# Organically Created Project Space:

## An Evaluation of Project Space as a Learning Environment for Young Adult Learners with Learning disabilities

By

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# ABSTRACT

This thesis provides an examination of the effectiveness of a Project Space as a learning environment for students with learning disabilities. Research was conducted through precedent studies and a case study of two Ontario secondary schools. Photo elicitation interviews with staff and students with learning disabilities were conducted to provide insight from users of the learning environment. Within each of the case study schools' there was an example of an organically created Project Space. These rooms were ambiguous in their design as they serve multiple purposes with each of the schools. This provided evidence that Project Space which allows control and ambiguity within a larger footprint is a more effective learning environment for students with learning disabilities. According to the Hamilton-Wentworth District School Board's guidelines for secondary school design a learning environment must be comfortable, flexible/adaptable, and provide extended learning environments to be inclusive. The primary goal of this study was to develop recommendations to the design problems evidenced in the precedent and case studies through the insights provided by students with learning disabilities and staff that use the space every day for learning.

# LIST OF FIGURES

# GLOSSARY OF TERMS

Learning Disability: a condition which causes difficulty in learning, such as attention problems, hyperactivity, or dyslexia.

Project Space: A term for a learning environment that is capable of being reconfigured and controlled by the user, the space is ambiguous of form and therefore can be changed at will.

Social Barriers: An invisible barrier created that impacts the inclusion of an individual therefore alienating them from participation in regular activity. For example, creating special education classrooms for students with learning disabilities excludes them from participation and interaction with their peers.

Normalization: The normalization principle means making available to all people with disabilities patterns of life and conditions of everyday living, which are as close as possible to the regular circumstances and ways of life or society.

Cognitive Mapping: A working memory of the environment and how an individual perceives it. Each individual will code their environment based on her or his perceptions of the design. For example, a student with a learning disability may exclude her/himself from use of a certain space if she or he perceive it as overcrowded based on the experience of similar spaces.

Territoriality: Ownership of space as dictated by the perception of belonging. A space can be marked with territorial markers that send a message to potential users as to whether they belong or not.

# 1.0 INTRODUCTION

According to the Participation and Activity Disability Survey (PALS) 2006, the rate of children with learning disabilities in Canada was 3.2%. A learning disability is defined as any condition that causes difficulty in learning, such as attention problems, hyperactivity, or dyslexia (2009, PALS). The rate of these conditions within Canada means that many families are affected and make considerations for the learning progress of their affected family member.

My vested interest in the built environment being inclusive is a family issue I experienced growing up. My older brother struggled with learning from the first grade. In third grade, he came home one day from school and announced he was quitting school, adamant he was never going back, or he would kill himself. My mother called his teacher the next day to discuss it. The teacher had many negative things to say about my brother, he was lazy, did not pay attention, did not do the work required, and that he would retreat and play quietly hoping to be unnoticed. An emergency appointment was set up with the Child Development Centre (CDC) to find out what was going on. After extensive testing, they determined my brother had dyslexia, ADHD and gaps in his short-term memory all hindering his ability to learn. The CDC worked with his elementary school and high school to ensure he was accommodated to achieved success. They provided him with assistive devices and separate testing areas as well as visual aids. This also led to negative feeling at times for being different than his peers, as this created a social barrier between him and his peers. He eventually graduated and went on to college, who retested him and further accommodated him. Today he is a highly successful IT Security Specialist for the Federal government. For every success, however, there are many more young adults who never graduate and develop their potential. This family struggle led me to my research, to explore and

understand how the built environment can be designed for success for students with learning disabilities.

Developing a greater understanding of all factors contributing to the achievement or failure of Student Success should be the goal of all stakeholders. In this thesis, I will summarize the existing body of research on types of learning disabilities prevalent in Canadian schools. I have used not only my experience, but existing research to analyze the effectiveness of current classroom design against Project Space for young adults with learning disabilities. A Project Space is a learning environment that is ambiguous in its design allowing the user to control the space. This analysis of precedent studies provided information on the most up to date designs being implemented into schools. As well the precedent study analysis allowed for an examination of classroom design effectiveness for students with learning disabilities.

For the research study, I visited two secondary schools in Ontario, Canada, each of which provided examples of the current standard of design in Ontario, Canada. The case study provided valuable knowledge into the social barrier on students with learning disabilities.

## *RESEARCH QUESTIONS*

1. What is a comfortable learning environment, as described by the HWDSB meaning the individual student's needs as far as seating, ventilation, temperature and ability to work are being met, creating an inclusive school environment for students with learning disabilities?
2. Can the classroom be redesigned to accommodate students with learning disabilities in a more effective manner than currently available in Ontario, Canada?

3. Can there be a more impactful design that lessens the social barriers for students with learning disabilities?

3. Does the ambiguity proposed by the Project Space provide a template for classroom design that is inclusive for the whole student body?

# 2.0 LITERATURE REVIEW

## *HISTORY OF LEARNING DISABILITIES IN THE CLASSROOM*

Learning disability is a relatively new term in special education. It was not until 1965 that special education textbooks mentioned the name and the students with these disabilities. In 1877 that research began on the idea of "word-blindness" a term coined by Adolf Kussamaul, a German neurologist. Kussamaul described "word-blindness" as blindness to text, despite having full capability of sight and power of speech. In 1878, following Kussamaul, a German physician, Rudolf Berlin, defined the term "dyslexia" as "very great difficulty in interpreting written or printed word" (Bakkan, J.P., Courtad, A.C., 2011, ch.4 p. 62). After this initial discovery of early learning disabilities, researchers sought to discover if head trauma experienced by an individual caused these types of impairments in the brain or if it was possible to be born this way. Evidence supporting both theories arose before the 1900s. James Hinshelwood described, in the medical journal *The Lancet*, a patient of his ophthalmologist practice, who at 58, woke one morning with no ability to read the written word, after a lifetime of being capable (Courtad, A., & Bakken, J. P., 2011). In another example, in 1986, Dr. W. Pringle wrote, in the *British Medical Journal*, of a 14-year-old who had high intelligence according to his teachers but had difficulty with reading and spelling (Courtad, A., & Bakken, J. P., 2011).

The term "learning disability" was first used by Samuel Kirk when he spoke at a conference in Chicago to a group that would become the Association for Children with Learning disabilities (Bakkan, J.P., Courtad, A.C., 2011, ch.4 p. 62). Before this, schools labelled children and adults with learning disabilities as "slow learners." This interpretation meant that educators and professionals characterized the children as being lazy and unable to learn. At the time, there

was no funding or special attention given to educational practices in the public-school systems, neither for these students nor for the protection for adults in the workplace. The implementation of the term “learning disability” allowed the American government to validate funding directed toward assistance for students with learning disabilities as well as in workplaces for adults. In 1969, the American Congress included the ‘Children with Specific Learning disabilities Act’ in the Education of the Handicapped Act of 1970. Support services are for students with learning disabilities are provided under this act. In the USA, there were two initial pieces of legislation. PL 91-230 was the education for handicapped student’s amendment to the broader education act. In 1975, L94-142 was enacted. This was the education for all handicapped children act. It was replaced 20 years later with IDEA (Individuals with Disabilities Education Act). PL94-142 listed the specific disabling conditions that would be recognized and be eligible for federal funding that would go to the states for special education.

Since the first use of the term learning disability in 1963, progress has increased in the field of study. The primary mandate for the review and research of learning disabilities to be established was in 1987 in a report by the Interagency Committee on Learning disabilities (Canada), the purpose of these centres would be to expand and understand the issue of learning disabilities. The implementation of the Individuals with Disabilities Education Act in 1990 to replace the Education of the Handicapped Act was done to remove the now derogatory term of “handicapped” from the Act; additionally, this act added autism and traumatic brain injury to the list of eligible disorders to require specialized services. This Act Individuals with Disabilities Education Act was changed again in 1997 to include regular education teachers and give students more access to general education.

With these changes in effect, students with learning disabilities are integrated fully into the classroom. The traditional classroom design is a response to the industrial age, the design of which regarded students as future factory workers and therefore should learn in assembly-line style learning environments (Bates, 2015, p. 74). These designs have evolved to accommodate technology, but innovation in the classroom is limited to adding onto what exists rather than reimaging a new setup. With the increase in diagnosed learning disabilities and learning disabilitys that impede upon learning, it is crucial to analyze the traditional classroom design and look to more flexible spaces for a better learning environment.

## *THE TRADITIONAL CLASSROOM DESIGN*

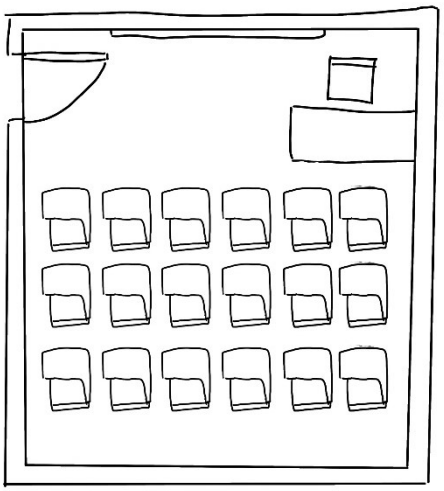


**Figure 1 TRADITIONAL CLASSROOM DESIGN**

An examination of the history of the built environment in the Canadian classroom provides insight into evolution of the treatment of students with learning disabilities. Canadian classrooms began with one-room log cabins in the early Eighteenth Century (Guy, A., Cottrell, M., 2013). While we now have access to virtual classrooms beginning in elementary school, we are not entirely able to do away with the physical classrooms as we still rely on building social interactions and collaborations between students and staff. Public education began in Upper Canada, now Ontario, in the late Eighteenth Century, the population of the province would have been roughly 90,000; at the time consisting primarily immigrants from the British Isles (Williams Ross, 1896). It was not until 1807 that the first public schools opened in the province.

As the population of Ontario increased so too did the size of educational institutions, with classroom design remaining the same. The model classroom was based on the emerging culture of industrialization, creating schools with the same principles as factories and mass production. In Figure 1A, Traditional Classroom Design, there have been variations on the furniture included, but the layout is the same where rows of students are facing a teacher at the front of the room. Current learning theory has moved beyond children copying the information from their teacher down in notebooks. Technology has evolved to accommodate notes and documents being stored digitally, so students are no longer required to only focus on the board; instead they are expected to converse with the class and engage in entirely different ways. The expectation is that multimedia technology seeks to engage more than one sense at a time and provide a variety of stimulation to students. Elements may include texts, spoken words, sound & music, graphics, animation and still pictures. This expectation supports cognitive load theory, and it demonstrates that the focus of the student needs to be engaged differently; often through methods like those expressed in the theory of multi-media learning. This is especially true for students with learning disabilities who struggle with the ability to process sensory information and maintain focus. Therefore, a new design for the learning environment is required that extends and accommodates the variety of multimedia activities taking place in the classroom.

## *PROJECT SPACE AS A LEARNING ENVIRONMENT*

A Project Space is found under different jargon circulating in media; such as, “innovative learning environments (ILEs)” or “third place” (Zamiri, & Zamiri, 2016). Schools in Ontario are undergoing constant renovation in an attempt to bring ageing infrastructure to align with modern educational theory. Motivated by their understanding of cognitive load theory, educators,

schools, and schoolboards are planning for more multi-functional spaces that allow students and educators the freedom to change and adapt their space to better suit them. They are adapting their learning spaces through a variety of design choices: including lighting controls, different types of seating, and inclusion of large Project Spaces such as 'learning commons' often in the front entry of newly built schools. This method of implementing Project Space is not a design that is viable for all schools that are ready for renovations due to the space constraints in existing buildings.

According to Zeichner (2010), the advancement in technology, i.e., laptops and tablets that allow students to become mobile learners, allows more than the classroom to be a learning space. Zeichner stated that there is a bridge between the formal and informal learning environments of the past that creates a transition for learners. This access to technology and mobility means that students can move to spaces like a Project Space that offers a setting with both formal and informal qualities that is not characterized by the traditional classroom's limited design. Students are not limited to being in classrooms following a lecture, but instead can choose a setting that works better for them. Due to the advent of mobile learning devices, these settings could include learning from home, resource centres, and libraries. The Project Space may be any size, from a single pod to a large cafeteria that allows students to gather in large numbers for different forms of learning engagement.

## *SOCIAL BARRIERS TO STUDENTS WITH LEARNING DISABILITIES*

The school building plays a primary role in students' social and emotional development (Parnell, R., Malinin, L.H., 2012). Opponents to inclusion in the general education classroom believe that students with learning disabilities are better served in special education classrooms (Fore, Hagan-Burke, Burke, Boon, & Smith, 2008; Holloway, 2001; McDonnell et al., 2003).

This exclusion from the general education classroom creates a social barrier to students with learning disabilities. Social barriers are invisible to most of us as they are disguised by "everyday appearance and function, however they can have a definite impact on those affected by them" (Bednar, M.J., 1978). Physical restrictions are more readily recognized within communities, and much progress has been made within the design community to accommodate those in wheelchairs, those who are blind, and those who have a physical disability that limits them. Barriers that are transparent or not readily recognized are invisible to those who are unaffected. These are the 'social' barriers designers need to interpret and accommodate in their design of environments. In my thesis, I propose that the design solution to the social barrier created is to create classrooms that are designed as Project Space as the ambiguity of the space provides for more fluid learning techniques to be used. This is especially important in the school setting where children are learning about the value of self from their peers, and from the school social structure. Understanding some of the psycho-sociological aspects and how the physical environments within the school facility send messages to everyone who uses the environment is an important aspect of the development of inclusive environments.

The process of 'normalization' with regard to the environment is defined as an environment that allows for all people, including those with disabilities, to be able to competently use the environment (Bednar, M.J., 1978). The psychosocial aspect of design and what the built environment communicates to its users, is an overlooked impact on its users. According to Steinfeld, Duncan, & Cadell cognitive mapping is a term that defines what a person knows about an environment, cognitive mapping also defines how something is valued and how an individual gets to where they want to go. Environments that are inaccessible can be perceived by those with disabilities as restrictive (Steinfeld, E., Duncan, J., & Cardell, P., 1978).

Territoriality, as related to hierarchies in our society, is recognized as ownership, which has a defined value in our society (Steinfeld, E., Duncan, J., & Cardell, P., 1978). The claim of space, via access denied by inaccessibility, produces a negative feeling of not belonging for those individuals and students with disabilities. Barriers to access serve as territorial markers that send a message of social dominance over those barred from access. This message can also translate itself to the user who is unable to access a space, as they are incompetent and are dependent on others, and possibly viewed by those in 'social dominance' as deviant (Bednar, M.J., 1978). The built environment communicates a silent language of expected behaviour and meanings. Those with disabilities may interpret this language differently, and this may result in inappropriate behaviour or a feeling of a lack of self-worth due to this environment. We should also note that 'special environments' that are built for those with disabilities may seem accommodating, yet they are in fact viewed as humiliating and isolating to those unable to function in the able-bodied world.

