describe the chosen methods and what was learned from each.

## 3.2 Semi-Structured Interviews and Understanding Data

A semi-structured interview allows for more discussion-based conversation than a fully structured interview. In general, semi-structured interviews are commonly practiced in qualitative research, allowing the researcher to listen and reflect on participant's real-life scenarios, stories and expertise; a depth of knowledge not gained by a literature review alone. Interviewees expanded on what I had studied and opened up new points of view which further enriched my research and ultimately, the designed outcomes. I was able to interview a pre braille specialist, two Principles of Montessori-based schools, a parent of a child with sight loss, six kindergarten teachers, and three teachers of the visually impaired (TVI), each bringing detailed knowledge of early education, ranging from daily structure,

activity types, and communication between the teacher, student and parent. The participants interviewed are located in the Greater Toronto Area (GTA) and Niagara Region in Ontario, Canada. With permission granted, interviews were recorded for the purpose of transcription and deleted once notes were complete. The interviews were approximately thirty minutes, but depended on the amount of time participants had and how much detail they offered. The list of questions was provided one day prior to the interview phone call (See Appendix A for list of questions).

I was used to coding as a natural next step following interviews, but in processing this information, I discovered that trying to codify majority needs and findings meant I was excluding individuals that did not 'fit' the majority. This realization came only after conducting initial coding into categories, i.e., government and curriculum, age group and type of teaching, teacher-parent-student relationships, etc. Instead of showing you the coded findings, I present some similarities found, but also the needs and barriers of participants.

Some areas of recurring practices and needs mentioned are as follows:

**Practices**

- Incorporating sensory activities (see 3.2.1)
  - Activities are sometimes conducted outside to engage the senses in ways the classroom cannot.
  - Tactile engagement is integrated in the kindergarten curriculum, and must continue to be integrated and developed upon.
- The kindergarten learning format is student-led, allowing teachers to capitalize on the student's interest to make learning more engaging. Students are only taught something new when the teacher believes they're ready for a change.
- Technology integration is different from school to school, but implemented in all to a certain degree. (see 3.2.2)

**Needs**

- Support: for teachers, parents and students with disabilities (see 3.2.3)
  - Greater teacher support within the classroom
  - Stronger communication between parents and teachers
- A need for more open discussions related to sight loss and other abilities.

I've broken down the following findings into areas within kindergarten education that displayed barriers, needs and successes, reflectant of the bullet points above.

### 3.2.1 The Value of Incorporating Sensory Activities

This section assesses the types of tactile engagement integrated in the kindergarten curriculum as well

as the types of activities conducted outside. It was confirmed during conversations with participants, that pre braille activities such as hand and finger strength, mobility and dexterity, are examples of literacy learning. By practicing tactile activities such as collecting materials outside that have the same size or texture, students are learning important skills for reading and writing.

When we discussed types of sensory and tactile activities, the mention of outdoors appeared repeatedly. 'Forest schools' was a new term to me. This idea has been incorporated into many schools. It is an allotted period of time per week, that students are taken outside to learn. If there is a forest or park nearby, the 'forest school' will take place there. Learning outdoors offers opportunities to touch, smell, and hear differently than indoors. Science is also a subject that allows for more sensory learning, and learning that can be done outside. For example, exploring the concept of growth, freezing or thawing by observing a plant grow and seasons change.

In an interview with Teacher Participant G, a teacher of the visually impaired (TVI), they discussed that in the event of a class trip outdoors, to say a nature conservatory, a pre-made kit will be delivered (during the COVID-19 pandemic) to the student with sight loss. The parents will then assist the child while the TVI explores the kit with the student virtually. This kit might include a branch asking to be smelt, handled and manipulated, and seeds, able to be cracked in the students teeth. Exploring the kit in advance allows the child the attention, knowledge, and sensory experiences before attending the trip with their peers.

Everything using fine motor, i.e., manipulating smaller objects, connects to pre braille learning. Understanding the importance of these tactile experiences and its connection to literacy and braille learning, affected the tactile pouch outcome co-designed by myself and teacher participants. Reflecting on the benefits of the pre-made kit in the example above, the co-designed pouch uses a variety of textures including rough Velcro, soft denim, hard plastic zippers, and smooth laces. Exposure to different textures will improve sense of touch, and ultimately reading. Each pocket on the pouch uses a different clasp for opening and closing, offering plenty of opportunities to work with different fine motor skills.

### 3.2.2 Technology

This section looks at the type and degree in which technology is used in the classroom. I am defining technology as assistive tools requiring internet connection, i.e., iPads or computers to use websites and applications. Because students are growing up in an increasingly digital age, technology is becoming less foreign to children. All teacher participants mentioned some amount and type of technology used in the classroom; each at slightly different levels. In this case, some classrooms introduced math manipulatives, hands-on tools to solve math problems. Other classrooms are using sites like gfletchy.com, where math problems are presented in the form of short commercials. These example tools and/or technology offer auditory and tactile strategies, differing from the previously taught math

problems conducted on worksheets. These have proved to be more effective, fun, and not limiting to sight dependency. One participant noted that their students enjoy learning math concepts when using manipulatives because it felt like a game. It is important to note that the type of technology available in the classroom is dependent on financial conditions and funding available.

For BPSI, technology can be impactful and lead to increased independence and confidence. Some of the technology present in an elementary classroom for BPSI are a Mountbatten brailler and a Victor Stratus Reader (audio book player). Other technologies introduced are audio devices, electronic books, and screen readers, all of which are described as assistive technologies.

### 3.2.3 Support: For Teachers, Parents, and Students with Disabilities

This section is reflective of the need for greater teacher support within the classroom as well as a need for stronger communication between parents and teachers. While teachers do their best, there is never enough time to support all students, especially in classes with twenty plus children (typical in Toronto public schools). Teacher participant B said “teachers need the same support a child needs.” This being the case, they feel as though parental support, to reinforce learning being done in the classroom at home, would be helpful, as well as extra and specialized support professionals in the classroom. Strategies to support students with sight loss and/or other learning disabilities from the point of view of kindergarten teachers, looked like: chunking work into manageable pieces, enlarging content, using assistive technology (dictation applications), creating unique tasks and visual schedules, having the student sit closer to the teacher, and helping kids understand what they’re feeling. TVIs noted the importance of students with sight loss to be at the same pace as their classmates. A suggestion was support over the summer months, a time when pre braille practice can be lost and/or delayed. Support over the summer for BPSI shows promise for future opportunity and development of this research project.

Parents are the first teachers of their children and they have a lot to share with classroom teachers if given the opportunity. This research focused on teacher insights. Further research would benefit from conversations with parents. Reading exercises and at-home literacy practices were briefly discussed with teacher participants who are also parents of young children. Primary discussions about parents were in conversation with teachers and how teachers interact and bring parents into the child’s learning. Some teacher participants suggested ways for parents to continue classroom learning in the home. One of these suggestions was going on a walk with your child and asking questions; simple and effective, enforcing curiosity and inquiry.

### 3.2.4 Unexpected Findings

While there were some similarities shared across teacher participants related to types of activities taught on a day-to-day basis, there were also unexpected findings. Firstly, the importance of

technology was particularly crucial to the one parent participant interviewed. Again, this would be interesting to explore with more parent participants in future studies. This parent has a child with sight loss and noted a lack of support for their child in the school setting, particularly in older elementary grades. They also made clear they wished their child would have more practice and exposure to technology in the classroom. “I want my child to be able to participate in the 21st Century.” Although important to note, the initial design in this research does not include technology, as producing something feasible to many was a priority; something that can be constructed by teachers and guardians if they’re unable to purchase tools. Activity prompts are able to be shared physically or digitally, and printed at a low-to-no cost.

Teacher participant C discussed the use of technology in their classroom. Since the beginning of the COVID-19 pandemic, this participant has looked to platforms like Twitter to help engage parents with the student’s classroom work and learnings. Other classroom teachers are making use of Google Classroom and conversations with parents and/or guardians via Zoom. The types of technology and platforms used were dependent on the teacher and parent interest. A TVI noted that their student caseload is approximately 70 students. This is not typical. It had increased when learning no longer took place in-person. Here, an opportunity emerged to develop a community platform or forum for teachers of the visually impaired to share experiences and expertise. Teacher J said “This job can be lonely. There aren’t many of us.” As a result, internal motivation is crucial to succeed in a job of a TVI.

With unexpected findings, I was able to incorporate unique barriers and needs that arose in the designed outcomes. The created activity prompt system (as seen in Chapter 4) may be a starting point for a community sharing project. Because the prompts are modular, they offer customization. It is my hope that teachers will add to and refine the activity prompts to then be shared within the community. This is a first step to addressing the need for a community where TVIs can share experiences, concerns and material. Other unique needs that arose in this section (Unexpected Findings) have created a space for new inclusive projects.