Exclusion can be viewed as territorial behaviour where only the able-bodied can claim the best spaces. When a person cannot function within an environment, the environment is blamed, when a disabled person cannot function within an environment, often the disabled person is blamed. A responsive and inclusive environment is where those with disabilities can display competence and overcome stigma and dependency. An interior designer's goal should be to design space that is inclusive of all ability levels and types. Project Spaces designed for young adults may assist those with disabilities in the learning process.

# 3.0 FRAMEWORK

In this chapter, I develop the theoretical framework for Project Space as a learning environment. I utilize the cognitive load theory to create a basis for how young adults learn and how learning disabilities can affect the ability to process new information. I then explain how multi-media learning theory provides a foundation for designers to develop classroom design regarding young adults with learning disabilities. This is followed by a summary of the most common learning disabilities in Canadian classrooms. Finally, I discuss learning disabilities and Project Space, how does this idea counteract the effects of the environment on learning disabilities and how can this create a more inclusive school environment for all students.

## *COGNITIVE LOAD THEORY*

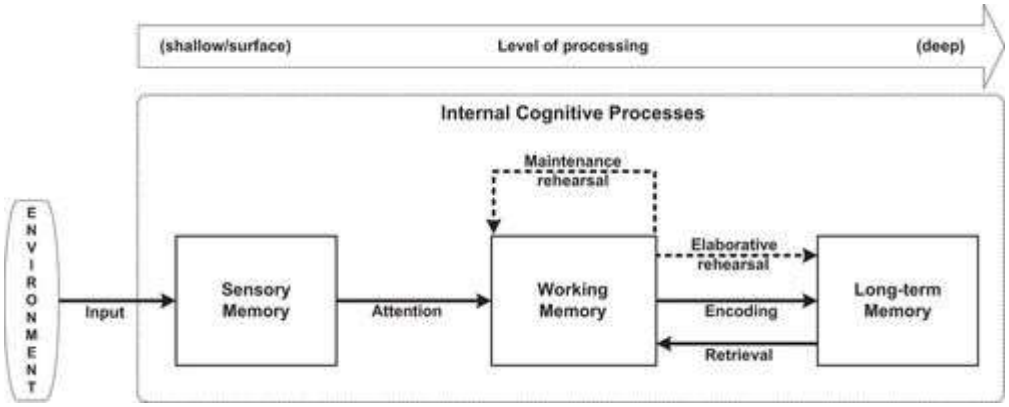



**Figure 2 COGNITIVE LOAD DIAGRAM (Khalil, M. Elkhider, I., 2016)**

Cognitive load theory states that lessons and learning are structured according to the learner's cognitive structures. The learner's cognitive structures would be structured around their learning disability. In Figure 2, (Khalil and Elkhider template) depict, the achievement of learning through the "Internal Cognitive Processes." If a young learner is meant to process what they are seeing or hearing, they must not receive external sensory stimulation, which would

detract from their ability to have the environmental input reach their sensory memory. As well students who struggle to maintain focus due to their learning disability must reach the next step, through attention, in the Internal Cognitive Process, so it is vital that the learning environment not create a distraction from the focus needed to make the next step of working memory and maintenance rehearsal.

Cognitive load theory can be used to produce learning environments that work with students with learning disabilities. The theory posits that sensory memory, working memory, and long-term memory create the structure for fully processing new information. This structure works through a combination of the limited working memory, and the assumed unlimited long-term memory. The working memory uses auditory and visual information to learn new ideas. The cognitive load has three types: intrinsic, extraneous, and germane. Intrinsic load is the inherent level of difficulty of the topic. Extraneous load is the manner of presenting of the information. Germane load is the processing of the information by the learner. According to Khalil and Elkhider, the principle of cognitive load theory is to "reduce extraneous cognitive load, manage intrinsic cognitive load, and promote germane load" (p. 149, 2015). For this study to inform the design of the environment, the focus for guiding environmental design is reducing extraneous loading. As interior designers, we cannot affect the subject matter or the student, but we can aid in creating an environment that does not add to the extraneous cognitive load. With an understanding of cognitive load theory, the basis of the classroom's design are theories that negate overloading the extraneous load on the senses of students with learning disabilities. One learning theory that suggests a method for this is the multi-media learning theory.

## *MULTI-MEDIA LEARNING THEORY*

Multi-media learning theory, originated by Richard Mayer in 1947, states that there are two distinct channels to the brain that a student can process information through, and that by utilizing both, a higher level of comprehension is reached. This cognitive-based approach to multimedia means that a student is presented with both spoken word and visual image, stimulating the auditory channel and the visual channel to the brain. The multimedia learning process aims to achieve excellent retention and good transfer performance. To deliver multimedia instructional material a teacher must recognize two distinct principles of creating them. First, there are two separate channels (auditory and visual) and that both must be stimulated to achieve higher retention. The second principle is that the human brain cannot process an endless stream of new information.

Mayer also concludes that there are three ways of using multimedia in learning. The first being 'response-strengthening', where the learning environment itself is the multimedia message. The second is 'information acquisition', in which multimedia is the vehicle for delivering information to the student. The third is 'knowledge construction', in which multimedia is an aide to the teaching process put alongside the actual delivery of a lesson. The theory of multimedia learning is nurture based in that it assumes that all humans need to have information processed through their auditory and visual channels to learn anything. This information is vital when assessing a learning environment for students whose learning disability provides a more significant detriment to processing information.

For designers, the multimedia learning theory can impact the design schematic drawing phase through preplanning of technology hubs, furniture and equipment as they are an integral

part of modern learning. And so, multimedia learning theory states that the environment inputs new information to the sensory memory through two distinct channels, auditory and visual, learning environments must therefore be designed to engage students through both; this is especially in the case of students with learning disabilities that effect the senses. Young adults with learning disabilities are affected to a greater extent by their inhibited sensory processing ability and therefore it is up to designers to create learning environments that mitigate negative factors and that enhance learning.

Learning disabilities cause young learners to struggle with the processing of novel ideas. To combat extraneous cognitive overload for a student with learning disabilities, it is imperative that designers create learning environments that will allow students to process both their visual and auditory information while enabling them to maintain their focus. Multi-media learning can be created through spaces that enable large visual displays for students, or area for students to have personal computers. The design can also accommodate use of headphones or design areas with sound dampening materials. Equipped with a greater comprehension of learning disabilities, acquiring historical knowledge of classroom development, what impacted school design in the past, and understanding why so many schools still reflect 1950s infrastructure elements will enable designers to ascertain which factors need to be considered in their design to formulate what future plans for learning environments need to reflect.

## *LEARNING DISABILITIES*

In order to understand the challenges of students with a learning disability, it is important to have a clear definition of the conditions and disorders considered as learning disability. A learning disability is defined as any condition that causes difficulty in learning, such as attention

problems, hyperactivity, or learning disabilities (2009, PALS).

## Dyslexia

Of the disorders defined as learning disabilities, Dyslexia is the most common (Voeller, K., 2004, p.740). Dyslexia is a learning disability that specifically impairs a person's ability to read (National Center for Learning Disabilities, 2011). Though the condition affects everyone differently, the common characteristics are difficulty reading, spelling and writing. A person with dyslexia may only suffer from one of these characteristics or all of them. Because dyslexia can be hereditary, a child can be born with these issues; though signs and symptoms may not be evident until well into their formal education. Adults can also have onset forms of dyslexia caused by brain injury.

Most environments affect the sensory processing stage of learning, which is a negative impact on students with dyslexia. Dyslexia may have an impact on a student's ability to process the visual information presented to her/him in the form of text. This means that the rate in which the brain processes text is slower than what is considered average for educational milestones. The design of the environment can aid in counter-acting this sensory processing disorder by providing an alternative solution to learn without a written text; this could include access to assistive technology or speech recognition software. While it is not up to the designer to provide the computer or software, it is the designer's responsibility to design with the intention of all students' needs for academic success. Close liaison between pupil and specialist, be that a teacher's aide or the classroom teacher, is the best service to provide to a young learner with a learning disability. In terms of classroom design, this means allowing enough space for students to meet at their own desk or providing a space where a student can receive this help. Larger desks therefore, with wider spacing between each desk is beneficial (Pollock, J., Waller, E., & Politt, R., 2004). Functional, semi-private space within a classroom for a teacher to

work with one or two students would also be helpful (using movable screens, for instance). The teacher can also put relevant materials such as ‘anchor charts’ up on the walls and chalkboard and eliminate extraneous decoration and text that might serve to distract or confuse students.

## Dyscalculia

According to the National Center for Learning disabilities, Dyscalculia is any lifelong learning disability involving mathematics (2007). There are many ways that dyscalculia can affect someone, but the two common aspects of the disorder are: firstly, language processing, where a person cannot process the auditory teaching of math, and secondly, visual-spatial processing, where a person cannot process what they are seeing. (A study of the neurological cause of visual-spatial processing of math summarized below.)

Dyscalculia is most impacted by the environment during the sensory processing stage of learning. Dyscalculia is either an inability to process visual stimuli or auditory stimuli. A student with dyscalculia may require larger desk space or better access to quiet areas, and they may also benefit from areas with natural light that allow for easier visual processing. Younger children may benefit from what math teachers call manipulatives (objects coded by relative size and colour to represent certain numbers). These help students with groupings and calculation tasks. As for the built environment, it is helpful to have accessible space to store the various pieces of equipment that students and teachers might use.

## Dysgraphia

Dysgraphia is a difficulty with writing by hand. Research on dysgraphia is relatively new in the field of learning disabilities, and it is limited in its findings. Some literature states that the

definition of dysgraphia should also include problems with spelling and memory, while others indicate that it is purely a difficulty with writing by hand (Hoorn, J., 2013, p.65). Dysgraphia, when understood as just a difficulty with handwriting, is characterized by "trouble organizing letters, numbers and words on a line or paper" (National Center for Learning disabilities, 2011). Dysgraphia is believed to result from one of two problems; the first could be a visual-spatial problem in which the individual has trouble with processing what they can see, despite having functioning eyesight. The second would result from a language problem, where the individual cannot process what they are hearing, despite full ability to hear; then coordinating the information to put it down on paper. The traditional classroom does not provide adequate desk space to accommodate assistive technology such as laptops or allow for students to receive additional help from staff.

## Dyspraxia

Dyspraxia is a lifelong disorder affecting fine motor skills. Dyspraxia is perhaps better known as "developmental coordination disorder." The range of effect of dyspraxia is vast, affecting whole body movements or specific areas such as facial movements or limbs. Roughly, 2% of the population is affected by some form of dyspraxia; of that group, more than 70% are male (National Center for Learning disabilities, 2011). There are four basic categories of how dyspraxia affects the body, but it is possible to occur in a multitude of ways.

- Ideomotor, trouble with single-step motor skills, i.e. waving.
- Ideational, trouble with multi-step tasks, i.e. making the bed.
- Oromotor, trouble with the muscle groups of the mouth working together to pronounce and form words.
- Constructional, trouble with movement about spatial recognition, i.e. moving an object from one place to a different destination. If the body of the student becomes the distraction from learning, it may be necessary as designers to provide a space that caters

to allowing movement.

## Executive Dysfunction

Executive functions are mental skills that are necessary for complex cognitive processing; this complex process is made up of coordination of several sub-processes. All these sub-processes begin in the prefrontal lobe of the brain (Elliot, 2003, p. 49). When an area of the prefrontal lobe becomes injured before birth or during a person's lifetime, this injury can affect their ability to perform executive functions. Management of time and space are examples of executive function processing. What most would consider being a regular daily task involving planning, organizing, and the ability to switch focus, become difficult for those who have executive dysfunction. Tasks considered simple, like making plans, keeping track of time, keeping track of multiple tasks at one time, evaluating ideas, the ability to change our minds, engaging in group dynamics all become more difficult when executive functions are dysfunctional (National Center for Learning disabilities, n.d.). A student affected by this disorder may need assistance from staff and other students to keep their focus on the next task. The learning environment can adapt to this by providing group desks or individual desks that can group. The grouping may not be possible in a traditional classroom because of size of the classroom and the furniture resources available. Teachers can limit certain types of décor and materials that are on the walls in order to limit stimulation. Teachers may put daily schedules on the board and review them with students every day. Students will learn to refer to the schedule if they are lost. Teachers can also review the transition points in the school day, in order to help students, learn what is coming, and what is expected.

## ADHD

ADHD is not a learning disability; it is a psychiatric disorder that affects the individual's ability to learn at the same pace and in the same way as the average student (Kooij et al., 2010, p.2). The prevalence of ADHD is approximately 1 in 20 children in the U.S., with roughly the same statistics internationally, between 3-5% (Sroubek, A., Kelly, M., & Li, X., 2013, p.103). The cause of ADHD is unknown, but there is speculation that it may have to do with genetics and the environmental factors of pregnancy and early childhood development. Nutrition and weight gain during pregnancy have both been evaluated to determine if the rapid growth of the brain while in the womb could be a cause, but findings are still inconclusive in determining an exact cause (Millchap, J., 2010, p. 26).

According to Henley, Ramsay & Algozzine (2009, p.53), Attention Deficit Disorder (ADHD) has three subtypes: ADHD- IA, ADHD-HI, and ADHD-C. The first ADHD-IA are individuals diagnosed for their inactive traits. The characteristics of this side of the disorder may be a failure at paying attention to fine details, not listening, difficulty organizing, and forgetfulness. ADHD-HI is visible by hyperactivity traits. The characteristics of this side of the disorder may be excessive fidgeting, inability to stay seated for long periods, excessive talking, and failure to remain calm. The third, ADHD-C is a combination of the first two forms of ADHD; meaning that an individual diagnosed with this can switch and sway between both hyperactivity and inactivity at different times. All of these subtype traits make the work of learning more challenging for students; the inability to keep focused on one task or the inability to sit still are detrimental to the learning process.

The traits of ADHD may mitigate by allowing staff to be closer to students to keep them on track. Larger classrooms provide more space for flow in and out that may be

necessary for students who require body breaks. Durak and Erkilic (2012) also found that larger classrooms provided room for more individual study, which was necessary for students with attention and sensory learning disabilities. Another solution is to create a more centralized lecturer position where students surround the teacher on all or most sides rather than the traditional classroom that puts the lecturer at one end and students at varying locations away from them. A conventional classroom with large windows that provide a view to the outside world may not be the most beneficial to these students. Interaction and exposure to the natural environment have been shown to effectively support attentional functioning for those with Attention Deficit Disorder (Taylor, A.F., Kuo, F.E., Sullivan, W.C., 2001).

## Anxiety

Anxiety disorder is not fear; anxiety disorders are "conditions characterized by pathological anxiety that has not been caused by physical illness, is not associated with substance use, and is not part of psychotic illness" (Starcevic, V.,2005, p.1). The characteristics of anxiety are fear, stress, chest pain, headaches, sleep problems, and nausea; all of which can contribute to an inability to focus and maintain effort in a classroom. This disorder is not a learning disability, but the effects of anxiety disorder are detrimental to the learning experience, and anxiety disorders are typical for students with diagnosed learning disabilities.

Normal anxiety is a natural adaptation that humanity has evolved to use for staying safe. This instinct is built into the psyche to react quickly and effectively to danger or threat. Normal anxiety escalates to a disorder when there is an evident change in the intensity, duration and the long-term effects of the anxiety on behaviour. An individual with an anxiety disorder may experience increasingly higher and longer periods of anxiety and this may impair their functioning ability to complete the task that causes the initial anxiety (Rachman, S.J., 2004, p.3).

According to the Canadian Mental Health Association there are seven types of anxiety disorder:

- Generalized anxiety disorder, when regular anxiety becomes unmanageable and impacts the lives of the individual.
- Phobias are fear of specific objects or situations, such as test-taking may cause anxiety to become overwhelming.
- Panic Disorder causes unexpected panic attacks frequently through an individual's lifetime.
- Social Anxiety Disorder is a fear of one's peers, reflecting on their behaviour negatively, fear of embarrassment.
- Agoraphobia is a fear of being in a situation where there is no escape.
- Post-Traumatic Stress Disorder, a frightening event in the past can haunt an individual their entire life, causing unexpected anxiety from small triggers to the psyche.
- Obsessive Compulsive Disorder is rituals and habits that become an overwhelming need, to the point of intensity and disruptiveness of ordinary life. ("Anxiety Disorders," n.d.)

Though this disorder is not a learning disability, the causes and the severity of the attacks can cause obvious stress on an individual trying to retain new knowledge when the body and brain are in distress. According to the Anxiety Disorders Association of Canada, the rate of anxiety is one in four, making it the most common mental illness affecting Canadians (n.d.). Due to the additional stressors that the disorder creates, it is essential that the learning environment is a space designed with additional time and assistance in mind. One example of this would be choosing seating that is designed to accommodate a student sitting for extended periods of time. A Project Space can therefore be ambiguous to include areas for extra time for tests. Spaces that allow a student to meet with a staff member for additional help would also be beneficial.

## Depression

Like anxiety, depression is not considered a learning disability and currently does not receive special consideration in the classroom. Though all people experience periods of unhappiness, these feelings are generally temporary; depression is a psychiatric disorder of intense feelings of despair that lasts for more than two months. Depression has been written about as far back as the Fifth Century B.C.E. when Hippocrates described a condition of despondency, irritability, sleeplessness and lack of appetite (Andrews, L.W., 2010, p. xxix). The characteristics of depression are very similar to those described by Hippocrates: feelings of despair, detachment, tiredness, inability to concentrate, loss of appetite, and thoughts of suicide are all included in modern definitions (Health Canada, 2009, p.1). These effects can contribute to an individual's inability to focus on school or work and play a large part in how depression affects an individual's ability to learn, and often individuals with depression miss out entirely on school and work to stay home.

Depression has not yet had one specific theory of its cause confirmed, but treatment occurs with an understanding that the reason may be neurobiological. The most common approach of the origin of depression is that the chemicals of the brain are at an imbalance. The chemicals in the brain, the neurotransmitters, are responsible for carrying information from one cell to another. When these chemicals become imbalanced, it alters the transmission of activity. Antidepressants are prescribed to rebalance the chemicals to create a steadier flow of communication. Various factors can trigger depression or depressive episodes and are becoming more common in Canada; depression now affects more than 11% of all men and 16% of all women in Canada (Health Canada, 2009, p.1).

## *LEARNING DISABILITIES AND PROJECT SPACE*

The basis for this research study is to examine the relationship between Project Space and students with learning disabilities, and how the disability can impact a student's ability to learn. Project Space can come in many forms and sizes and may serve as a functional learning environment for mitigating learning disabilities. The learning environment must be designed in a way to counter-act the disability if possible, and to be more inclusive and accessible for students with learning disabilities. For critiquing Project Space based on learning disability needs, there are two categories of learning disabilities based on how the environment most impacts learning. I have divided the learning disabilities based on Khalil and Elkhider's Cognitive Load Theory. The two categories of learning disabilities are those that effect sensory memory and learning disabilities that affect the attention needed to move new information to the working memory.

## *HAMILTON-WENTWORTH DISTRICT SCHOOL BOARD – SECONDARY SCHOOL DESIGN GUIDELINE*

The Hamilton-Wentworth District school board's guideline for secondary school design was chosen because there are no provincial guidelines in place for design and this set was determined to be the most comprehensive with a focus on inclusivity for all students/ The Secondary School Design Guideline provides the district with a set of principles that each new school and each renovation in the district must follow. To enhance opportunities for Student Success, the Hamilton-Wentworth school board created the guidelines. The public-school board for the city of Hamilton is similar to many within southern Ontario. The board's responsibilities encompass 15 secondary schools in various stages of renovation. The purpose of the guidelines is two-fold, to create a framework for educational reform to enhance opportunities for Student

Success, and to meet the needs of all students by providing a safe, inclusive, innovative and engaging school environment (HWDSB, p.1, 2018). According to these guidelines, new spatial conditions will be required to meet the needs of educational reform; spaces beyond the traditional classroom will be required to act as learning spaces. These spaces may be considered Project Spaces.

The basis for their design guidelines is "flexibility in curriculum delivery, based on personalized learning, supported by appropriate technologies and quality learning environments" (HWDSB, p.2, 2018). The fundamentals of the guidelines are that the school environment is learner-centered. According to the HWDSB, learner-centered means a range of learning environments that can flex between single-use to multi-purpose, formal to informal, and physical to virtual (p.2, 2018). This flexibility is critical to young adults with learning disabilities who struggle with Focus Maintenance and Sensory Processing.

To create these guidelines, the HWDSB performed group workshops with teachers, staff, students and other key stakeholders from the community. The board's guiding principles regarding Project Space are:

1. All schools will be great schools, new and existing.
2. Create flexible, robust, and adaptable learning environments that are accommodating diverse learning styles, in all program areas and for all pathways.
3. Collaborative settings – break out spaces, eating spaces, social spaces for students and staff.
4. Provide personalized, informal, social and study spaces for students that promote student ownership, student voice and student engagement.
5. Enable students and staff to achieve their maximum potential by providing healthy, safe, inclusive and comfortable environments.
6. Imagine the learning commons (Library) as a fully integrated and central node for formal

and informal study-with unlimited access to multiple resources, learning supports and student services.

7. Provide abundant and robust infrastructure to fully integrate technology tools in all aspects of teaching and learning (2018, p. 9).

The planning concepts from the board's guidelines that can be used to evaluate the effectiveness of Project Spaces are:

1. Comfort: A comfortable environment that promotes engagement and connections to other students and staff. Each student will have their own needs for individual seating, varied types of movable seating should be provided to allow students the ability to choose what suits them. All areas of the school or learning environment should provide enough surface for students to work and lay out the items that they require, i.e. assistive technology, computers, and other materials. The individual room and its use should control heat and ventilation. Lighting should be available on multiple levels for students to manage. A moderation of noise, heat, cold, light and air quality are all necessary for student comfort (HWDSB, 2018, p.10).
2. Flexible/Adaptable/Robust: To work with varied instructional and learning styles learning environments should be diverse in size and form. To accommodate education reform and future proof, the design phase should ensure any future renovations will have little impact on student workspaces. Strategies for this that are recommended by the board include providing private spaces, small group spaces, large group spaces, a grouping of teaching areas to make space multi-use, and classroom and learning environment space design that allows for a variety of layouts (HWDSB, 2018, p.10).
3. The school design should provide learning spaces and amenity spaces: both large and small collaboration spaces that can be informal or formal. Schools should include quiet

> personal spaces and collaborative group spaces for study. Project Spaces and large-scale collaboration spaces should, when needed be able to be broken into smaller spaces for study when needed. According to HWDSB, these diverse areas provide "areas adjacent to classrooms where a multitude of activities can take place. This space will not have walls and is intended to "extend" the classroom for instructional or support purposes" (HWDSB, 2018, p. 11).

The goal of the HWDSB guidelines is to create great secondary schools that provide healthy, safe, inclusive and comfortable atmospheres for their students. These guidelines are used to evaluate the schools examined in the precedent and case studies undertaken. They formulate a basis to critique and assess Project Space and its ability to function as a multi-purpose flexible learning environment for young learners with learning disabilities. Each Project Space can be evaluated against these guidelines as to its effectiveness to create a space that is comfortable, flexible, and extends beyond the traditional classroom design. Examples of how these criteria are demonstrated are listed below in table 1.

## Table 1: Meeting Guideline Criteria Examples:

| Guideline Criteria: | Effect on Sensory Memory: | | Effect on Attention: | |
|---|---|---|---|---|
| | Design Problem: | Design Provision: | Design Problem: | Design Provision: |
| Comfort: | Walls painted bright colours | Limited use of patterns | Hard seating | Ability to move around classroom during lessons |
| Flexible/Adaptable: | Walls with posters on them | Mobile seating available for students to redirect their line of sight | Loud classmates | Private learning areas with noise mitigation |
| Extended Learning Area: | Schools provide separate rooms for test taking free from sensory distractions | Test taking rooms are free from sensory distractions | Classroom aisles between desks are narrow limiting body breaks | Larger floor plan allowing for larger desks and more aisle room |

### *CHAPTER SUMMARY*

In this chapter, I discussed how cognitive load theory determines how a young adult processes new information. The study also examined how a learning disability affects the ability to process new information at the same rate as a student without a learning disability. With information on where in the learning process the learning disability affects a student, as designers we are better equipped to design learning environments for young adults. Multi-media learning theory provides one theory for designing for learning disabilities as it stimulates both the auditory and visual channels for new information. The theory of multi-media learning demonstrates that there are ways to teach and design the classroom so that it responds to learning disabilities. This would be one way to create a learning environment that is more comfortable and inclusive for students with learning disabilities. Definitions and the examination of the most common learning disabilities allow me as a designer and researcher to develop an understanding of how learning disabilities interacts differently with the environment. These distinctions will also allow me to analyze the precedent studies and case study schools for students with learning disabilities.

# 4.0 METHODOLOGY

## *LITERATURE REVIEW*

I began my research by studying the history of learning disabilities in the classroom in order to understand what progress has been made regarding this and to understand the potential of using project space as a future learning environment for these students. The work of Bakkan and Coutad (2011) provided the most thorough depiction of the beginning of students with learning disabilities being introduced into the classroom as well as a history of how this was documented. I then researched the various laws and acts that have been implemented in North America which aided in determining how and why students were further integrated into the general classroom. This research lead me to Williams (1896) who described the traditional classroom model as seen in early Canadian school houses with Guy and Cottrelll (2013) this research provided insight into how the classroom has stayed much the same in today's schools compared to their initial creation in the industrial age model. With an understanding of the traditional classroom model I wanted to explore the idea of using a multi-functional space in place of the classroom. This lead me to the work of Zamiri and Zamiri (2016) who described the "third place" which is used in reference to corporate interior design as a space that is neither office nor home but instead an in-between of the two that fits neither definition completely. These places provide a gathering space that is more formal than home and more informal than work. I believed that this as a design idea was to be the most ideal of learning environments for students with learning disabilities. The research of Zeichner (2010) indicated that the advancement of technology has allowed students and teachers to become mobile learners. While this has not allowed students to work entirely from their homes to has allowed students and staff

to become more creative with how the classroom is setup and where learning occurs regularly. This further frees the design of the classroom to be ambiguous.

The primary goal of this study was to determine if project space could provide a learning environment that was more effective than the traditional classroom for students with learning disabilities. What made the research important was the statistics that students with learning disabilities were less likely to graduated from secondary school than their peers. This could be attributed to the fact that despite laws enforcing implementation into the general classroom more students with learning disabilities are often distributed to other areas of the school for assistance and a more accommodating environment. According to Parnell and Malinin (2012) the school building plays a role in the social and emotional development of all students. The work of Bednar (1978) is the primary text used for the social barriers research of this paper as they discuss in depth how the environment can alienate individuals from using a space and feeling a sense of belonging. This element of the research was essential in the justification of the study as invisible barriers to the students are what are preventing them from success, these are not as easily identifiable as physical barriers.

There are two theories that comprise the framework for this research. The first is the Cognitive Load theory by Kahlil and Elkhider (2016), this theory is vital for developing an understanding how new information is processed by the brain and specifically how the environment can affect those with learning disabilities during this process. By understanding the sensory memory as a processor of new information through the senses I was able to create the first category of learning disabilities which assisted in the analysis of the precedent and case study schools. Further into the process is the attention required by the individual to move the new information from the sensory memory to the working memory allowed me to then create the

second category of learning disabilities for analysis. The second theory used in this research is Richard Mayer's multi-media learning theory (1947). There are many modern learning theories available to use as framework for developing learning environments for students with learning disabilities. I determined that multi-media learning theory was the appropriate theory for this research because of Mayer stated that the environment inputs new information through the auditory and visual channels of the brain which aligns further with Kahlil and Elkhider's Cognitive load theory of new information being processed by the senses. Mayer's theory also provides a physical guide for designers to determine how the environment can be created to combat the extraneous load posed on students with learning disabilities through the use of engaging multiple senses at once.

## *CASE STUDY*

The research study compromises two secondary schools located in eastern Ontario, Canada. The University of Manitoba Research Ethics Board (REB) approved both the survey instrument and distribution plan on April 17, 2016 (see Appendix B). This was then amended April 10, 2017 (Appendix C) to allow me to open my study to other schools that may be willing to participate in the research study as the first approval was granted as for three schools in British Columbia. The original intention of the study was to study three newly developed secondary schools. This plan was changed when it became evident that this would not provide insight into how the students and staff used the space as the schools had only just opened. The selection was then based on their categorization as public schools, their location (Ontario), current infrastructure, a willingness to participate, and with a diverse student body and a Student Success department willing to work towards the development of future guidelines. The evaluation was

done through observations and interviews. The interview questions were curated through an examination of existing research into the effects of the learning environment and learning disabilities. By examining the "organically created" Project Spaces within two public schools, it can be determined how effective the Project Spaces are to the general population of young adults and serves to verify the criteria of factors that deter or enhance learning for students with learning disabilities.

As an interior designer, the examination also provided a means to analyze the Project Space with the input from the perspective of students with learning disabilities. The staff have utilized current educational theory such, as cognitive load theory and multi-media learning to design the Project Spaces, they did this without the use of funding, and instead utilized the existing furniture from other areas of the school. The case study format provided insight into the end users' experiences of the space. It provided opportunities for observation of active use of the space as well as how students and staff utilized Project Spaces versus the traditional classrooms still existing in the school. This was vital in providing evidence to validate the hypothesis that a Project Space is a more effective design for a learning environment than the traditional classroom.

## *PHOTO ELICITATION INTERVIEW*

Photo elicitation is a research method that uses visual images to facilitate interaction between researchers and the people interviewed. Eye contact and direct questions can make youth uncomfortable with the interview process. To avoid this discomfort in photo elicitation the photo becomes the focus and serves as a bridge between the interviewer and interviewee (Leonard, Mcknight, Leonard, & Mcknight, 2016). The photo elicitation method provides a

means for students and staff to be prompted by the pictures which were shown to them individually with questions designed to elicit their response. While working with a vulnerable population, the photo elicitation method provides a way for the student to be put in the position of "power." The focus is drawn from the impact of the interview and instead is on the picture set in front of the interviewee. This method provided helpful insight into the end users' experience and it provided opportunities for observation of students' reactions to each space.