## 3.3 Co-Design

I’ve learned to adapt both the language and design used throughout this project process. When introducing the idea of co-design sessions to participants, there was hesitation. Many people hear the word design and if they do not have a design background, they feel fearful. Adjusting the name to co-creation or workshop allowed for a greater ease and welcoming nature to the process. Going forward, I will be toggling back and forth between the terms co-design and co-creation.

As I learned in the Inclusive Design Master program, co-design means recognizing that your participants are the experts; experts in a field of study and in real-life experiences. I considered how co-design could be used as part of this project. By co-designing we can learn from participant’s unique experiences and begin to design systems, products, etc., that address the needs and barriers

of people who aren't considered the majority. I co-designed with kindergarten teachers and teachers of the visually impaired. Whether currently teaching, retired, or specialized, i.e., an orientation and mobility specialist (O&M), all teachers have rich experience and unique styles of teaching to learn from. Co-design is an important part of inclusive design. It is one of the three dimensions outlined by Jutta Treviranus, director of the Inclusive Design Research Centre at OCAD University. "Use inclusive, open and transparent processes, and co-design with people who have a diversity of perspectives, including people that can't use or have difficulty using the current designs" (The Three Dimensions of Inclusive Design, Inclusive Design Research Centre). The purpose of the co-design sessions was to have teacher participants design a multisensory kit including objects and activities that could be used in the classroom, whether the students have sight loss or not. It is important to reinforce that during a co-design session, I as a facilitator, am meant to actively listen and guide when needed. The designed outcome is to be created by the participants without influence or bias.

Co-design sessions are an appropriate and effective method when conducting participatory research. They allow for learning and feedback from individuals constantly working with the intended age group. We arrived at co-designing a multisensory kit from literature and interview findings. Co-designing the proposed design outcomes allowed for most needs to be met. The importance of: play for learning and retention of information, tactile activities in place in the kindergarten classroom, and an opportunity for more inclusive conversations, naturally developed to a kit (object and activities). A need arose for objects with multiple modes of tactile engagement, one that allows for manipulation of large objects and small, each requiring different finger and hand manipulations. I am naming the designed object a tactile pouch as it offers multiple modes of tactile and pre braille practice, i.e., collecting and sorting as well as more fine motor development (wrapping a string around a button). Design decisions for the tactile pouch are discussed in greater detail in Chapter 4. Beneficial to the design was knowledge of materials that are safe for the kindergarten classroom, what a child would be most engaged with whether having sight loss or not, and how classroom activities could integrate the tactile object.

### 3.3.1 Co-Design Session Reflection

A number of co-design sessions were set up in order to learn from participant's creations. The created outcomes highlighted types of materials, what participants would like incorporated into the classroom and what they could do without. The first session did not go as planned, which had its benefits: unique learning opportunities! It compelled me to reflect on different set-ups for future sessions. The first co-design in practice was more conversational. I posed a few questions at the start, i.e., Is the kit used outside or inside? Does it only contain activities specific to one subject area? Conversations deviated from the posed questions and included the sharing of techniques and current experiences in the classroom. I predict both participants were curious about one another's background and not enough time was allotted for them to get to know each other outside the conducted co-design. The opportunity to converse during breaks for example, would have been more natural in an in-person setting. Due to the COVID-19 pandemic, the co-design session took place via a three-way phone call. This

posed its own challenges as we had no indicator of who was to speak next. Understanding it can be uncomfortable speaking to multiple strangers on the phone or in a video chat, I decided asynchronous activities would be more valuable for both participants and myself.

### 3.3.2 Asynchronous Activity Co-Creation

As a result of busy schedules and excessive time spent in front of screens, an asynchronous activity (not in real time) was proposed. The asynchronous activity allowed participants the time to test without the stresses of scheduling and planning with other participants. Each participant was given an introduction to the research project, a warm-up activity to help them feel more relaxed with the idea of designing, and a formal activity. After about a week, a follow-up call was scheduled to discuss thoughts and findings.

The formal activity is as follows: Inspired by action words used in pre braille, i.e., sorting, stacking, stringing, twisting, matching, grouping, comparing and tracking.
1. Make something that incorporates the act of stacking; or
2. Stack your collected materials (a suggested list was provided beforehand)

The activity then asked participants to consider the materials they used. Posing questions like: Is the material safe for a kindergarten classroom? Is it a found material? Can you see this material transferring to other pre braille activities?

| Creations by Participants | Materials | Observations |
|---|---|---|
|  | • Marker lids<br>  • Sort by colour and size<br>  • As marker wears out, collect lids in larger bin<br>• Buttons<br>  • Staple in the classroom<br>• Playdough<br>  • Mouldable, holds its shape and takes on various forms<br>• Often used recycled materials in classroom when discussing shapes | • The smaller the material the more agile and precise one has to be<br>• Playdough allows for different hand strength and muscles to be used<br>  • Material like wood does not allow for same sort of manipulation |
|  | • Playdough<br>  • Can be made at home or in classroom<br>  • Stamp letters in playdough<br>• Beads<br>  • Reusable<br>  • Different colours used for matching and sorting activities<br>• Pipe cleaners<br>  • Reusable<br>  • Used to form letters<br>• All materials safe for K classroom | • Conducting activity required:<br>  • Hand-eye coordination<br>  • Depth perception<br>  • Pincer grasp to pick up individual objects, i.e., bead<br>• Activity would have been easier with larger materials<br>  • Beads with larger hole<br>  • Cut-up rings of paper towel roll |

**Table 1. Asynchronous Activity Findings**

### 3.3.3 Review and Response to the Asynchronous Activity

Although it appears the asynchronous activity was only conducted by two individuals (looking at the figure above), multiple teachers participated. I believe some felt more comfortable speaking to their design without photos of what they'd created. In the future it may be beneficial to ask participants to record not the outcome, but the materials used. This on its own is extremely beneficial to the design process. As seen in Table 1, many of the materials used can be found in the home and a kindergarten classroom. Conversations were had about sizing of beads, the kitchen-friendly ingredients of playdough, and repurposing materials post-use. Most interesting to note is that kindergarten includes a large age range of approximately three-to-six-year-olds. Older students in kindergarten may have no trouble using their pincer grasp when manipulating beads, younger students on the other hand, may need larger objects to start with. This made it clear that the materials used with the tactile pouch should be inspired from assessing where the child is at in terms of their fine motor skills, hand-eye coordination, and depth perception. A solution may be to have beads (and other materials) of different sizes in the classroom so students can choose and use what they feel comfortable with and/or are able to manipulate. It is also important to use found and recycled materials, as mentioned by multiple participants. As to be inclusive to both students with sight loss, and students with sight, materials might be limited to ones BPSI are familiar with. Although, materials will likely be customized by the classroom teacher and students.

## 3.4 Feedback Sessions

I showed teacher participants early sketches following the asynchronous activity for further design feedback. When looking at early sketches of the tactile pouch, teacher participant G suggested the pouch fit on the child's lap, as kindergartners like to work on the floor where there's more room and less confined space. In terms of activity prompts for teachers, participant G thought there might be a way to allow teachers to create activities based on observing how their students interact with it. "Place the pouch on the math table and see how kids interact. Are they stacking? Sorting? Stringing?" depending on their range of skill and manipulation ability, especially with smaller objects.

Another conversation led to insights about a kindergartner's work ethic. "Kids are able to build at this age. They are also result and goal-driven." This highlights the importance of keeping activities challenging. This could be addressed through levels or layers within the pouch, or modifications to activities, i.e., a prompt that is relatively easy (to manipulate) and one that requires more fine motor challenges. The tactile pouch could include Velcro and buttons in the first layer, and string in the second. The levels and/or layers would allow the child to work through different tasks and manipulate their fingers in different ways in isolation.

# Chapter 4: Working Practices

Chapter 4 takes knowledge learned from research, interviews and co-creation with kindergarten teachers and teachers of the visually impaired (TVI), to describe how the design came to be. Sections within the chapter explore materials and prototypes for both the pouch and activity prompt system.

Co-creating with teacher participants meant designing and reviewing the tactile pouch and activity system's benefits, safety and mutability. It is my goal that with the design outcomes in hand, teachers and kindergartners will work together to explore textures in a safe space, while simultaneously conversing about what it means to read tactually.