Photo Elicitation Plan:

1. The first half of each initial day was spent at each school attending a tour and taking pictures of the different learning environments of the school. Photographs were taken of a variety of rooms preselected by the staff reflecting different seating arrangements, types of furniture, library, Resource Rooms, and extended learning areas.
2. The photos taken during this time were merged into a document, a "Photo Interview Kit" (Epstein, Stevens, McKeever, & Baruchel, 2006).
3. The Photo Interview Kit was then used in thirty-minute-long interviews with students and one-hour interviews with staff.
4. Each interview was then transcribed and summarized to provide the perspective of the students and staff on the spaces that they had created.

## *PROCEDURES*

Upon the completion of the touring and photographing phase of the study, interviews were conducted with ten students and five educators at each school. Through the student services organization at each school recruitment was completed before my arrival for the case study. Students and staff were asked to volunteer to talk about their schools to help inform future design. All participants were required to give fully informed consent. Additionally, students were

required to have a parent/guardian consent as per compliance with the University of Manitoba. Consent and information forms, as well as interview questions, can be found in Appendix A-C.

## *INTERVIEWS*

The focus on these questions was to develop an understanding of what students with learning disabilities, and what teachers/staff that work with these students, consider to be either vital or detrimental in their learning environment. Students and staff were given an iPad with pictures from their school that they could flip through and talk about each photograph. They were given the same set of questions about the space for them to reflect upon. Students and staff were able to flip between photos while commenting on a specific photo; this allowed freedom for them to express ideas as they manifested.

Upon completion of the interview process, any additional areas that were discussed by interviewees that were not previously photographed were documented. All information from the interviews as well as notes and photographs were stored on a password-protected computer to be kept confidential. Interviews were transcribed and summarized for analysis. Each room was then analyzed against the categories of learning disabilities. While it was not possible to determine the specific learning disability of each interviewee, it must be assumed for this study that students fall into one of the two defined categories.

## *PRECEDENT STUDIES*

The purpose of the three precedent studies used in this thesis is to provide visual examples of how the learning environment can mitigate, aid or hinder the learning process for students with learning disabilities. The study of renovations and newly built learning spaces allows for a comparison against adopted guidelines and to be able to compare against what has

developed organically by end users in case study schools. The precedent analysis will enable designers to develop design criteria best suited for successful learning environments for students with learning disabilities. To gauge the effectiveness of Project Spaces for students with learning disabilities, the HWDSB guidelines framework for factoring what constitutes an inclusive school have been identified as “comfort, flexible/adaptable/robust, and extended learning areas.” Learning disabilities with sensory processing issues, such as dyslexia and dysgraphia, affect the brain’s ability to process one or more of the senses. Learning disabilities that affect the ability of the learner to remain focused would include disorders such as attention deficit disorder and dyspraxia; this category is called “focus maintenance.” To identify the proper resources for students with learning disabilities, each precedent study is analyzed to determine how they meet the needs of these two groups. Each study will be broken down into these categories based on the HWDSB school design guidelines and analyzed for its distinctions and failings.

# 5.0 PRECEDENT STUDIES

In this chapter, I will analyze through precedent studies newly built learning environments and renovations to learning environments. Three precedent studies were chosen for their significant use of Project Space as a learning environment. Each school was chosen as an example of a demonstration of different methods for implementing a Project Space as the learning environment. I analyzed each learning environment based on the most commonly occurring learning disabilities and the environment's effect on those students' learning process. Utilizing the Hamilton-Wentworth District School Board's outline for comfortable and inclusive school design I formed a basis for what can be considered an inclusive and comfortable school for all students. This basis allowed me to determine how well each of the designs worked for inclusivity.

## *PRECEDENT STUDY 1: ACADEMY HIGH*

Designer: Stantec
Location: Plano, TX
Size: 71,000 sq. ft.
Grades: 9-12

PICTURE NOT AVAILABLE DUE TO COPYRIGHT

**Figure 3 STANTEC, ACADEMY HIGH 1**

Stantec Inc. designed Academy High as a collaborative open concept space. There are no dedicated classrooms, and areas range from use for small group projects to entire grades working on a project together ('Academy High School' n.d.). The company used an existing commercial building floor that is on one single level with fully glazed walls that allow light to pass through from the large windows, and the spaces seem more substantial. The design of the campus is for

collaborative and immersive learning of STEAM (Science, technology, engineering, arts, and mathematics) programs. Rooms range in size, but there are no dedicated classrooms or confined spaces.

COMFORT AND INCLUSIVITY

In the 1999 study by the Heschong Mahone Group found a correlation between natural light and the performance of students. Natural light has been shown to influence the wellbeing of all students; it also aids in the visual processing of information of students with learning disabilities (O'Connor, M., 1999). The lack of acoustical buffering due to the open ceiling would be detrimental for students who struggle with auditory processing, buffering the sound (Barrett, P., Davies, F., Zhang, Y., & Barrett, L., 2015). The colour scheme throughout the design is neutral, with only the blue used on seating and select walls; this disability of colour use is less visually distracting. The plan also provides wide tables that allow students with sensory processing difficulties to spread out their work and easily use assistive technology such as laptops. Additionally, outside the classroom, students can access computers provided by the school.

For students with learning disabilities which affect attention, the design of Academy High may prove to be challenging to learning. The use of colour is limited to furniture and select walls while flooring and ceilings are monotones in colour. The large windows while beneficial for the bright natural lighting they allow in can prove to be a distraction as the outside world has many distractions for students who struggle to maintain focus. The open ceilings create a space that appears larger, which is beneficial for avoiding a feeling of overcrowding that students with learning disabilities may find distracting. A large amount of clutter that is apparent in the ceilings

where pipes and wires converge and scatter above them create a distracting visual element.

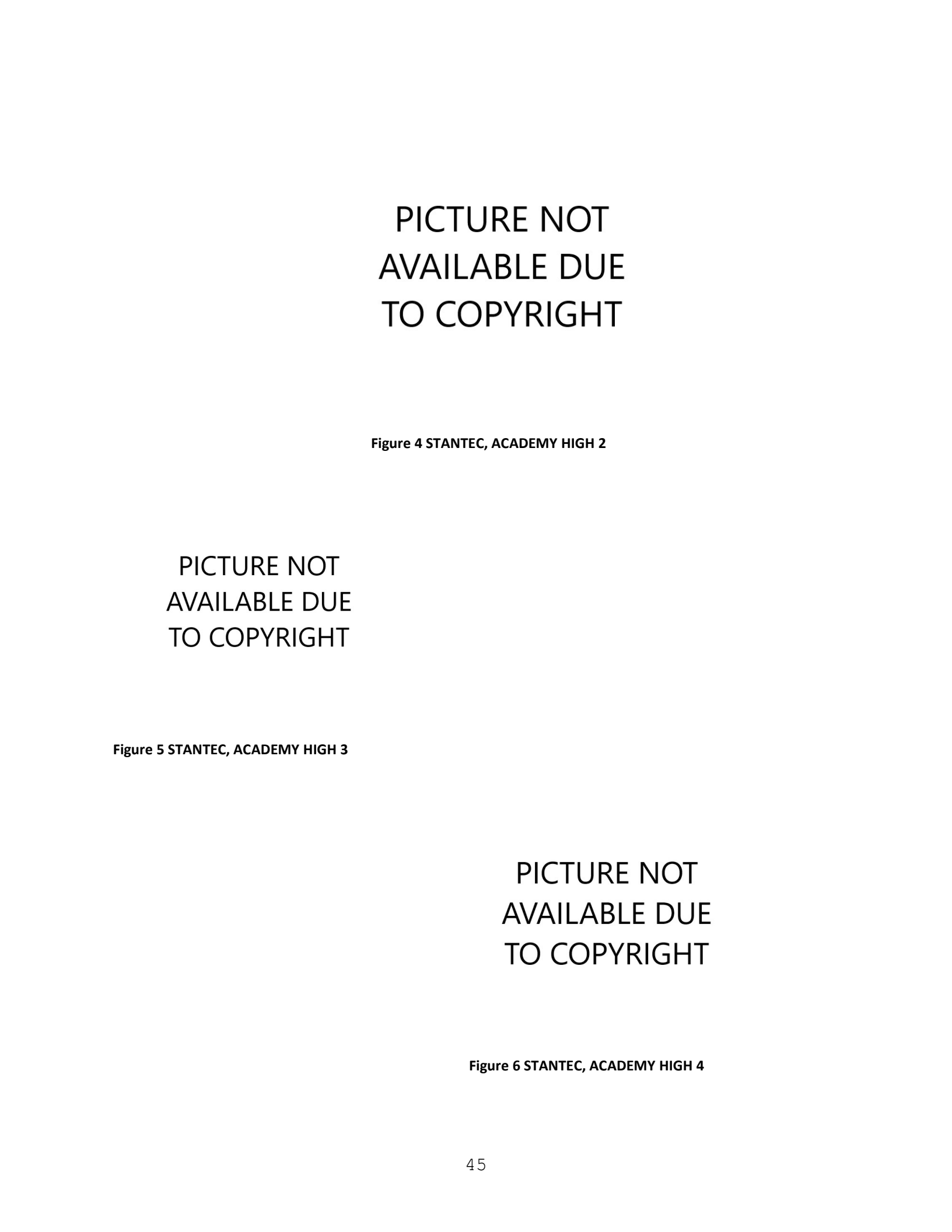



**Figure 4 STANTEC, ACADEMY HIGH 2**




**Figure 5 STANTEC, ACADEMY HIGH 3**




**Figure 6 STANTEC, ACADEMY HIGH 4**

FLEXIBLE/ADAPTABLE/ROBUST

What makes the design of Academy High successful for students learning disabilities that affect the senses is the inclusion of diverse seating arrangements. There is a wide mix of sizes and types of seating arrangements that cater to the ideals of collaboration and immersive learning. In the hallways, individual workstations allow students to take time for themselves to be in an area that is individual while still connected to the school. Small and large group seating is available in other areas of the school so that students can choose to work however best suit them. A student who requires time with their peers to discuss and co-operatively learns would benefit from the lounge seating shown in the library or from the small group seating shown in the classrooms. The benefit of including both sizes of group seating is that the student can choose what works best for the individual's disability. A student with a learning disability that affects the ability to process audio may prefer a smaller group desk so as to be able to focus better while still benefitting from the group learning module. In the semi-private areas, students can continue to work with peers, but this area also provides a space for students with learning disabilities to work with the staff. Students with dyslexia may need a private section to use assistive technology, and the individual area allows them to do so inconspicuously without fear of being "outed" to their classmates. Group desks also provide a discrete venue for students with learning disabilities to receive extra help as staff can work with the whole group rather than singling out the student with the learning disability.

Academy High's school design is successful at creating a space that is exceptional at focus maintenance. Students are not only able to use their technology easily and discretely, but facility provided technology is readily available for students and staff to use for learning and

teaching “on-the-go”. This flexibility allows for students to choose from a broader range of learning environments. Learning spaces range from completely private workstations to large open learning environments that enable students to decide for themselves the number of distractions they are exposed to.

PICTURE NOT AVAILABLE DUE TO COPYRIGHT

**Figure 7 STANTEC, ACADEMY HIGH 5**

PROJECT SPACE AS A LEARNING ENVIRONMENT

Stantec’s design for extended learning areas is unique in that there are no official classrooms in Academy High. Each space is utilized for learning. The design provides computers and small bar height tables in the hallways so that students are easily able to access the internet if they have an immediate need for research. The library offers the students and staff lounge seating areas to converse and learn from one another or where teachers can hold informal lessons. This means that students with learning disabilities are not segregated from the general student population. This decreases the social barriers placed upon students with learning disabilities.

UNIQUE DESIGN

What makes Academy High unique in its design is that the building was formerly not an

education facility. Its former use meant that Stantec was challenged to think outside of the regular secondary school form. The traditional form of long rows of classrooms connected by hallways with physical activity space and eating spaces as the only break from the norm has been scrapped to instead focus entirely on collaborative learning spaces. The form of the spaces follows the 21st Century learning model of collaboration space; this, however, does not account for students who do require time to be worked with individually. The designers of Academy High also recognized the necessity of providing access to electronics in central areas of the school, implementing strategies such as power boxes that hang from the ceiling so that students who require a place to plug in are never far from the source. They created a uniquely designed space, with large windows that bring light to every corner.

According to the HWDSB guidelines Academy High meets much of the criteria for a great school. It is a comfortable atmosphere for students, providing natural light, limited use of bold colours, wide tables, and access to computers. The design provides comfort and flexibility through diverse seating, individual workstations, small and large group seating arrangements, semi-private areas, and the ease of use of technology through drop down outlets. Where the design fails is that the learning spaces do not have adequate sound buffering, the school has distracting views through large windows and ceiling clutter, and it does not provide spaces to allow for private student/teacher interaction. Diverse collaborative spaces are important for students with learning disabilities; the design still reflects some deficiencies important within each category.

## *PRECEDENT STUDY 2: LAKE FOREST HIGH SCHOOL*

Designer: Perkins+Will

Location: Lake Forest, Illinois
Grades: 9-12


**Figure 8 P+W, LAKE FOREST HIGH 1**

Perkins + Will implemented an addition and a renovation of Lake Forrest High School to update and modernize the campus, including the library and student resource areas. The firm worked with the community and stakeholders to add more classrooms, renovate their science wing and better incorporate computer access and access to the internet.

COMFORT AND INCLUSIVITY

The ceilings of Lake Forrest High school immediately stand out as a design feature; they are clean and elevated, allowing an abundance of light to travel into the room. This natural light benefits students with learning disabilities when they attempt to visually process what they are learning visually. Natural lighting is more comfortable than artificial light, and the provision of enough light to complete work or while reading is beneficial. The colours and artistic visuals on the wall are cohesive with one another providing little distraction to the students. As a renovation, the tables and chairs stand out as less modern than other case studies as they are older and less ergonomically designed. There are comfortable seats available in the resource area, but they appear to be limited. Computers are available at the second level of the resource area. Table sizes are smaller and would provide less space for students with assistive technology to comfortably lay out their items.

Students struggling to keep focused may be distracted by the seating available to them in the main study areas, as the furniture is not ergonomically designed. Sitting in furniture not

designed for extended periods of time could mean more body breaks for students with learning disabilities, which effects focus on learning. The large visuals on the wall of the resource area may be a distraction. The ample open space could prove to be a distraction for students depending on the noise reduction methods used. The flooring appears to be tile and would likely reflect the sound of movement and activity in the space. The interior windows look directly into another area of the interior of the school, (see Figure 11) in the school rather than outside making natural light limited, and the action of students passing through the main hall may prove to be another distraction.

PICTURE NOT AVAILABLE DUE TO COPYRIGHT

**Figure 9 P+W, LAKE FOREST HIGH 2**

**Figure 11 P+W, LAKE FOREST HIGH 4**

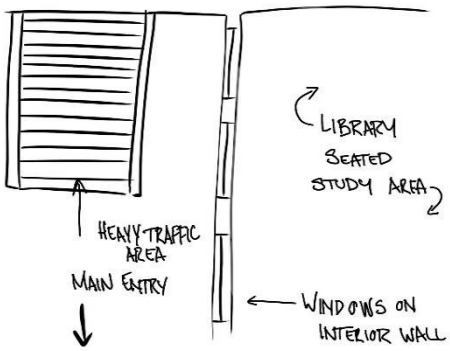



**Figure 10 P+W, LIBRARY INTERIOR WALL DIAGRAM**

PICTURE NOT AVAILABLE DUE TO COPYRIGHT

FLEXIBLE/ADAPTABLE/ROBUST

Some students with learning disabilities which affect the sensory processing may struggle in a school design like Lake Forrest High. Computer desk workspace is small and not ideally suited for students to spread out reference materials while using desktop computers. Individual spaces under the stairs of the resource centre allow students to work in a quiet, isolated space. This space does not provide natural light to a student as space is shaded from the natural light that comes from the upper level of the room. The ability to change the level of lighting may be useful for students working on personal laptops to avoid screen glare or allow students to focus on their visual processing without external interference. There are multiple types of seating available, so students can work in a way that suits them, however tables and chairs are heavy and bulky making the space less adaptable for a student requiring different group configurations.

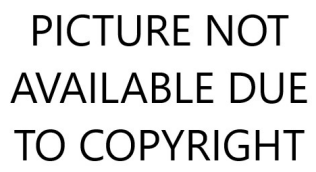



**Figure 12 P+W, LAKE FOREST HIGH 5**

The design of Lake Forrest High is a successful design for students who require collaboration with other students to aid with maintaining their focus. The interior resource centre provides ample collaborative seating for many groups of students to use the space at the same time. It fails in being flexible for students who need a more secluded area for study. The seating is heavy and encumbers rearranging the furniture for different sized groups. There are computers available to students, but they are desktop computers and limit the students moving to a different area. Due to the use and size of the space, there is no control for individual students to engage

the environments' lighting and noise levels. If a student with focus maintenance learning disabilities struggles with paying attention to the information, they are being taught they may need to choose another area of the school.

## PROJECT SPACE AS A LEARNING ENVIRONMENT

The extended area for learning available to students attending Lake Forest High includes the new entry space, an exterior patio space, and the renovated library/Resource Room. This renovation by Perkins+Will essentially create a large-scale Project Space for students with learning disabilities. The entry space contains tables and chairs for students and staff to use. The outer patio space is much the same, providing students with an area with tables and chairs semi-sheltered from the elements. The library and Resource Room are combined to create one large space; one space to provide students and staff with a space that has access to multiple necessities for learning, i.e. physical books and computers. The tables and chairs in the central area allow study and small group activity to occur. The computers along the edge of the mezzanine and the sides of the main floor provide students with access to research and use assistive technology. Lounge seating creates a less formal setting for students and staff to meet. The disability with this kind of renovation is that it isolates the beneficial learning environments for students with learning disabilities to one area rather than the entire school being inclusive.

## UNIQUE DESIGN

The Lake Forest High school is unique from other designs in its incorporation of the Resource Room and the library. Both printed material and online resources are available and within proximity to each other, allowing students to use both resources in one study area. As a

renovation and addition, the design capitalizes on keeping the traditional atmosphere of the existing building while incorporating modern architectural elements, such as the sizeable glazed wall in the addition that provides natural light into the adjoining spaces. The natural light provides students with a space that is easier for visual processing, which is important in the internal processes of learning.

Lake Forrest High is a renovation, funding was budgeted to add to the existing school while using existing furniture and resources. The reuse of furniture meant that the tables used in the primary study area are old and made of hard materials, this makes them heavy to move and to rearrange. Without the ability to rearrange their space, students of both categories of learning disability may encounter cognitive overload during the important steps of environment input to the sensory memory or to the attention needed to bridge to the working memory.

Lake Forrest High is moderately successful at creating a great school. It connects to the old existing school while incorporating modern technology. It would have benefited from a budget that allowed for the integration of mobile furniture with better ergonomic design for extended sitting. It is a comfortable atmosphere for students because it provides natural light, has a limited use of bold colours, has wide tables, and has access to computers. The design provides comfort and flexibility through diverse seating, individual workstations, and group seating arrangements. It fails by providing distracting views through large windows, its furniture and tables are old, making them difficult to rearrange, also making them uncomfortable after long periods. Computer desks size is inadequate and individual work carrels have artificial lighting that the individual cannot adjust.

## *PRECEDENT STUDY 3: SAUNALAHTI SCHOOL*

Designer: VERSTAS
Location: Espoo, Finland
Grades: 1-9

PICTURE NOT AVAILABLE DUE TO COPYRIGHT

**Figure 13 VERSTAS, SAUNALAHTI SCHOOL 1**

The Saunalahti School acts not only as a grade school but through a daycare, youth house, and public library the school acts as a connection to the greater community. Verstas designed the building using concrete and timber to keep with traditional architecture. According to Verstas, the "architecture has been tailored to support the pedagogical ideas of the school in pursuit of better learning results" (Saunalahti School – Verstas Architects, n.d.).

COMFORT

As a multi-purpose building, the ceilings are exceptionally high for an educational building. The tall ceilings allow for large curtain walls which allow natural light into every space. The specified lighting elements of the design are not the traditional fluorescent apparent in many educational spaces; instead, the designers opted for diffused lighting. The available seating is not only varied in size but comfort level. Lounges and cushions allow students to spread out and get into different positions while learning; this is available in both the classrooms and extended learning areas. The décor, walls, windows, furnishings, throughout the design are in keeping with traditional Scandinavian architecture, with concrete and timber construction being the primary focus. Accent walls and furniture are used to bring bright colours into space, making it more visually appealing while still maintaining an overall relaxed and non-disruptive environment.

The Saunalahti School design is very accommodating to students with trouble

maintaining focus. The design uses colours sparingly, and the construction materials chosen are sound absorbing. The large windows may provide a distraction at times for students as they have easy access to looking outside. The multi-purpose use of space in the design of the building impacts the amount of foot traffic in and out of the space. There are student workspaces in more secluded areas of the school which help to cut down on the amount of distracting activity that the students are exposed to.


**Figure 14 VERSTAS, SAUNALAHTI SCHOOL 12**

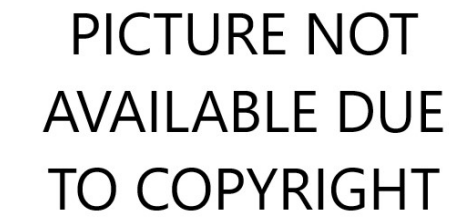



**Figure 15 VERSTAS, SAUNALAHTI SCHOOL 3**

FLEXIBLE/ADAPTABLE/ROBUST

The design of the Saunalahti School does not have areas created for individual study. This deficiency is an issue for students with learning disabilities that affect sensory processing as it limits the flexibility of their learning environment. The school design focuses instead on diverse learning spaces, ranging from smaller classroom sizes to large labs and collaborative areas. Students and staff are also able to use the public library and outdoor spaces as additional learning environments which may provide a venue for students to change their environment to one that better suits their needs for sensory stimulation.

As the school is multi-purpose much of the space needs to be flexible. Classrooms have tables and chairs that are mobile, and therefore provide an environment that can adapt to a student's needs. Access to technology and electrical outlets is noticeably missing; this could be due to the consistent changing of the space to accommodate different groups and lessons.


**Figure 16 VERSTAS, SAUNALAHTI SCHOOL 4**

## PROJECT SPACE AS A LEARNING ENVIRONMENT

To also function as a building which serves the local community, there are some extended learning area ideas that the architects included in the design. There is a shared library area that students and staff can utilize. At the centre of the building is a dining hall which the furnishing can be reconfigured during meetings of all sizes. According to Verstas, the construction supports "learning outside the classroom" as they were to encourage unorthodox ways of learning in their design (Saunalahti School – Verstas Architects, n.d.). The school does not have classrooms in the traditional sense where students return each day at a scheduled time. Instead, each space has use for students and community to use for their lessons. In this way, all the areas of the school are extended learning areas and Resource Rooms, and students are free to travel to any area of the school to work. While the design is not entirely fit for use for students with learning disabilities, this new build demonstrates how Project Space can be used as a classroom design formula. The school as a whole becomes more accessible for students and decreases social barriers for them.

## UNIQUE DESIGN

There are many elements of the design of Saunalahti school that make it unique. Due to its connection to the community, the school is open after regular school hours for workshops, clubs and for others to use the spaces for learning and collaborating. According to the architecture design group, the intention was creating a learning environment where students are also learning from and engage with community events. The lighting chosen for space is also unique from others because it is not standard fluorescents lights commonly used in education facilities. The lighting is instead diffused to create a residential effect on the design. The overall

design mimics residential design in many ways; the softer lounge seating available in the classrooms, the materials, such as wood and brick, chosen to reflect the Finnish community.

For students with learning disabilities, the schools' design works well as a flexible, comfortable and adaptable environment. With the use of mobile furniture and mobile technology the interiors are capable of rearrangement to fit that day's lesson. If one room does not suit, then the class can move to another learning environment better suited or reconfigured to suit their needs. Similarly, a student can move to another room if the environment does suit their learning needs. Some students with learning disabilities will find that high traffic areas are noisy, that they lack individual workspace, and that there is limited access to electrical outlets for technology, all of which negatively impact them.

## *CHAPTER CONSLUSIONS*

The Project Spaces examined in the precedent studies address areas of comfort, flexibility, adaptability and robustness. Through this analysis it is clear that the design of a Project Space can meet the criteria of the guidelines set by the Hamilton-Wentworth District School Board. They have taken into consideration the importance of natural lighting, group seating, individual quiet work areas, and flexible seating choices, however some Project Spaces still struggle with distracting views, noise and adequate workspace for the use of technology. The design of these environments can conflict with the ability to learn between types of learning disabilities, designers must be cognizant enough to recognize and accommodate multiple groups in their design elements. Whether the failure is related to a lack of understanding by designers, or to a failure to solicit end-user input, or to budget constraints is unclear. We can now use the

information gathered through case studies to evaluate how user input can influence improvements.

# 6.0 CASE STUDY SCHOOLS

In this chapter, I will analyze case study schools in the same format as the precedent studies. The two case study schools were chosen for their depiction of the average learning environment in Ontario, Canada. I analyzed each learning environment based on the most commonly occurring learning disabilities and the environment's effect on the student's learning process. As with the precedent studies, I utilized the Hamilton-Wentworth District School Board guidelines as a basis for what can be considered an inclusive and comfortable school for all students. This basis allowed me to determine how well each of the designs worked for inclusivity. Student and staff interview, as well as the observations made while attending the schools, are included in the analysis to accurately determine the inclusivity of the space according to the users.

## *CASE STUDY SCHOOL A*

SCHOOL A: Name redacted for the privacy of students

Location: redacted for the privacy of students

Grades: 9-12

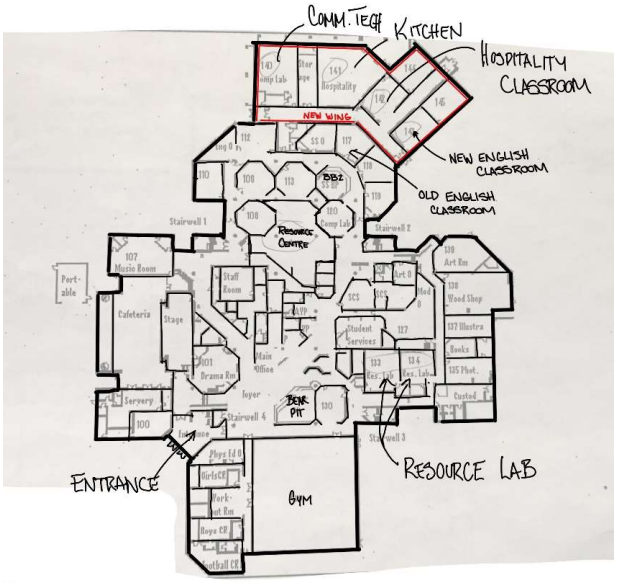



**Figure 17 CASE STUDY SCHOOL A - 1**

School A is located in a town in Southeastern Ontario, Canada, and was built in the 1970s. The school presents a unique design from most other schools in Ontario as it was initially intended to employ "open concept learning" as part of an experimental approach to education in Ontario at this time. The school is octagon shaped, with an ample open space and windows bringing in natural light on all outside walls. It originally had different learning areas segregated by aisles and groups of desks and by

varied learning spaces. As time passed, staff and students who use the space gravitated towards a more traditional learning environment; and the need for walls was deemed necessary. Thin walls were erected to work around the form of the original building, resulting in diverse classroom shapes. These inner classrooms lack windows and natural light. In 2009 School A opened a new section which houses classrooms with large windows as well as new culinary classrooms with direct access to the garden.

## COMFORT

The learning environments in School A have limited natural light. This is primarily due to the original open concept design, being reconstructed into separate classrooms. Students and staff, when interviewed, agreed that the colours used for most of the school are relaxing with the recent addition spaces painted light blue. One staff member noted that the "builder beige" was noticeably more draining on her. As a newcomer to the school, the bright blue and orange of the science classroom in Figure 19 is shocking, but students and staff were mostly unaware of it, one science teacher interviewed said that they had never noticed, and their students had not complained about it. When asked to discuss the graphics on the walls throughout the school, students and staff were happy that the walls were not bare and boring. In one interview, a staff member noted that the spaces would benefit from "more positivity" on the walls. The classrooms throughout the school have some varied seating types available, but most students indicated they were not happy with how uncomfortable the chairs are. A staff member noted that in their classroom, students would often rush for the few seats that had cushions. The majority of the students interviewed found rooms such as the Resource Room and Student Success to be comfortable and easy to use because of their adaptive nature. These rooms made it easier for them to relocate from their main classroom to a space that was designed intentionally to

accommodate their needs.

According to the staff interviews, the doors into the of the Resource Room were often heavy and made considerable noise when opened and closed this often caused a distraction for students. Both teachers and students noted the school ventilation system is underperforming and usually leaves the students and staff cold in the winter and hot in the summer. The quality of the air in spaces lacking exterior windows created ventilation issues that were distracting for students and faculty due to the air being “hot and stuffy”. In the Resource Room, students can select items to help stay focused while seated including cycling pedals (a device that sits beneath the desk with two pedals that a student can rotate with their feet without disturbing other students) and exercise balls. The Resource Room provides students with focus issues to make choices from a variety of learning spaces. Students can work in private offices or travel into the Student Success room to break off from the grouped learning area of the Resource Room. The Student Success room, according to staff and students, provided students with a quick escape but is used far less frequently than the Resource Room.


**Figure 18 CASE STUDY SCHOOL A - 2**

Fluorescent lighting overhead.