## 4.1 Inspiring the Design

As stated in Ontario's Kindergarten Program 2016 (first mentioned in Section 2.4), children are engaged in inquiry when they "gather, compare, sort, classify, order, interpret, describe observable characteristics and properties, notice patterns, and draw conclusions, using a variety of simple tools and materials" (The Kindergarten Program, 2016, p. 23). These acts connect well with pre braille activities, i.e., sorting, left and right, tracking, matching, stringing and lacing (Rollings, L., & Urban, D). The activity prompt system was inspired by a need for ideas and/or suggestions on how one might use the pouch for classroom activities. When constructing activities with teacher participants, we noted distinctions between learning outcomes, settings (outdoor versus indoor), and the pre braille actions themselves. The prompts then evolved to become a modular system, allowing mixing and matching between options related to the three distinctions. More detail about the modularity can be read in section 4.5.

## 4.2 Material Exploration

As my research focuses on the sense of touch, it became increasingly crucial to test materials that could be used in the kindergarten classroom, as well as, receive feedback from teachers to confirm whether the materials were appropriate. Materials with unique textures allow us to develop finger sensitivity, but also an understanding of usability and safety. Therefore, the materials chosen were based on appropriateness, effectiveness and dual purposality, i.e., safe for the students and classroom, resulting in thoughtful teachings, and able to be used by both BPSI and students with sight.

A resource from the Inclusive Design Research Centre's SNOW project, titled "One is Fun, Guidelines for Better Braille Literacy" by Marjorie Troughton, reinforced the materials and actions that should be used when beginning to learn braille as a child. "Interesting books for preschool readers include cloth, zippers, buttons, magnets, Velcro, action figures, pockets, etc. as well as books of different shapes" (Troughton, 1992, p. 33).

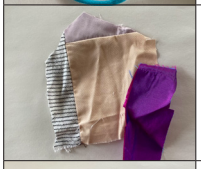
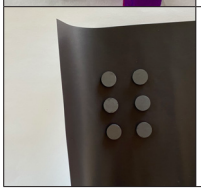
| Photograph | Material | Advantages | Disadvantages | Activity (Pre Braille) |
|---|---|---|---|---|
|  | • Wood | • Sturdy<br>• Structural integrity | • Can be heavy<br>• Difficult to transport<br>• Requires additional tools for manipulation<br>• Splinters | • Blocks used for stacking and sorting<br>• Noticing patterns |
|  | • Rope | • Available<br>• Can use to teach tying shoes | • Dangerous if too long<br>• Require advanced fine motor development | • Stringing (fine motor)<br>• Two-handed coordination<br>• Pincer and grasp |
|  | • Fabric | • Variety of textures<br>• Beneficial to develop finger sensitivity | • Some available<br>• Subconsciously teaches material waste | • Differentiating textures (rough and smooth)<br>• Matching opportunity<br>• Comparing |
|  | • Magnet | • Can use a variety of objects with magnets<br>• Move and manipulate attached objects<br>• Portable | • Magnets work with water? | • Sort<br>• Group<br>• Tracking and tracing fingers over objects |

**Table 2. Sample Material Exploration Chart**

This table represents the review and testing of materials found in my apartment, outlining the advantages, disadvantages and relationships to pre braille activities. Materials were chosen based on what I already had and/or what I could access during the COVID-19 pandemic. The benefit to using found and familiar materials during testing was that many of these materials would also be accessible to teachers and parents. A creatively inclined parent might use these materials to make their own tactile pouch. The items tested were inspired by a pre braille document shared with me by a manager in the Blind Low-Vision Early Intervention Program at Surrey Place, as well as being mindful about what children use and how they play. As you can see in the above figure, wood is a sturdy material with structural integrity, but can be heavy, difficult to transport, and may need additional tools for manipulation. Magnets include a variety of benefits for exploration. They can be moved to different locations, allow for manipulation of objects, and are small enough for transport. A full Material Exploration Chart can be found in Appendix B.

## 4.3 Design Ideation

Before beginning to prototype objects and activities, I revisited my research questions in more detail. This allowed me to clearly outline the specific needs that arose from discussions with participants; needs that would be addressed in the final design outcomes.

### 4.3.1 Research Questions Revisited

**What tools and/or support might teachers need to conduct greater inclusive-based lessons in the classroom?**

As gathered from interviews, teachers are looking for further support, whether that's in the classroom, or at home. There is an opportunity to continue learning in the home environment but it requires strong communication of expectations between parents and teachers. Teachers are interested in more manipulatives and tools to use in their teaching, however these tools can often be expensive. As a result, students share and work with them in small groups. Here, an opportunity for an educational tool at a low-to-no-cost emerged.

**How can we increase engagement in pre braille and awareness about the braille writing system?**

Ways of engaging in new material might include: play-based inquiry, the outdoors, manipulatives, and engagement in multisensory activities, all tactics used in kindergarten teaching. These types of learning are found to be most important at this stage of development. I use the example of egg cartons simulating the braille cell in the activity prompt systems, seen in Chapter 5. This idea was inspired by a teacher participant who had experience and success using this specific material when discussing braille. Objects like egg cartons, cut in half, offer an introduction to the braille cell formation. Both the halved egg carton and braille cell consist of two columns and three rows. When stones or marbles (objects found outside and inside the classroom) are placed in the carton divots, the braille writing system is simulated. There are many activities that can spark discussion about the braille writing system. The activity prompt system will help with initial pre braille activity ideas and construction.

## 4.4 Tactile Pouch

Early design ideas for the tactile object, used a wooden board as a starting point. The board was to have carved out circle depressions which would then be filled with materials like marbles, allowing children to track and trace their hand over the objects (see Figure 3). In discussion with participants, it became apparent that a wooden board may not be the best material for kindergartners. Although sturdy and long-lasting, wood is heavy, especially if the students are meant to carry this board to and from school. Wood also poses challenges when it comes to cleaning and disinfecting (something that should be considered during the global COVID-19 pandemic).

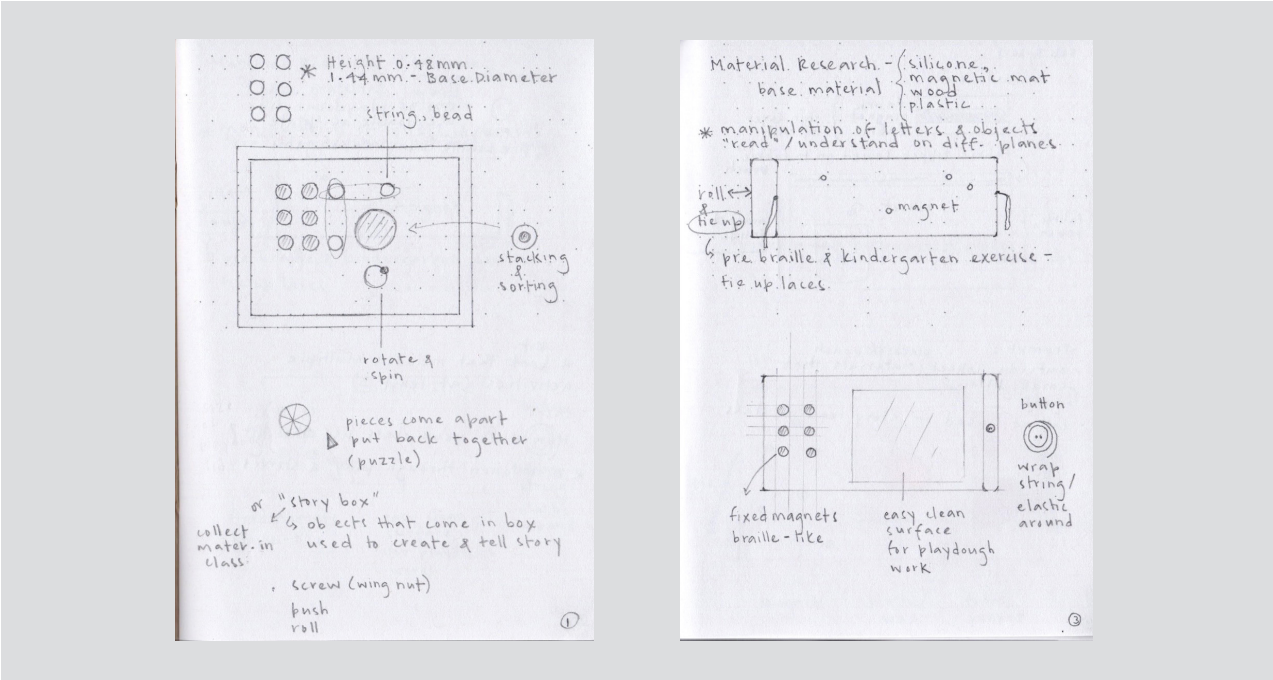



**Figure 3. Object Design Sketches**
Drawings by the Author (2021)

A magnetic sheet became a unique solution to a wooden board base. The magnetic sheet rolled up easily, making transportation simple. Magnets allow for the exploration of materials on a variety of planes, i.e., upside down and on an angle.