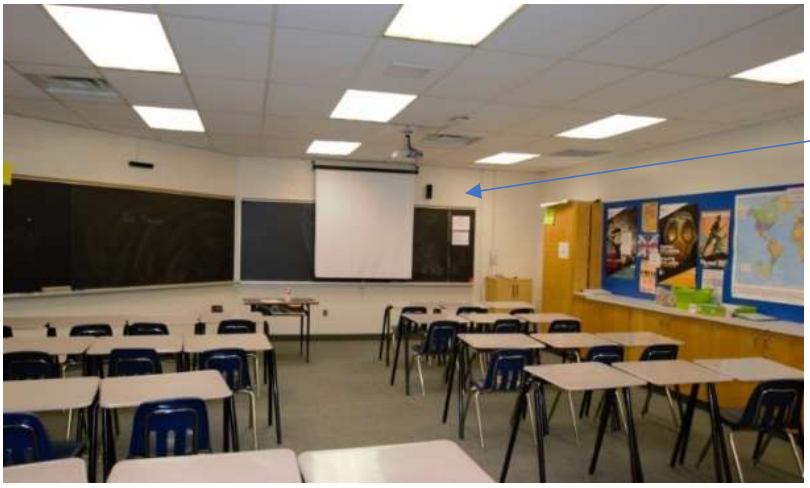
**Figure 19 CASE STUDY SCHOOL A - 3**

Hard plastic seating.

Millwork cannot be moved because of plumbing/electrical.


**Figure 20 CASE STUDY SCHOOL A - 4**


**Figure 21 CASE STUDY SCHOOL A - 5**



Interior rooms surrounded by other classrooms do not have access to windows and therefore lack natural light.

**Figure 22 CASE STUDY SCHOOL A - 6**

Taller ceilings in the addition make the rooms appear less crowded.

**Figure 23 CASE STUDY SCHOOL A - 7**

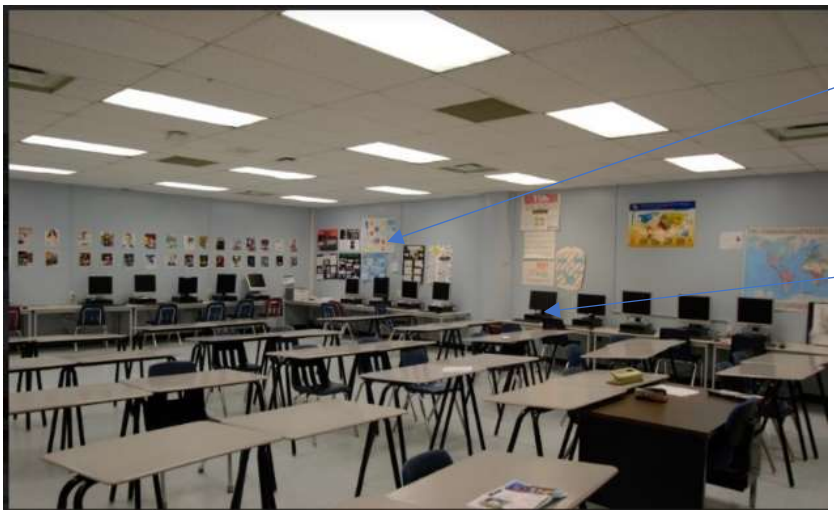



**Figure 24 CASE STUDY SCHOOL A - 8**

FLEXIBLE/ADAPTABLE/ROBUST

Within the Resource Room and Student Success rooms, which are joined together by a small hallway at the back, there were two small private offices. According to the two staff members who used these offices, students can join them in these offices to work with assistive technology or students can work by themselves if they require a secluded space. Throughout the school access to technology was difficult for students to find. While computers were available to them in both the Resource Room and library, students found it difficult to find a plug for their laptops. Students interviewed expressed that they liked the openness and the size of the Resource Room and the math classroom (Figure 20). These rooms had larger square footage, allowing them to move easily and to circulate between the desks easily. According to School A Student 5, there is “lots of space,” and the “desks are less crammed together.” They enjoyed the vertical workspace but noted the downside was that from some of the desks they had to pivot their bodies uncomfortably to be able to see the boards.

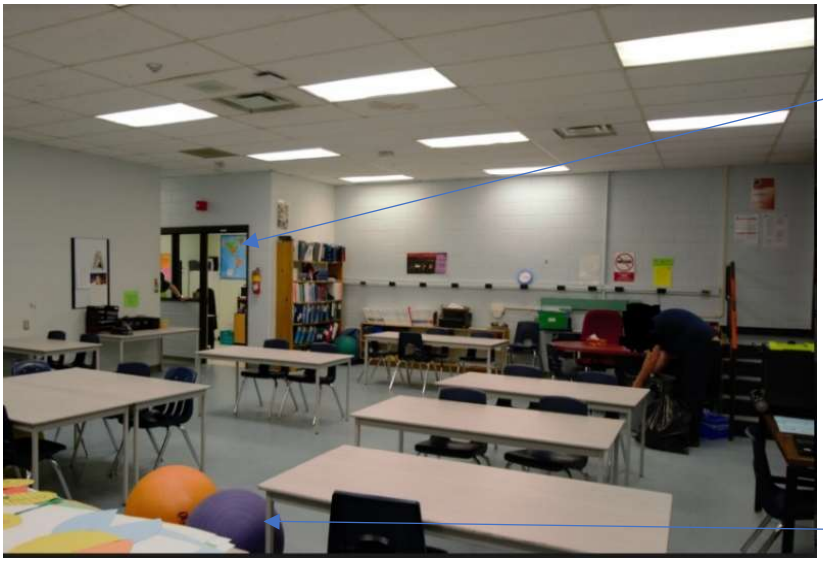
The density of the furniture in the classrooms and learning areas proved to be a significant distraction for many of the students interviewed. Students did not like classrooms that they felt were crowded with desks and chairs. In the Resource Room, students noted that, due to the larger space, it was easier to focus because they could choose where to sit based on their individual needs. Conversely, some students found places that were organized into work groups with desks and chairs, like the English classroom (Figure 20), to be as distracting as other classrooms because they were forced to stay in groups at all times. Some students specifically did not like the English classroom environment because of this issue. Students often noted in areas of high traffic, like the Resource Room, they could use headphones to block out the noise. Students enjoyed rooms that had vertical work surfaces because they allowed them to be up and moving while working through a problem. Some of the room shapes in the building made it difficult for the plan to allow for collaboration. The science classroom (Figure 19), which is a narrow and long polygonal shape, is an example of a poorly designed reshape, combined with the existing millwork which houses electrical power making redesign of the positions difficult. The science classroom only fits long slim desks in rows. These rows also pose a problem for students with difficulty focusing. If the teacher of students needs to move into or out of their seats, they must travel the narrow passage to one far end. A better example of a less dense area is the Math classroom (figure #24). The staff member who uses this room explained how one of their students with a learning disability often needed to take body breaks. In order to allow for this, the staff member arranged the seats and desks so that the passages in between were widespread and clear of obstruction.

Project Space is seen throughout the design of school A; this may be because of the unique original design of the school requiring to be reworking of the design multiple times. The effectiveness of Project Space-based design for classrooms is evident in rooms such as the math and English classrooms of the new wing, where larger classrooms are available. The larger footprint of the class has allowed for more flexibility in the design and has created a more comfortable atmosphere for inclusion. Students in School A were more open to discussing each area of the school rather than just the Resource Rooms.

The Resource Room, along with the attached Student Success room, provides students and staff with an area that encompasses many of their specialized needs. The Resource Room and the Student Success room are not traditional classrooms. They instead serve a multitude of purposes, including learning specialized skills, test taking, homework, group work and one-on-one time with staff. The rooms provide the most flexibility for students experiencing restless bodies. Students can choose to use an exercise ball or cycle pedals underneath the desk without causing too much of a burden on other students. Students can decide to move themselves to a secluded area such as the private offices or the less populated Student Success area. Desks are available for individuals, groups of two are facing towards the front or groups of four for students to look at each other. There is ample area for students to circulate through space without disturbing others. There are no windows in the space, meaning that there is no natural light and no proper air circulation. If they stayed in these rooms for extended periods students complained that being under the fluorescent lights left them with headaches. The connection to Student Success, students and staff complained about the noise and movement of students passing

through the room through the back was distracting. The loud creaky door added to the distraction.


**Figure 25 CASE STUDY SCHOOL A - 9**



Private offices at the back of the room allow students to meet with staff for private meetings or to use assistive technology without interruption.

Exercise balls and stationary bike pedals allow students who need body breaks to stay in the room during lectures.

**Figure 26 CASE STUDY SCHOOL A - 10**

In the same room the light weight desks have been rearranged for a different day to allow the students to use them as groups rather than facing the front individually.

**Figure 27 CASE STUDY SCHOOL A - 11**

UNIQUE DESIGN

What makes the design of School A differ from other school designs is the original octagonal design that forced renovators to create spaces not part of the design's original concept or intention. The vital rooms that were later developed were constructed in dark areas with no natural light and other rooms built with thin walls ultimately needed holes cut into the tops to allow for better air circulation. These holes now contribute to increased noise issues, causing a distraction for most students. Overall the school has attempted to change the original design as best they could and has tried to provide diverse learning environments. The school design has been updated to use modern learning theories that employ technology as a teaching tool, multi-media learning theory states students require auditory and visual channels to be engaged to learn. Figure 20, the math classroom in the new wing, shows the projector built into the ceiling of the room, providing a resource for the teacher to have visuals displayed while lecturing. Smartboards are frequently used in the design; this technology integration provides students with the ability to follow along with the lesson and engage with their class. This type of learning engagement with classmates and lessons creates an environment where students can pay attention and gain working memory of the new idea.

## *CASE STUDY SCHOOL B*

**Figure 28 CASE STUDY SCHOOL B - 1**

SCHOOL B: Name redacted for student privacy
Location: Redacted for student privacy
Grades: 9-12

School B, built in 1957, is located in Southeastern Ontario. The design of school B would be considered traditional, with long hallways lined with classrooms. The design of the school began as one linear two-story building, a hallway down the middle dividing classrooms and administrative offices on each side. Later additional wings were added, creating a rectangular pattern with an interior courtyard space for students. The school was expanded and renovated in 2006 to add classrooms to the back of the building and to update the library for modern technology use.

Millwork makes reconfiguration of the space for group work or meeting with a teacher difficult.

**Figure 29 CASE STUDY SCHOOL B - 2**


**Figure 30 CASE STUDY SCHOOL B - 3**

COMFORT

The walls of School B are all painted off-white with the space appearing cold and uninteresting. The bare walls could be viewed as an aid for students who have trouble with visual processing as they have less to process; staff and students have made walls more visually appealing through the use of posters and student artwork. Most students and staff voiced support for the idea that classrooms and learning environments with more visuals were more comfortable for them to work in and appealed to their connection to space. There are plenty of large windows in each classroom, with the exception of the computer classroom in the new wing. The natural light provides for better visual processing by students. Hard floors and surfaces within each room make for a lot of sound reverberation, causing difficulty for students with learning disabilities that affect attention. In geography and history classrooms, multiple students and staff were happy with the visual aids on the walls. They stated that the visuals did not distract them, rather these gave their eyes an educational place to wander until they were able to refocus on their lesson. One student did mention though that they felt “the visuals were chaotic and disorganized” (student 3, School B), The posters and artwork are placed at different height levels above the

floor and in different ways throughout the room causing a distraction for the students. Students and staff noted that they enjoyed a large amount of natural light allowed in the room by the wall of windows. Many students did note though that because the school is on the main road in town the windows of the classroom located at the front of the building could be a distraction. Students were more receptive to the windows in rooms such as the math classroom (figure 32), which faces all desks towards the side of the classroom, so windows are behind the students while they work. Unseen in the pictures of the science classroom (figure 29), are hard metal stools available for seating. Students find these stools uncomfortable. Ageing seating was common throughout the school and was a common complaint by those interviewed. Each student interviewed complained about seating choices that they had available to them in various rooms. In the English classroom (Figure 30) in the new wing, the hard, pre-formed chairs attached to desks were as common a complaint as often as the metal stools.

FLEXIBLE/ ADAPTABLE/ ROBUST

Students with sensory processing issues find many of the rooms in School B a difficult experience, especially if they are looking for any kind of solace. If they need a change in their environment, they may be able to change the lighting levels by using blinds on the windows or by turning off some of the lights. It is unfortunate for students with audio processing that they need to relocate or make use of their assistive technology, like headphones, to help offset distracting stimuli. Access to electrical outlets is also very limited within the school, and this means that students need to leave their lesson to plug in any devices they are using to assist them with their work. Students experiencing this issue have their lessons interrupted, and full participation is blocked in the complete learning experience in those classes.

If students are easily distracted, they may find the learning environments of regular classrooms in School B challenging. There are no areas for private study within these classrooms; students need to find a space in the library or the Resource Rooms if they require a quiet environment to complete their work. Rooms such as the science classroom (figure #29) provide no options for students who need to choose what makes them comfortable in terms of seating or grouping scenarios; students are organized to sit uniformly on stools facing the front of the class. The English classroom's furniture (figure #30) provides little opportunity for adaptability; uncomfortable hard plastic chairs are attached to desks trapping students that effectively make impromptu changes harder, and make comfort more difficult. The density of furniture spacing experienced in many of rooms in School A are not in School B; the classrooms have maintained large-sized classrooms since 1957, and this makes the rooms easier for students to navigate.


**Figure 31 CASE STUDY SCHOOL B - 4**


**Figure 32 CASE STUDY SCHOOL B - 5**

Visuals were chaotic and distracting for some students, other students were able to ignore them.

Smaller square footage overall means that rearranging individual desks is more difficult while allowing spacing between desks.

**Figure 33 CASE STUDY SCHOOL B - 6**

PROJECT SPACE AS A LEARNING ENVIRONMENT

Compared to School A, School B was less successful in adapting their classroom designs to be more inclusive of students with learning disabilities. Instead, students spoke often of needing the assistance offered by the Resource Rooms in order to do their schoolwork effectively. The Resource Rooms in School B were formerly set up as typical classrooms, but

the staff redesigned the space to be more ambiguous and therefore more adaptable to the student's needs rather than the student adapting to the classroom. This redesign of a typical classroom demonstrates that the design of other areas of the school may be capable of being based on Project Space. The Resource Room and the Student Success room at School B are not connected but are located next to one another. Students and staff use these rooms in much the same manner as School A. Across the hall there are private offices for the Resource Room staff to conduct one-on-one meetings, or to provide them with a place to use assistive technology and services, such as transcription. Students interviewed at School B found both the Resource Room and the Student Success rooms easy to use.

The individual rooms are smaller in size individually than the Resource Room at School A, so there are more issues related to crowding. Students stated that they had difficulty focusing when made to sit in the middle of the Student Success room because other students would be engaged in conversations all around them. They did, however, say that the room was still more comfortable to use because it had fewer students and less noise and activity happening than in their regular classrooms. Students using these rooms noted the steady flow of students coming into the Student Success room for test taking could be distracting and difficult for them to ignore. The heavier furniture and visuals in these rooms make the rooms appear smaller in size. Staff interviewed indicated they did not believe that the visuals in the rooms were distracting to their students with learning disabilities but said they did keep their visuals located only on one wall in each room. The desks are rearrangeable, as shown in the pictures of the Student Success (figure 31-33), and the students can rearrange the space to best suit their needs. This flexibility of desk arranging has less opportunity in the Resource Room, but the design of this room provides students with different work areas to choose from within the small space. Along the edges of the

room are individual carrels for students to work individually. In one corner are desktop computers, and the middle of the room has group desks. Each of the rooms is bright and well-lit, and according to the students interviewed, the staff controls the noise levels within each room.


Interiors are well lit by the natural light from the windows.

Desks can be rearranged to easily allow large groups to meet.

**Figure 34 CASE STUDY SCHOOL B - 7**


Students identified the one wall as distracting but stated that because it was only one wall it was easy to face away from.

**Figure 35 CASE STUDY SCHOOL B - 8**


**Figure 37 CASE STUDY SCHOOL B - 11**

Students appreciated that the room offered a mixture of different types of desks so that they could determine their use of the space.

**Figure 38 CASE STUDY SCHOOL B - 13**

UNIQUE DESIGN

What differentiates the design of School B for students with learning disabilities is the generous size of its classroom spaces and the abundant amount of natural light coming into most rooms. Much of the school's design and dated furnishings have a negative impact on the comfort level of students. When students are uncomfortable, they are unable to remain focused on what they are learning. The interiors of the school were renovated, and technology has been added to allow for the visual and auditory teaching methods reflected in multi-media learning theory. The interiors are well lit throughout the building; large windows encompass one full wall of each learning environment. The natural light allows students and staff to determine the number of overhead lights to have on. The air quality of the school is a concern for students and staff; the heat in the building was a subject that was mentioned about many rooms and is an ongoing issue. Outlets were often dedicated to a standing fan in an attempt to improve the air quality in each room but provided limited impact.

The Resource Room provides laptop computers to students who require them, or students can attend computer labs or the library to use desktop computers. Unfortunately, due to the age and infrastructure of the building, outlets are a scarce resource. During the walkthrough of the building, the science classroom was the only room with outlets readily available for students to "plug-in" at their station. Classrooms had outlets on the walls, but there were not many available, and because of heat issues, often they were allocated for other purposes. If a student with a learning disability required a laptop or other piece of technology to aid them, they would need to make sure that they were sufficiently charged before the lesson, which in and of itself was challenging to accomplish.

The desk sizes in primary classrooms were smaller in size than would be necessary for a

laptop and other resources to sit comfortably on the surface. The small size of the desk makes collaboration efforts difficult. This conflicts directly with the theory that students are impacted positively when struggling to work through a problem if they can collaborate with their peers or one-on-one with a staff member. Many of the standard desks used in primary classes were attached to a chair, making rearrangement difficult. The Resource Room and the Student Success room were the only two rooms that showed evidence of the intervention of these standards. These rooms can be classified as extended learning areas as they do not function as a classroom. The Project Spaces have larger desks that are separate from the chair; chosen specifically as they can be rearranged into more collaborative layouts. Figures 34 and 35 show how the half hexagon desks can be pulled together to create one larger desk. The Resource Room also has individual study carrels available to students; this provides the students with the ability to quickly change their learning environment without needing to leave the area and allows that the staff are still available to help. The age and design of the building prevent the school from creating the large open spaces exhibited in the precedent study schools. Instead, the school and staff have opted for using two classrooms that are next to one another (figure 40) to create an extended learning environment to benefit students with learning disabilities and who require assistance. The classrooms are in the front of the building. According to Staff #5, this allows easy access to the administrative areas and better integrates the rooms into the school. These areas are not hidden; all students are welcome to use the space and utilize the resources and staff members at any time.

# 7.0 CONCLUSIONS

## *ORGANICALLY CREATED PROJECT SPACE*

When interviewed, the students and staff at School A and at School B were engaged in talking about the effectiveness of the designs of the Resource Rooms in their respective school. The flexible floor plans and comfortable environment made it so that students wanted to take time away from their regular classrooms to attend these rooms instead. Therefore, Project Space, as a non-discipline specific, multi-functional room could therefore prove to be a more effective template for the design for learning environments. Similar to Academy High and the Saunalahti school design, by replicating this design in newer areas of the school, School A effectively created a more inclusive school, with fewer social barriers to students with learning disabilities. I believe that the organic creation of Project Space by staff and students in each of the school's Resource Rooms demonstrates the necessity of this design for students with learning disabilities. The principle of the design therefore can be further replicated into more areas of the school for better inclusion of students with learning disabilities.

All children should have the right to learn in an environment that meets their needs. According to the HWDSB guidelines for creating learning environments that are healthy, safe, inclusive and comfortable, the school must be comfortable, flexible/adaptable/robust, and have extended learning areas. The guidelines specifically include future designs to have extended learning areas necessary to allow students options to choose from. The necessity for extended learning areas is especially true for young adults with learning disabilities. Through the analysis of space and learning environments in the precedent studies, and through the interviews and

observations made at the two case study schools, Project Spaces that are multipurpose, non-discipline specific provide a basis of design for students with learning disabilities. The Resource Rooms and the Student Success rooms in the case studies act as one whole Project Space for each of the two schools. Each of these Project Spaces was created "organically" by the staff and students who use them. There was no intervention by a professional design team or a large budget for high-end office furnishings. The staff and students instead used their hands-on knowledge and innate ability to understand what they needed to then create these comfortable, flexible, adaptable and robust extended learning environments. As shown in the drawings below of the floor plans of the Resource Rooms the design differs significantly from the typical classroom design. Desks are larger in the resource rooms, meaning more than one student is able to sit at them at one time, the tables used, as seen in Figures 25-27 and 34-38, are light-weight and easily moved so that students and staff can rearrange them. In School B the tables used for collaboration are polygonal and reconfigure into hexagons so that up to 6 students can sit together comfortably. The shape of these tables makes the pathways between desks more difficult to navigate for some students as they are not straight, they are angled therefore this table shape may not be as effective a choice as the large rectangular tables used in School A. School A's tables can be reconfigured to be used for collaboration of 4 students facing each other while still leaving clear straight pathways between for students to navigate.

In School A's layout the two Resource Rooms are used for separate purposes but because they are connected students are able to utilize the large amount of square footage more effectively than School B. In School B the two rooms are separated by a hallway of the main school this means that if a student needs to use the area that is for individual study, they must

leave the one room to join the other. This also means that more staff is required for School B's design, staff members must be present in each of the two classrooms in School B making it difficult for one staff member to help a student who may need to relocate to the other room for their needs. For example, if a student with a learning disability requires a space that is quieter, they may choose to move from the left room to the right in order to use a study carrel, but a staff member may not be able to leave their current classroom to continue to assist that student.

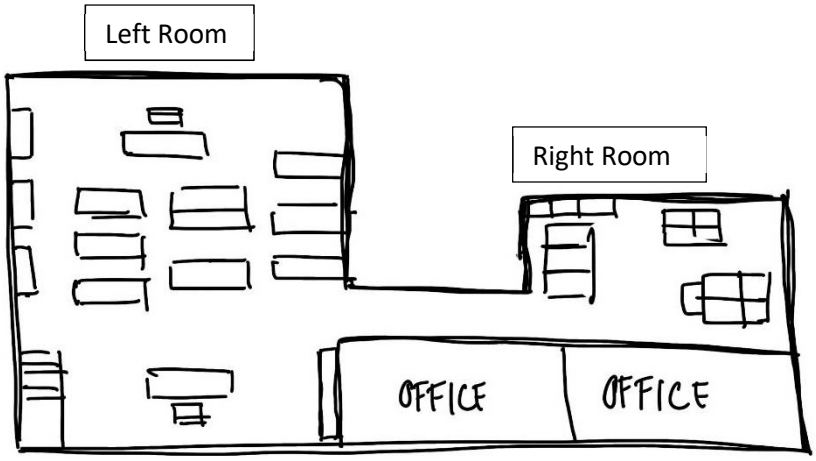



**Figure 39 SCHOOL A PROJECT SPACE FLOOR PLAN**

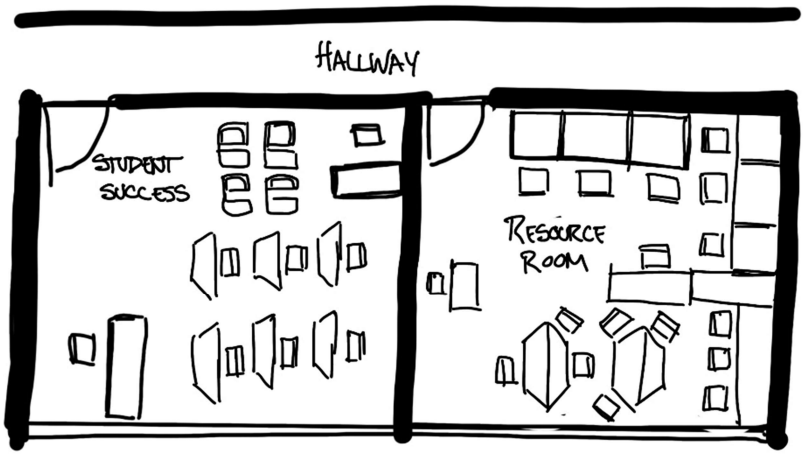



**Figure 40 SCHOOL B PROJECT SPACE FLOOR PLAN**

## *COMPARISONS & RESEARCH*

The research conducted for this paper contributed to a better understanding of the most common learning disabilities and of the characteristics shared by each type of disability and what makes them unique. These shared characteristics aligned themselves into two major categories. Effects on sensory memory, when the student's disability affects the ability to process one of their senses at a rate that is considered 'normal', include but is not limited to dyslexia, dyscalculia, dysgraphia, non-verbal learning disorder, and auditory/visual processing disorder (Brace, 2012; Hoorn 2013; Ansari, 2007; Schott, 2007). The second category, effects on attention, means that the disability or disorder affects the student's ability to maintain focus on subjects and to stay organized, this includes dyspraxia, executive dysfunction, attention deficit hyperactivity disorder, anxiety, and depression.

Understanding Cognitive Load Theory and how the elements in the design such as lighting, noise, temperature, view, density, visuals, and colour must not detract from a young learner's ability to have the environmental input reach sensory memory and negatively impact the ability

to learn. The learning environment for students who struggle to maintain focus must not be placed into an environment that creates a distraction from the attention needed to make the next step of working memory and maintenance rehearsal. By understanding Cognitive Load Theory as it relates to those with learning disabilities designers can better analyze the impact of their designs on young learners.

As outlined in precedent studies, each design can be examined as to how it addresses areas of comfort, flexibility, adaptability and robustness for both groups, and examined through the identification of factors contributing a negative impact on learning for students with learning disabilities. Designs can be adjusted to better accommodate and facilitate learning. Through these organically developed Project Spaces the case studies contribute to the importance of what the end users need. They further verify what elements in the design are best needed to accommodate students with learning disabilities.

The question remains, what can we as designers take away from this research and apply to the design of our future learning environments? While most of the learning environments in School A and School B did not provide the perfect learning environment for students, we can glean much information from the "organically created Project Spaces" to help us create better plans for learning environments for all learners.

COMFORT

A comfortable environment is necessary; chairs should be ergonomically designed, and there should be an option for students who need body breaks to use items like exercise balls or other movement-based seating items. Designers should choose flexible furniture to allow furniture reconfigurations into various combinations of seating and tables arrangements. Seating should not be attached to desks or in any way fixed permanently to desks or tables.

All rooms should have access to natural light, and while windows should be significant, it is beneficial that the outside distractions are out of view for students who need to concentrate. Noise should be buffered; designers should choose materials and furnishings that help to absorb sound and create spaces where students can escape a noisy area.

It is also essential students have access to and be able to use their assistive technology and services comfortably; larger desk work surfaces should be added to some areas to assist with this feature.

FLEXIBLE/ADAPTABLE/ROBUST

A student's learning needs within the environment can change frequently and each student's needs are unique. These changes mean that students need a space that adapts to their needs and has room for growth as the future often brings more informed concepts on classroom design. The Resource Room at School B provides a great example of fitting many needs into a space that does not necessarily need to change on a daily basis. Space contains group tables, individual pods and an area for use of technology. Designers can choose to mimic a similar setup or elect to create a space comparable to the Resource Room in School A; where the overall floor plan is more extensive and allowed for more flexibility by the user. Group desks are available, students can however move to a desk to work by themselves or transfer into the adjoining private office.

A feature that each of the "organically created Project Spaces" would benefit from adding is more control over lighting and noise. While students are free to move to another area,

these spaces only provide a limited amount of control of the lighting and sound, and instead rely on staff to turn off lights or tell students to be quiet. For future design, a space that has more student control of these features would be beneficial to students with learning disabilities. Providing more electrical resources for assistive technology will also provide students with more flexibility in their choices of where to work.

## EXTENDED LEARNING AREAS

The extensive literature and research on libraries as an extended learning area meant that I could chose not to explore the libraries of School A and B. Instead I focused on the Resource Rooms as a form of Project Space. In newer buildings, such as Academy High and Lake Forest High (precedent study # 1 and 2), the designers took the next logical step and merged the ideas of warehousing books (library space), Project Spaces, and resource storage. Due to budget and space constraints, the case study schools converted existing classrooms into Project Spaces. These rooms provide extended learning areas to accommodate learners of all ability levels and type. These rooms have been vital to the students who require extra aid, time or space to meet their goals. Utilizing the designs ideas from these spaces to inform future planning of learning environments will create more meaningful and more inclusive designs for all learners.

It is through analysis and understanding of learning disabilities, through user input from students and staff, and through the impact of that knowledge, that great strides can be made to enhance learning environments and invest in Student Success. The chart below shows the primary concerns that arose during the study that students and staff commented on.