For the magnetic sheet to hold or contain opportunities for other activities, it was decided to wrap it in fabric. The fabric would allow for sewn-on pockets, zippers, Velcro, and buttons, each requiring unique hand position, movement and other considerations.

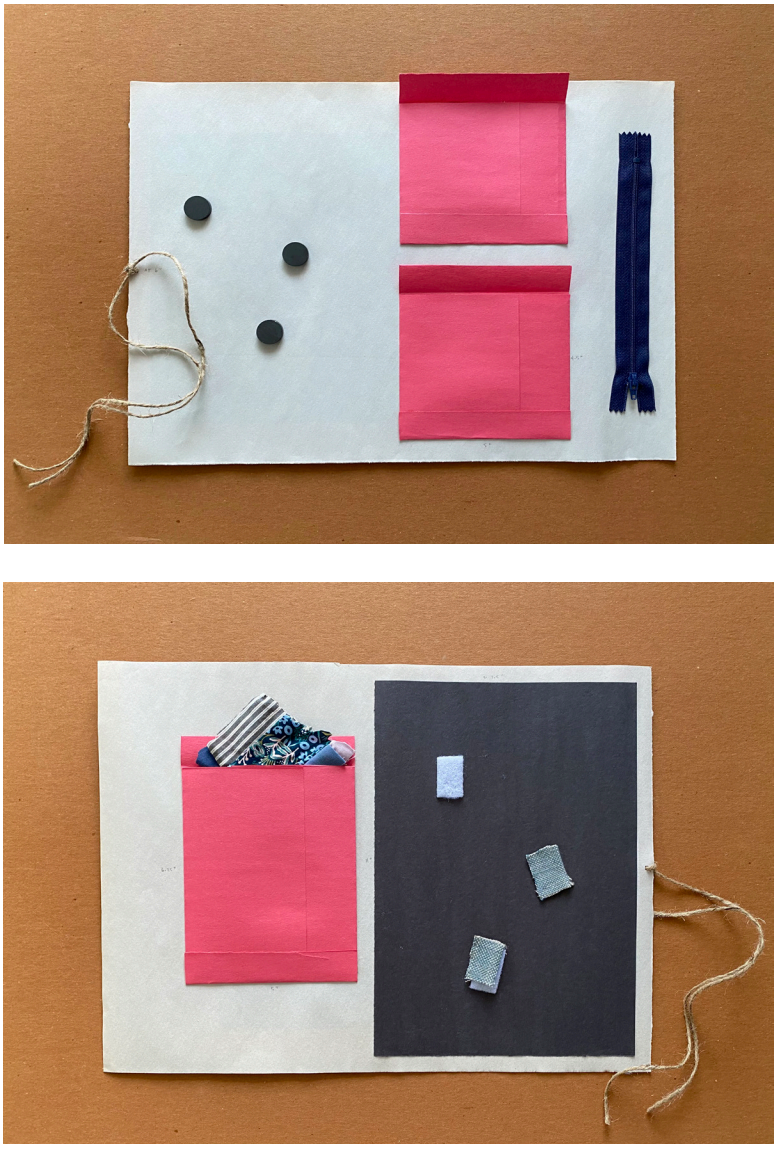


**Figure 4. Paper Prototype**
Prototypes by the Author (2021)

The figures above show a prototype for a tactile pouch. Using paper and fabric to prototype made for quick and multiple iterations. Three contrasting colours were chosen, a light grey, red and black, with the knowledge that people with partial sight can see some colour. The pouch itself will be 16 in by 12 in. This size will fit within a child's lap so that they can use it in any location and/or position. The front, in a washable fabric, will contain: two pockets and additional magnets. Each attachment, i.e., pocket,

has its own unique purpose and function. The pockets are meant for collecting, sorting and matching pre braille activities. The magnets supplied with the pouch, can be used in conjunction with objects throughout the classroom. The magnet can attach to the object (with a sticker backing) allowing for manipulation and comprehension on different planes. The backside of the pouch will primarily be used with a Velcro patch and Velcro stickers. Attached is one pocket at 6.25 in, able to hold collected materials such as fabric scraps. The fabric scraps, when attached to the pouch with Velcro, permit tracing and tracking; noticing different and like-textures.

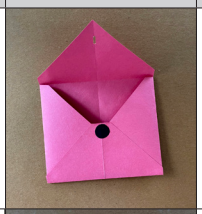
| Section of Pouch | Type | Image | Pros | Cons |
|---|---|---|---|---|
| Pocket | Button |  | • A pre braille activity<br>• Requires more fine motor movement | • Needs a large flap to prevent materials from falling out |
| | Velcro |  | • Easy to use<br>• Effective for younger kindergarten students | • Could wear over time; lose traction |
| | Clasp |  | • Uses many pre braille activities, i.e., finger strength, fine motor development and two-handed coordination | • Could be difficult to manipulate for younger ages<br>• Requires fine motor and finger strength |

**Table 3. Pocket and Clasp Exploration**

## 4.5 Activity Prompt System

The activity prompt system includes suggestions and prompts related to: materials, settings, context, pre braille activities, etc., helping kindergarten teachers create classroom activities that foster pre braille practice and introduce the braille writing system. The system includes ten settings, ten pre braille actions and ten learning outcomes. These 30 prompts can be mixed and matched to create 1,000 unique activities. In addition to the prompts, the system, titled “Introduction to Sensory Learning,” includes eight grouping suggestions for initial activity ideation, two detailed examples, and blank activity cards for personalized groupings and recording of activity creations.

The activity prompt system became modular after an initial version was completed (see Figure 5).

The proposed activity "Field Trip," could be done either inside, outside or both, splitting the time between the two. There was also a chance to use stones, marbles, etc., depending on the activity setting. An opportunity for mixing and matching materials and locations (environment) became clear.

The next version, as seen in Figure 6, introduced a modular system. Modularity allowed the system to be accessible to any teacher, no matter what materials and objects they have in their classroom. They can use the system in consultation with the Ontario Kindergarten Program 2016, specifically, the learning outcomes in the document, as well as the space and materials available to them. While speaking with teacher participants early in the design process, it became clear that the messaging was not detailed enough. It was only after explaining via phone calls that they understood completely what the cards were meant to do. To clarify the modularity, three shapes were used to distinguish the prompts setting, pre braille action and learning outcome. The shapes, as well as the colours dedicated to each shape improved the clarity and recognition of the system.

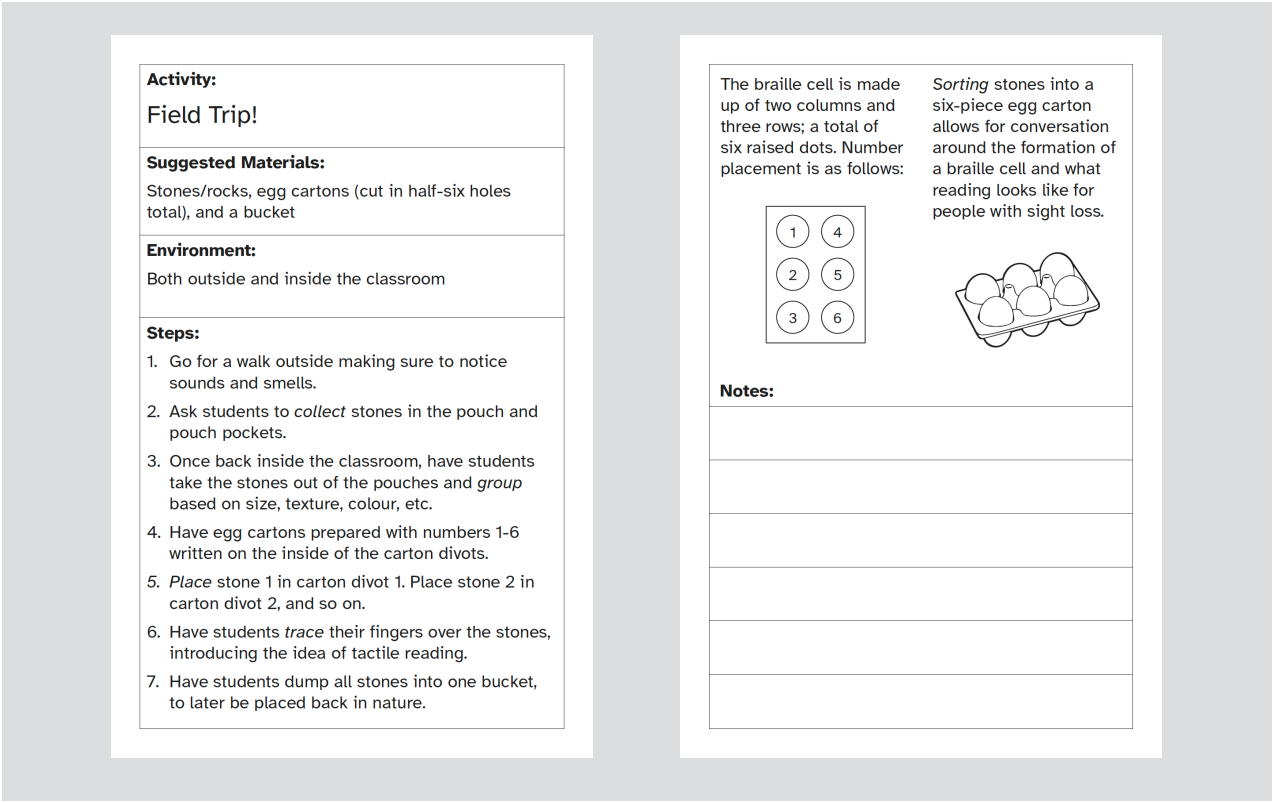



**Figure 5. First Version Prompt Cards**
Graphics by the Author (2021)

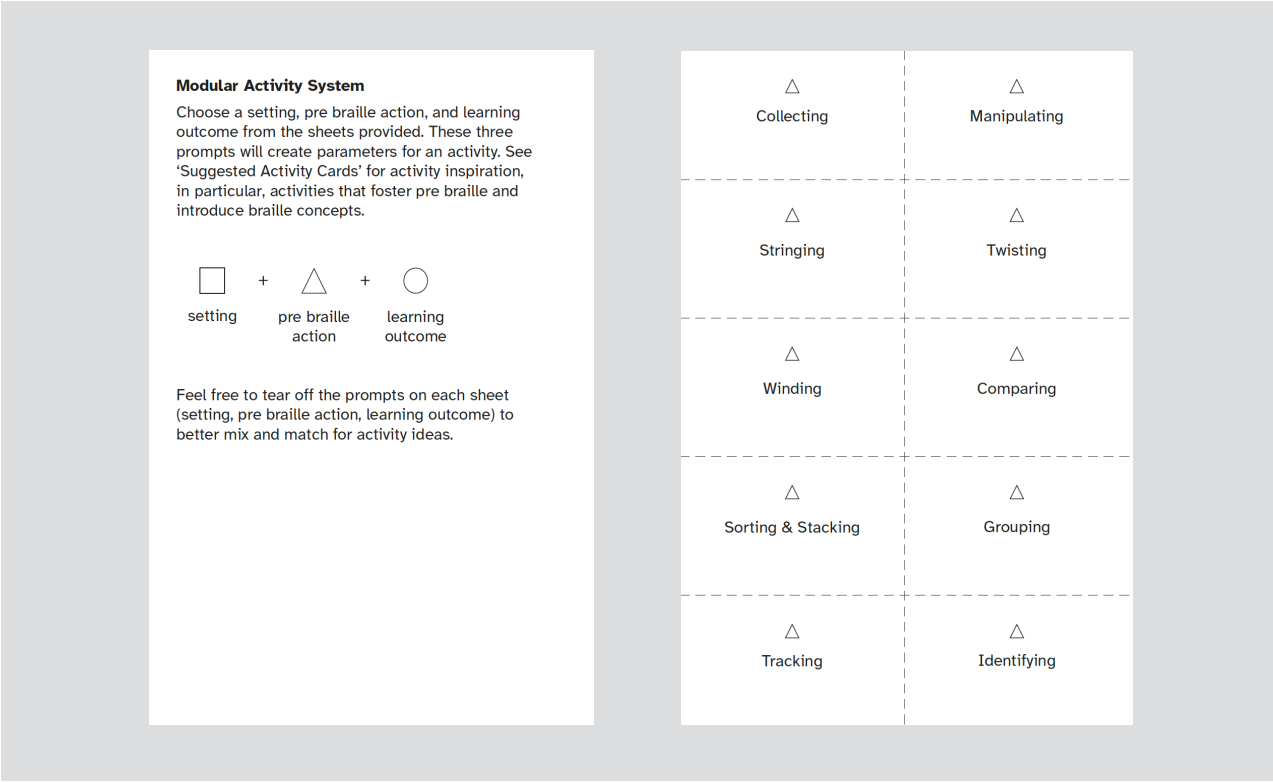



**Figure 6. Second Version Prompt Cards**
Graphics by the Author (2021)

## 4.6 Inclusive Considerations

It is important when designing for a marginalized group to ask: Is the product available? Does it function with ease? Is it feasible? Is it reliable? And, are needs recognized and understood? Participants and I co-designed with kindergarten teachers in mind as the primary user. These users may or may not have students with sight loss in their classroom. Some of the families attending the school may be of low income, others with children who are blind or are developing sight impairments. Designing for people outside of the majority, demands different questioning and holistic thinking.

**Figure 7. Colour: Fabric**
Images by the Author (2021)

The swatches above illustrate the colour decision. High contrasting colours make the pouch accessible to students with various sight abilities (low vision, colour blind, sighted). The contrast allows for distinction between different sections and functionalities, although not crucial to comprehension, therefore, the pouch can be used by those who are blind.

The activity prompt system required similar colour considerations. Three colours were chosen to distinguish between the setting, pre braille activities and learning outcomes. Initially, red, yellow and green were chosen. After conversation with my advisor and additional research, a colourblind-friendly colour palette was chosen. The three colours are: a light blue, purple, and deep blue. Even when printed in black and white, this colour palette is distinguishable due to high contrast between the three tones.

**Figure 8. Colour: Digital**
Images by the Author (2021)

# Chapter 5: Designed Outcomes

## 5.1 Proposed Tactile Pouch

From the co-designs, in particular with teachers of the visually impaired (TVI), we reached a slightly different pouch design layout. Early ideas and concepts arose throughout the interview process. Coming into co-design sessions, participants did not have any reference to early sketches and/or mockups I'd done. It was only after they participated in an asynchronous activity and shared their thoughts and suggestions, that they saw the early mockups. The mockups then evolved, incorporating the specific needs described by participants, for example, a space to carry braille books. Early iterations only made room for a magnetic sheet. A new design allowed the same size pouch, 12 in by 16 in, to carry braille books of which are 11 in squared in size.

**Figure 9. Proposed Tactile Pouch**
Images by the Author (2021)

**Figure 9. Proposed Tactile Pouch**
Images by the Author (2021)

So many tactile activities coincide with learning math concepts, such as counting, sorting and grouping. In fact, the kindergarten classroom holds an array of centres, one being specific to sorting. In discussion with teacher participant H, a teacher of the visually impaired, the pouch encourages manipulation, having to look for objects in a pocket, then opening the pocket to play. Each pocket benefits from a different type of opening, i.e., button with string and magnetic clasp With unique openings, the child will have to move their hands in different ways. Before the student has retrieved the objects from the pouch pockets, they will use problem solving skills, determining how to access the objects, and then what to do with them once access is gained.

Understanding how to use zippers can be liberating for students with sight loss. The zipper is a difficult but necessary device to operate as it's something we come in contact with every day on clothing and accessories. Zippers will help students practice their finger and pincer strength. In addition to having a zipper on the tactile pouch, the activity prompt system suggests activities that help develop fine motor skills such as zipping and stringing.

The proposed tactile pouch holds a structured form allowing the depth for multiple books and objects to be stored. The opening of the pouch includes a toggle to pull and keep objects inside secure. The toggle is a tool that requires fine motor manipulation and finger strength. The front, in a dark denim fabric, has two yellow pockets, each with unique clasps. A zipper is placed between the pockets. It's function is solely to practice fine motor manipulation. Inside the pouch, is a mesh pocket. The pocket holds a magnetic sheet that works in combination with magnetic stickers. A portion of the backside is lined with

Velcro strips. The Velcro is effective in combination with Velcro stickers. The whole pouch is washable. This was important in considering the COVID-19 pandemic and the mess that comes with play.

## 5. 2 Proposed Activity Prompt System

The proposed activity prompt system includes introductory cards of 4 in by 6 in, outlining what the system is, what's included and how to get started. Cards of this size don't require a lot of space. They can be stored in a drawer, on a desk or in one of the tactile pouch pockets. Following the introduction, are three 8.5 in by 11 in sheets (letter-sized paper), each listing ten prompts; ten settings, ten actions and ten outcomes. These three sheets are intended to be cut out by teachers, stacking the prompts together with a staple, bulldog clip or other fastening device. I suggest using a clip or ring, allowing ample flexibility, exploring all opportunities when mixing and matching the prompts. In addition to the three sheets, there is a card (4 in by 6 in) dedicated to demonstrating activity possibilities, matching eight settings, pre braille actions and learning outcomes. This can be referred to by teachers when planning class activities. The system takes these eight pairings one step further, with two detailed examples. The examples specify where the activity should take place, the types of materials the teacher might use, why the activity is important, and a list of steps to plan and construct. These specific examples highlight introductions to the braille writing system that might be discussed in class.

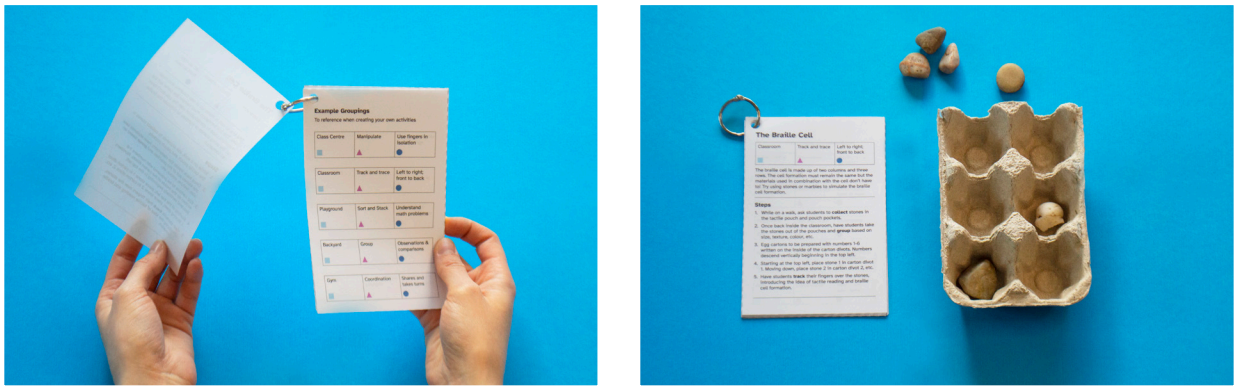



**Figure 10. Proposed Activity Prompt System**
Images by the Author (2021)

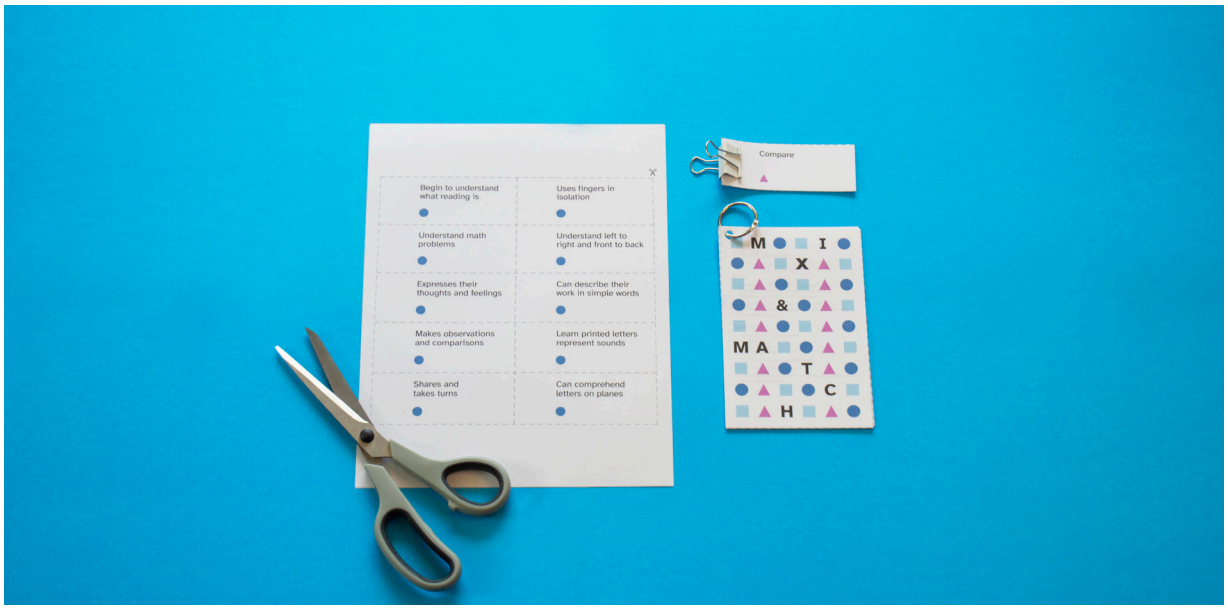



**Figure 10. Proposed Activity Prompt System**
Images by the Author (2021)

The Ontario Kindergarten Program 2016, was especially helpful when constructing the prompt system, especially the pre braille actions and learning outcomes. The Appendix located on pages 306-318, breaks down the overall expectations of kindergartners in relation to: belonging and contributing (BC), self-regulation and well-being (SRWB), demonstrating literacy and mathematics behaviours (DLMB), and problem solving and innovating (PSI). Section 8 was particularly interesting in regards to the action prompts. This section outlines multiple outcomes that relate well to pre braille activities, i.e., "demonstrates control of small muscles, e.g., use a functional grip when writing, while working in a variety of learning areas, e.g., sand table, water table, visual arts area, and when using a variety of materials or equipment, e.g., using salt trays, stringing beads, painting with paintbrushes, etc." (Ontario Ministry of Education, 2016, p. 309). I urge teachers to reference the document, in particular the Appendix starting on page 306, when looking for additional outcomes for activity creations. The additional activities can be recorded on the blank cards provided in the activity prompt system.

# Chapter 6: Conclusion

Practicing tactile skills such as finger and hand strength, two-handed coordination, and fine motor development is especially important in an ever-evolving digital world. Literacy learning requires continuous reading and writing practice, but with technological advancements, students are using devices to assist their work at an earlier age.

I worked directly with kindergarten teachers and teachers of the visually impaired, listening and learning from their experiences, understanding what types of support and/or needs they require while teaching. Together, we used our knowledge on the importance of literacy learning and created a system that would assist kindergarten teachers engage students in pre braille activities and introduce the idea of reading tactually. “Every child should feel that he or she belongs, is a valuable contributor to his or her surroundings, and deserves the opportunity to succeed” (Ontario Ministry of Education, 2016, p. 125). By introducing reading tactually, also known as braille, students become aware of other abilities, making the classroom a safe and inclusive space to learn and explore.

The project was only possible through multiple design iterations and co-design sessions required in participatory research methodology. Co-design, or co-creation, means listening to and learning from participants’ experience. From there, assessing the needs and barriers that prevent something from being truly inclusive. This project built upon a need for a tool that is feasible, available and fosters multiple modes of tactile engagement. Design iterations explored a variety of textures, vision-friendly colour palettes and flexibility in materials, spaces and outcomes. I argue that with continuous tactile practice, in the form of pre braille activities, students who need to later learn braille will benefit from this early exposure. It will also assist those new to the braille writing system and reduce stereotypes in the classroom.

Based on work with teachers, future research will look at the benefit of tactile and play-based learning in grade schooling, after kindergarten. Some teacher participants explained grade schooling, grades one and two, do not engage play and inquiry-based learning like kindergarten does. Students have to make big changes in learning styles between the summer of kindergarten and grade one. This is especially concerning for students who learn kinesthetically. There’s a possibility to reinforce the benefits and introduce pre braille learning beyond the kindergarten classroom.

## 6.1 Limitations

As previously mentioned, the global COVID-19 pandemic of 2019-2021, made the Major Research Project process quite challenging. Going into schools and speaking with teachers was no longer an option, interviews and co-creation sessions were done remotely, and design feedback relied on visual and audio descriptions of what was being created. Gaining trust with people in person can be difficult,

let alone in the digital space. The co-creation process of this project was altered to fit the teachers time and schedule, only appropriate for the mental and physical exhaustion that came with work and school moving to a fully online experience.

The proposed design outcomes are yet to be tested by participants. Teacher participants co-designed the initial system and offered feedback via emails and phone calls, but did not have the time to test the tactile pouch and activity prompt system in the classroom. Only two pouches were made, and completed later in the process, therefore, could not be sent to all participants and in time. The activity prompt system could have been emailed to participants for them to print and test during class time, however, classes were conducted online at this time. Introducing a new and tactile system would benefit from in-person testing, especially when first introduced.

## 6.2 Recommendations for Further Research

This research demonstrated many opportunities and directions, some of which include: a sharing platform, opportunities to continue pre braille learning and development outside of school months (summer), and conducting similar research with kindergarten students and their parents.

Teachers need to be intrinsically motivated to do their job, but support can always be increased. Support may look like extra assistance within the classroom, cooperation and stronger communication between parents and teachers, a platform to speak with other teachers and share experiences, or more manipulatives and tools available in the classroom. I especially see an opportunity for further work on a digital platform or forum for teachers of the visually impaired (TVI) and orientation and mobility specialists (O&M) to share and assist one another.

Another area of interest and possibility is support for students with sight loss over the summer months, when formal school is not in place. A space and time to continue practicing their pre braille activities in the months off of school would be most beneficial. This could be in the form of a camp, summer classes, multisensory kits that could be used at home with parental assistance, etc. Instead of developing something new, there may be possibilities of working with or integrating this teaching into existing schools and galleries that host summer classes.

The tactile pouch is an inspiring piece. It provides an idea of the format, materials and types of activities that can be used to foster pre braille exercises and introduce the braille writing system. Using found materials throughout the co-creation and design process inspires a do-it-yourself (DIY) project, as readers reflect on found materials in their home or classroom to produce a pouch. With limited sewing knowledge, I was able to design something that could be recreated fairly easily. I enlisted some sewing help, but for those who have sewing knowledge, I imagine creating their own pouch wouldn't be very challenging. Workshops encouraging the making process, could be hosted by parents and teachers with sewing practice. Tactile pouches could be made for people with limited resources and/or

experience. The tactile pouch workshop idea is borrowed from face mask DIY and workshops emerging out of the COVID-19 pandemic.

Parents are the first teachers of their children and they have a lot to share with teachers, as I understand from my interviews. It would be interesting to conduct a similar research and co-creation process with parents of children in kindergarten. There is an opportunity to discover and address the parent's needs, in addition to improving communication between parents and teachers of students at the kindergarten level.

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# Appendix A

## Research Ethics Board (REB)

- Recruitment Email
- Interview Questions

# Recruitment Email

## Request to Consider Participating in my Masters Thesis

I hope all is well and you are staying safe and healthy during these uncertain times. And thank you for reading my letter of request.

My name is Jaime Hilditch. I am a 24-year-old designer and writer. I am currently in my second year of the Inclusive Design Master's program at the Ontario College of Art and Design University (OCADU).

My letter is to introduce you to my thesis theme, pre braille (early tactile strategies and exploration) implementation into early education, in the hope that you will consider participating in my research.

I am researching what pre braille activities, (e.g., moulding tough clay to teach finger sensitivity for learning braille), could be implemented into a kindergarten classroom; activities that go beyond the sensory bin. It is in this capacity that I would like to interview you and learn from your experiences.

It is my hope that through collaborative tactile activities and awareness building, students with sight loss will be inspired to learn braille, feel included in activities with fellow peers, and empowered through inclusive discussions such as "what can we learn from blind and partially sighted individuals (BPSI)?" Students with sight, will become further aware and practice using their other senses (besides sight), incorporate inclusive terms into their daily vocabulary, and learn from individuals with other abilities.

Although this project is focused on the kindergarten age group (3-6 years old), I will be working directly with teachers and parents. I ask that teachers of BPSI have at least one year of teaching experience. Parent and teacher participants should have children and/or students in the age range of 3-6 years old.

I am reaching out to you to see if you have any interest in participating. Participation requires your time for:

- One interview (approximately 30 minutes)
- An asynchronous co-creation session with a follow-up call (total of approximately 1hour)
- Possible further communication via phone or email regarding feedback on my design iterations

Information captured will not be associated with your name or institution, rather, it will be referred to as participant A, institution B, etc.

Your participation in the study is completely voluntary and you may choose to stop participating at any time. In the event you withdraw from the study, all associated data collected will be immediately destroyed, wherever possible.

I acknowledge these are hectic times and I appreciate any information and time you provide; therefore, I will be compensating you with a $50 office supply or grocery store gift card.

If you are interested in learning more, I will follow up with suggestions regarding timing for a short telephone call. On that call I will explain my project in more detail and ask you if you have any questions.

I know these are busy times, but It would be most beneficial if I could hear from you regarding your potential interest, within the next two weeks.

Thank you in advance for your consideration.

All the best,
Jaime Hilditch

# Interview Questions

## Interview Guide: Pre Braille-Implementation in Early Education

Date

Questions

1. What age group do you teach?
2. Typically, how many students do you have in a class?
    a. I ask you to think about a day of teaching, what did it entail? What types of activities are conducted?
    b. Did activities/lessons change from the beginning to the end of the course? In what ways?
3. Can you share with me a couple of examples of how you engaged all five senses in your teaching? To what extent do you think tactile engagement is helpful to students independent of their abilities?
4. Given my research focus on early tactile strategies and exploration, what do you believe are effective teachings already in place in current curriculum?
5. Do you believe there are areas of curriculum improvement, specific to engaging the senses? If so, what are these areas?
6. Do you have experience in your career with students with visual impairments?
    a. What do you believe students with visual impairments need to help them succeed in their learning, and help with their social inclusion and engagement with other students in the class?
    b. What specifically do you believe these students need (in terms of support)?
7. Is there anything that would have helped you before beginning to engage with students? Anything you wish you knew at the beginning of your career?
8. What is it that educators need to help them fulfill their role as a teacher in the moment of teaching?
9. In what ways are parents included in early education? Considering both the current situation of the COVID-19 pandemic as well as in ‘regular’ times, is there anything that would help parents extend the education of their children?

# Appendix B

## Other

- Asynchronous Activity Email
- Material Exploration Chart (in full)
- Printable Activity Prompt System

# Asynchronous Activity Email

## Co-Design Activity

### Introduction

As you are aware, my Major Research Project looks at the implementation of pre braille into kindergarten classrooms, regardless of whether students have visual impairments or not. I'm working to design a pre braille activity kit for teachers.

We are all designers. In fact, we design and use many systems throughout our day. For example, some common systems we use are classroom lesson plans, and calendars that keep ourselves (and our families) organized. And please note, you do not need a background in design to complete either of the two activities discussed in this piece (warm-up or activity 1).

The term 'co-design' can be intimidating, but it simply means creating together. The co-design approach that we are taking allows for ideas from a diversity of voices to be shared and built upon.

### Warm-up Activity

This warm-up activity is commonly referred to as "blind contour" sketching. To be more inclusive, I'll simply refer to it as contour drawing. I suggest you grab a piece of paper and a pencil. Set a timer for two minutes. In that time, draw, without looking at your paper or lifting your pencil from the page. Look only at a nearby object that you would like to be the subject of your sketch. Draw the object and trust that your mind and hand will guide your pencil where it needs to go. Your sketch is not supposed to look 'good', or perfectly depict the object that you were sketching. This exercise is simply meant to get your hand moving, in coordination with your mind. When you're done, you should have a squiggly, long, twisting line on your page with some general reference to the object you were observing.

*Pre Braille: Activities to develop finger sensitivity, mobility, dexterity, two-handed coordination, etc. Examples follow: distinguishing between textures, stringing buttons or beads, manipulating clay and winding up toys.*

### Personal Interest

You may find pre braille activities (as stated above) fit well with the Ontario Kindergarten Program, which fosters play and inquiry. As I noted earlier in this piece, I intend to make an object or kit with activity prompts for teachers. The purpose of the object is to incorporate multiple modes of tactile exploration. Some early ideas include a board with compartments for: stacking and sorting, collecting

and manipulating objects, and tracking/tracing. I am specifically interested in what materials would be appropriate and effective for kindergarten students. This is where I need your help!

**Activity 1**

I welcome you to use any materials laying around your house or outside for the following activity. Suggested materials: markers, paper, play dough, egg carton, cardboard, buttons, pipe cleaners, leaves and twigs.

Inspired by action words used in pre braille, i.e., sorting, stacking, stringing, twisting, matching, grouping, comparing and tracking.

A. Make something that incorporates the act of stacking; or
B. Stack your collected materials

While you are making, consider the materials you're using.
A.

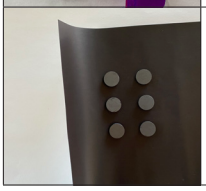
- Is the material safe for a kindergarten classroom?
- Is it a found material? Recyclable? Reusable?
- Can you see this material transferring to other pre braille activities? i.e., same material used but for sorting or matching.

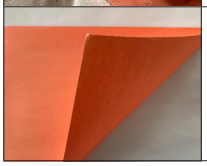
B.

- Was stacking easy to do with the materials you had?
- What materials would have made this easier to accomplish?
- What activity did you notice in your hands?
- Did the act of stacking require finger strength? Two-handed coordination? Finger mobility or dexterity?

Thank you for your willingness to work with and support me in my research project. I look forward to a 20-30-minute discussion and reflection following this activity.

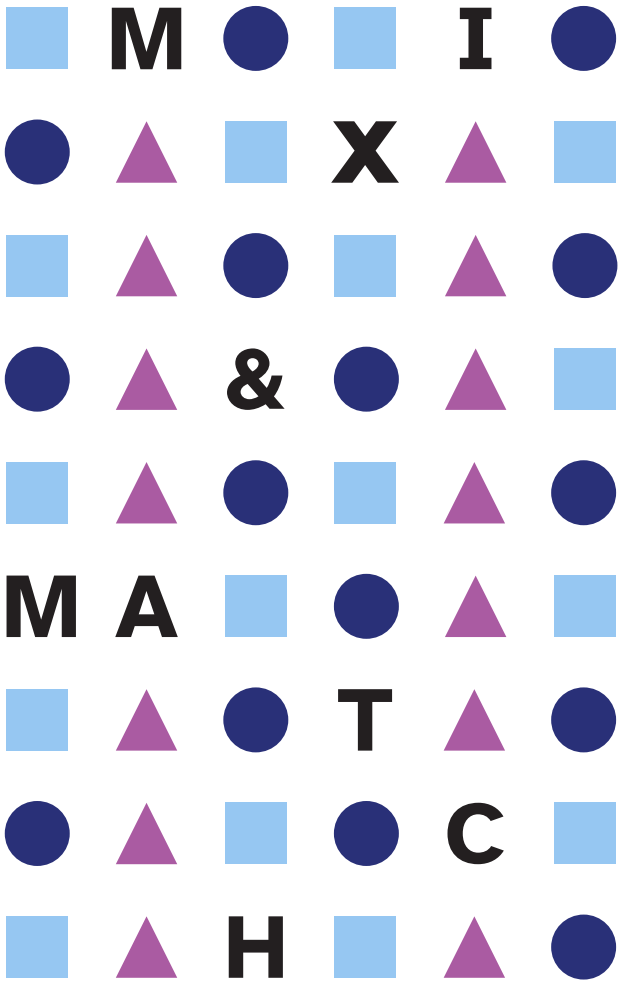
# Material Exploration Chart

| Photograph | Material | Advantages | Disadvantages | Activity (Pre Braille) |
|---|---|---|---|---|
|  | • Wood | • Sturdy<br>• Structural integrity | • Can be heavy<br>• Difficult to transport<br>• Requires additional tools for manipulation<br>• Splinters | • Blocks used for stacking and sorting<br>• Noticing patterns |
|  | • Rope | • Available<br>• Can use to teach tying shoes | • Dangerous if too long<br>• Require advanced fine motor development | • Stringing (fine motor)<br>• Two-handed coordination<br>• Pincer and grasp |
|  | • Fabric | • Variety of textures<br>• Beneficial to develop finger sensitivity | • Some available<br>• Subconsciously teaches material waste | • Differentiating textures (rough and smooth)<br>• Matching opportunity<br>• Comparing |
|  | • Magnet | • Can use a variety of objects with magnets<br>• Move and manipulate attached objects<br>• Portable | • Magnets work with water? | • Sort<br>• Group<br>• Tracking and tracing fingers over objects |

| Photograph | Material | Advantages | Disadvantages | Activity (Pre Braille) |
|---|---|---|---|---|
|  | • Cardboard | • Pliable<br>• Available<br>• Reusable<br>• Cost-efficient | • Can be flimsy<br>• Not waterproof | • Two-handed coordination<br>• Folding<br>• Hand and finger strength |
|  | • Egg Carton | • Available<br>• Cost-efficient<br>• Carton and similar molds offer pre braille opportunities | • Specific mold (coffee shop)<br>• Not waterproof | • Sorting and stacking within divots<br>• Gather<br>• Hold textures to compare and match<br>• Tracking over materials in divots |
|  | • Playdough | • Malleable<br>• Available | • Messy | • Two-handed coordination when molding clay<br>• Hand and finger strength<br>• Pincer |
|  | • Construction Paper | • Available<br>• Takes many forms<br>• Recycle after use<br>• Multiple sizes and dimensions | • Not sturdy<br>• Not waterproof | • Folding<br>• Two-handed coordination<br>• Finger strength |

# Activity Prompt System

## Printable worksheets on the following pages




# Introduction to Sensory Learning

## What

- A modular system helping you create classroom activities that foster pre braille practice and introduce the braille writing system.
- Pre braille: activities that work to build hand coordination, mobility, dexterity, etc. all essential to reading braille.

## Includes

- Three 8.5"x11" sheets with:
  - 10 settings
  - 10 actions
  - 10 outcomes
- Eight groupings for activity ideas
- Two detailed examples
- Blank activity cards for your personalized groupings and activity creations

## Getting Started

1. Choose your **prompts**
   - Feel free to include more than 3 prompts per activity, i.e., 1 setting, 2 actions and 2 learning outcomes.

| Setting | Action | Outcome |
|---|---|---|
| ■ | ▲ | ● |

2. Consider what **materials** you might use
   - Recyclable and re-purposed materials
   - Objects that hold a variety of textures
   - Familiar to students with sight loss
   - Safe for students and the classroom
3. Reference the **Ontario Kindergarten Program 2016**, in addition to the "outcome" prompts when designing your activities.

## The Story Box

| Class Centre | Manipulate | Use fingers in isolation |
|---|---|---|
| ■ | ▲ | ● |

The story box is a collection of items that correspond to items in a story. The objects help create a more interactive story experience. Make use of found and/or recyclable objects available in the classroom and surrounding areas!

### Steps

1. Pick a story to read as a class
2. Create characters for the story using materials in the classroom
3. Urge the students to use a variety of materials, allowing for many pre braille exercises, i.e., **two-handed coordination, manipulation** of play dough, **grasp** and **fine motor** used to pick up small objects, etc.
4. Place the character in the pouch until it's introduced in the story, allowing the students to share their work and take turns.
5. The plush toys can later be used as puppets in a classroom centre.

## The Braille Cell

| Classroom | Track and trace | Left to right; front to back |
|---|---|---|
| ■ | ▲ | ● |

The braille cell is made up of two columns and three rows. The cell formation must remain the same but the materials used in combination with the cell don't have to! Try using stones or marbles to simulate the braille cell formation.

### Steps

1. While on a walk, ask students to **collect** stones in the tactile pouch and pouch pockets.
2. Once back inside the classroom, have students take the stones out of the pouches and **group** based on size, texture, colour, etc.
3. Egg cartons to be prepared with numbers 1-6 written on the inside of the carton divots. Numbers descend vertically beginning in the top left.
4. Starting at the top left, place stone 1 in carton divot 1. Moving down, place stone 2 in carton divot 2, etc.
5. Have students **track** their fingers over the stones, introducing the idea of tactile reading and braille cell formation.

## Example Groupings

To reference when creating your own activities

| Class Centre | Manipulate | Use fingers in isolation |
|---|---|---|
| ■ | ▲ | ● |

| Classroom | Track and trace | Left to right; front to back |
|---|---|---|
| ■ | ▲ | ● |

| Playground | Sort and Stack | Understand math problems |
|---|---|---|
| ■ | ▲ | ● |

| Backyard | Group | Observations & comparisons |
|---|---|---|
| ■ | ▲ | ● |

| Gym | Coordination | Shares and takes turns |
|---|---|---|
| ■ | ▲ | ● |

## Example Groupings

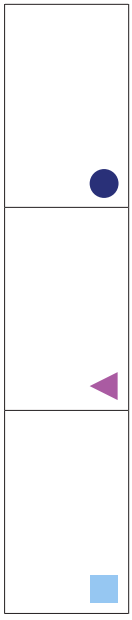
To reference when creating your own activities

| | | |
|---|---|---|
| Forest | Collect | Express thoughts and feelings |
| Living room | Identify | Understand what reading is |
| Kitchen | Compare | Comprehend letters on planes |
| Park | Touch | Printed letters make sounds |
| Hallway | Hand and finger strength | Describes work in simple words |

## Title

**Context and Materials**

**Steps**



**Title**

**Context and Materials**

**Steps**

Classroom

Hallway

Living room

Backyard

Gym

Kitchen

Playground

Class Centre

Forest

Park

Identify

Compare

Manipulate

Collect

Group

Track and Trace

Sort and Stack

Coordination

Finger and Hand Strength

Touch

Begin to understand what reading is

Uses fingers in isolation

Understand math problems

Understand left to right and front to back

Expresses their thoughts and feelings

Can describe their work in simple words

Makes observations and comparisons

Learn printed letters represent sounds

Shares and takes turns

Can comprehend letters on planes

# Colophon

The typeface used in the activity prompt system is called Atkinson Hyperledgible. It was developed specifically to increase legibility for readers with low vision, created in partnership with the Braille Institute. To learn more see: https://fontesk.com/atkinson-hyperlegible-font/

The colours chosen in both design aspects, the activity prompt system and tactile pouch, referenced colour-blind friendly resources such as: https://venngage.com/blog/color-blind-friendly-palette/