## Table 2: Design Problems and Solutions for Learning Environments for Students with Learning disabilities which Effect the Sensory Memory

| Guideline Criteria: | | Effect on Sensory Memory: | |
|---|---|---|---|
| | Student/Staff comment: | Design Problem: | Design Provision: |
| Comfort: | Staff at School A preferred the brighter colours used in the new areas of the school, in the science classroom students and staff remarked that the bright colours were easy to ignore. | Walls painted bright colours | Students with learning disabilities seemed unaffected by bright colours on walls so long as there was a limited use of other potential sensory distractions. |
| | Students and staff in School A stated that it was difficult to work under the fluorescent lights. | Lack of natural light | All learning environments should have access to windows to the outside. |
| Flexible/Adaptable: | Students were uneasy about posters on walls if they were within their peripheral vision. | Walls with posters on them | Mobile seating available for students to redirect their line of sight, or limited use of posters to relativist ideas to the classroom. |
| | Students noted that within the resource room the desks were larger and allowed for use of technology | Small individual desks within classrooms make having a laptop difficult | Access to a larger desk allows students to have assistive technology with them. |
| | Students would often need to meet with a staff member in another area or at the front of the room at the staff members' desk. | Meeting at a staff desk could be construed as a social barrier as it distinguishes the student from their peers. | Access to a larger desk allows students to have a staff member meet with them within the classroom. |

| | | | |
|---|---|---|---|
| Extended Learning Area: | Students preferred to be in the resource rooms for test taking in order to have access to a quiet space free from distraction. | Schools provide separate rooms for test taking free from sensory distractions | Test taking rooms are free from sensory distractions, or areas within the classroom that allow a student to be free from sensory distraction, i.e. study carrels. |

## Table 3: Design Problems and Solutions for Learning Environments for Students with Learning disabilities which Effect Attention

| Guideline Criteria: | | Effect on Attention: | |
|---|---|---|---|
| | Student/Staff comment: | Design Problem: | Design Provision: |
| Comfort: | Students often complained that the seating available to them was a distraction from their studies as it was hard and uncomfortable for the period of time required of them to stay seated. | Hard seating | Ability to move around classroom during lessons |
| Flexible/Adaptable: | Within most areas of each school students complained that they needed to move to the resource rooms to avoid the noise of other students. | Loud classmates | Private learning areas with noise mitigation, study carrels and noise cancelling headphones. |
| Extended Learning Area: | Students who require body breaks noted that the classrooms with rows of seating made navigation easiest, by being clear and straight. | Classroom aisles between desks are narrow limiting body breaks | Larger floor plan allowing for larger desks and more aisle room |
| | Students enjoyed using the vertical worksurfaces as an alternative to staying seated at their | Students with focus maintenance issues require body breaks | Vertical work surfaces |

| | | | |
|---|---|---|---|
| | desks | | |
| | Students complained that most areas of the school required them to stay in their seat throughout a lecture without any assistance. | Students with learning disabilities that affect the ability to maintain focus require body breaks. | Exercise balls and other items that allow students to have body breaks while maintaining their seated position in class. |

## *CONCLUSIONS & FUTHER RESEARCH*

The reason for this study was to ask whether the ambiguity of a classroom designed as a Project Space instead of the traditional design would be more inclusive of students with learning disabilities. According to Khalil and Elkhider's Cognitive Load Theory individuals learn through the process of inputting new information through the senses. If a young learner is meant to process what they are seeing or hearing, they must not receive external sensory stimulation, which would detract from their ability to have the environmental input reach their sensory memory. As well students who struggle to maintain focus due to their learning disability must reach the next step, through attention in the Internal Cognitive Process. It is vital that the learning environment not create a distraction from the focus needed to make the next step of working memory and maintenance rehearsal.

I have organized the most common learning disabilities into two categories, those that effect the ability to process sensory input and those that effect the ability to maintain focus. This allowed me to study how the environment's design affects those with learning disabilities.

Through the analysis of the precedent studies and the case study schools I was able to conclude that the key component of Project Space that makes it more inclusive is the ability for the environment to adapt to the student needs. Within tables 2 and 3 we can see that each of the

design problems evident in the case study schools were able to be counteracted through the design of the learning environment.

The key findings from the research were that a learning environment designed as a Project Space provides three key factors to success: control, ambiguity, and a larger footprint.

Control of the space benefits students with both types of learning disabilities. Students are able to control their exposure to design elements that may create extraneous load on their processing of new information. Students stated that they were able to choose to relocate themselves to the resource rooms in both of the case study schools, this allowed the students a sense of control as they were able to choose an environment that better suited them. Within the resource rooms the students were able to choose the type of desk that they required to do their work. By providing study carrels students are able to control their exposure to noise and visual distractions, this benefits students with both types of learning disabilities. The resource rooms also provide different sizes of desk, individual and group desks, therefore a student can control how many of their peers they are seated with. Overall this control allows for better integration of students with learning disabilities.

Ambiguity of the design of the space creates another element of control for students as they are able to mold the space. The Project Space is not defined by the subject matter being taught because the room serves multiple purposes within the school. These learning environments are better for students with learning disabilities, as evidenced by the resource rooms in the case study schools. The students were able to change the space by moving the furniture layouts to suite them. In Figure 34 the tables have been arranged for individual use, in Figure 35 the desks are instead arranged for one large group of students. Rearrangement of desks was evident throughout the case study schools as within Figure 30, the staff had taken individual

desks and arranged them into groups. The ambiguity of the spaces provided in the case study schools proved to be important in providing them a learning environment that better integrates them into the regular classroom with their peers.

In order to provide control and ambiguity in the design of learning environments one element that was essential was a larger footprint. To be able to change the ambiguous space and create control there were a number of reasons to make the space larger. Students responded that the larger desks within the resource rooms allowed for them to have their assistive technology (laptops/tablets) on the desk with them while working. In order to provide options such as study carrels the footprint needs to be larger for the Project Space to avoid being crowded by furniture. If students need to rearrange the space, having a larger space provides more room for moving furniture quicker. I believe that a larger footprint for Project Space as replacement for the traditional classroom is essential for the design process.

Within the case study schools, we still see segregation of students with learning disabilities. By creating the resource rooms from existing classrooms students and staff have attempted to create organic Project Space, but the rooms still require students to leave their regular classrooms to attend these rooms instead when they have need of these spaces. This creates a social barrier to the students that may not exist if these design elements were replicated into the regular classroom. For designers of future learning environments to create inclusive space they should focus on all end users, especially those with learning disabilities in order to create a space that works for every student to succeed.

I believe the ambiguity of a Project Space, the non-discipline specific design and lack of defined space, may be the solution for designing for students with learning disabilities. In the spaces shown in the precedent studies and the case study schools it is clear that the classroom

design is evolving to allow students and staff a sense of control. This control allows students with learning disabilities to develop a sense of belonging as they are no longer required to leave their primary classroom in order to learn in their unique way. Whether that means the inclusion of furniture pieces such as study carrels or making the overall footprint of the classroom larger should be determined in the early design stages with the assistance of all types of students and staff.

The purpose of this study was to determine if project space could replace the traditional classroom design in an effort to create a more effective learning environment for students with learning disabilities. This made it fundamental that each school examined had definitive examples of project space implemented as a learning environment but limited the study to two schools, future research should be done with a larger scope to include more schools. What this study has shown for future research is that there is a need for students and staff should be engaged in the design process of learning environments. The students and staff who participated in this study were apt at discussing their current environments and often offered insight into why they needed the space to engage them in different ways for their specific learning disability. As this study researched two secondary schools that are within aging infrastructure future research should be done to determine if newly built schools have implemented some or all of the necessary design elements into secondary school learning environments. If this is true of current learning environments research should be done to monitor the success rate of students with learning disabilities within these schools and their graduation rates compared to schools that have social barriers. Beyond the interior design professional body of knowledge and research implications into the field of education and disability studies regarding these social barriers created by the learning environment should be further explored.

The input from students and staff in this study was invaluable and established that the users of the space will create what they need from available resources. All designs for education spaces should reflect the inclusion of students of all learning levels and types When design is effective for students who have learning disabilities it benefits all learners.

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# APPENDIX A

Educator Consent Form

Research Project Title: Learning Environments for Young Adults with Learning Disabilities

Principal Investigator and contact information:

Taryn Chambers

E: chambert@myumanitoba.ca

P: REDACTED

Research Supervisor (if applicable) and contact information:

Lynn Chalmers

ph: REDACTED

lynn.chalmers@umanitoba.ca

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

**Summary:**

My name is Taryn Chambers and I am a graduate student at the University of Manitoba. The reason for my visit to your school is to better understand the design of the interior spaces and how well it works for students with learning disabilities. This interview will require you to look at photos I have taken of your school and to answer questions about the various rooms in your school where your students learn and study. It includes ten questions and will take roughly one hour of your time. I will be recording the interview with a voice recording device so that I am able to properly record your full answers to the questions. The information you provide today will help my research to create future schools designed to better suit students with learning disabilities. As an educator there is no additional risk involved to you for your participation, I are committed to your privacy as well the privacy of your students so I would request that no names or descriptive attributes of your students be used in this interview.

Your name and any information that could identify you will not be used nor published in my study. If at any time, for any reason, you wish to withdraw from the study you may do so by stating that you would like to withdraw from the study and no negative repercussions will occur. When my research is complete and my thesis has been written I will provide your school with brief summaries (1-3 pages) of my thesis and your school will contact you when it is available and distribute it to you if you wish. My final thesis will be posted to the University of Manitoba's MSpace website and a link will also be provided when it becomes available.

Following this consent form is a copy of the questions that I will ask during the interview, the photos will involve different spaces in your school such as classrooms, libraries, and study spaces.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way. This research has been approved by the Join Faculty Research Ethics Board. If you have any concerns or complaints about this project, you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122. A copy of this consent form has been given to you to keep for your records and reference.

Participant's Signature _____ Date_____

Researcher and/or Delegate's Signature _____ Date _____

Interview Questions: Educators

School:

I would like you to look at these photos of this space (Display photos of area previously photographed at secondary school). We will repeat these instructions for each photo set of the classrooms, library, and break out rooms. In these questions the short form LD has been used for learning disabilities.

1. What do you like/dislike about the space? Why?
2. When you are using ~~in~~ this space are your students with LD able to focus and stay on task? What do you find is distracting for them, if anything?
3. Do you find that the aesthetics of the classroom design, i.e. colours, graphics, patterns on the surfaces can act as a distraction for some students?
4. Are your students with LD comfortable working in this space?
5. How do you feel the lighting in this area works for your students with LD?
6. Is there adequate types of seating in this area?
7. How do your students with LD use this space? Individually? With a teacher? In group work?

8. How easy is it for your students with LD to use the space?
9. Do your students with LD receive any individual help in this area, can you tell me about this process?
10. Do you have any final comments on this space that you would like to add to, specifically what works and does not work for your students with LD? Is there anything in this space I should have included in a photo?

Final Question (not repeated) would you like to be sent a copy of the thesis when it is complete?

# APPENDIX B

Research Project Title: Learning Environments for Young Adults with Learning Disabilities

Principal Investigator and contact information:

Taryn Chambers

E: chambert@myumanitoba.ca

P: REDACTED

Research Supervisor (if applicable) and contact information:

Lynn Chalmers

ph: REDACTED

lynn.chalmers@umanitoba.ca

Parental Information Package

Includes:

Research Study Summary

Photo Elicitation Definition

Parental Consent Form

Copy of Participant Consent Form

Research Study Summary:

Hello, my name is Taryn Chambers and I am a graduate student at the University of Manitoba in the Master of Interior Design Program. It is my pleasure to welcome your child to participate in my research study.

The intention of my study is to analyze current school design in the hopes of developing guidelines for the design of new secondary schools in Canada specifically in regards to students with learning disabilities. In 2013 The British Columbia Ministry of Education developed a Special Education Services Manual (2013) which specifically defines learning disabilities and the extra care that is required for the teaching of students with learning disabilities it also describes a range of needs for students with disabilities. As well in 2012 the British Columbia Ministry of Education developed The Special Education Services Manual, this document details

the allocation of space for new and renovated education facilities. Within the secondary school section, it specifies that additional space is needed for working outside of classrooms and libraries. For the purpose of this study, these spaces will be referred to as project spaces. When educational boards are in pursuit of funding these spaces become optional for architects and interior designers to determine to include or omit, however such spaces may be vital in educating students with learning disabilities who require a space with limited sensory stimulation catering to individual work. I believe that through observations and photo elicitation interviews my research will demonstrate the need for spaces that are molded to benefit students with learning disabilities.

I am committed to your child's privacy and safety, because of this recruitment has been facilitated through their school emails directly to them from their student services department. The student services department of their school has fully facilitated this meeting and I have not been made aware of your child's name or learning disability. In order to avoid exposure to their peers for their participation in the study I have arranged with the school to meet one on one with students in a private office/classroom away from their classmates.

Photo Elicitation Interview Definition:

Photo elicitation is a research method that uses visual images to facilitate interaction between researchers and people being interviewed. Eye contact and direct questions can make youth uncomfortable in the interview process, to avoid this discomfort in photo elicitation the photo becomes the focus and serves as a bridge between the interviewer and interviewee (Leonard, Mcknight, Leonard, & Mcknight, 2016).

If at any time you have additional questions of comments about my study that you would like to discuss please do not hesitate to

If you have any concerns or complaints about this project, or you wish to discuss the study further you may contact myself or my advisor listed above or the Human Ethics Coordinator at 204-474-7122.

Parental Consent Form

Research Project Title: Learning Environments for Young Adults with Learning Disabilities

Principal Investigator and contact information:

Taryn Chambers

E: chambert@myumanitoba.ca

P: REDACTED

Research Supervisor (if applicable) and contact information:

Lynn Chalmers

ph: REDACTED

lynn.chalmers@umanitoba.ca

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

**Summary:**

My name is Taryn Chambers and I am a graduate student at the University of Manitoba. The reason for my visit to your child's school is to better understand the design of the interior spaces and how well it works for students with learning disabilities. This interview will require your child to look at photos I have taken of your school and to answer questions about the various rooms in your school where your child learns and studies. It includes six questions and will take roughly one half hour of their time. I will be recording the interview with a voice recording device so that I am able to properly record their full answers to the questions. The information they provide today will help my research to create future schools designed to better suit students with learning disabilities. The risk involved in this study is exposure to of your child's learning disability to their classmates. Because of this risk I have worked with their school to create a safe interview room and they will only be contacted through their student services department for arranging the interview time.

Their name and any information that could identify them will not be used nor published in my study. If at any time, for any reason, your child wishes to withdraw from the study they may do so by stating that you would like to withdraw from the study and no negative repercussions will occur. When my research is complete and my thesis has been written I will provide your school with brief summaries (1-3 pages) of my thesis and their school will contact them when it is available and distribute it to you if you wish. My final thesis will be posted to the University of Manitoba's MSpace website and a link will also be provided when it becomes available.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way. This research has been approved by the Join Faculty Research Ethics Board. If you have any concerns or complaints about this project, you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122. A copy of this consent form has been given to you to keep for your records and reference.

Participant's Signature _____ Date_____

Researcher and/or Delegate's Signature _____ Date _____

Student Consent Form

Research Project Title: Learning Environments for Young Adults with Learning Disabilities

Principal Investigator and contact information:

Taryn Chambers

E: chambert@myumanitoba.ca

P: REDACTED

Research Supervisor (if applicable) and contact information:

Lynn Chalmers

ph: REDACTED

lynn.chalmers@umanitoba.ca

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

**Summary:**

My name is Taryn Chambers and I am a graduate student at the University of Manitoba. The reason for my visit to your school is to better understand the design of the interior spaces and how well it works for students with learning disabilities. This interview will require you to look at photos I have taken of your school and to answer questions about the various rooms in your school where you learn and study. It includes six questions and will take roughly half an hour of your time. I will be recording the interview with a voice recording device so that I am able to properly record your full answers to the questions. The information you provide today will help my research to create future schools designed to better suit students with learning disabilities. The risk involved in this study is exposure to your classmates of your learning disability. Because of this risk I have worked with your school to create a safe interview room and you will only be contacted through your student services department for arranging the interview time.

If for any reason before the interview you feel that the meeting will expose you to your peers, please contact your student services representative so that other arrangements may be made or your participation in the study ended. Your name and any information that could identify you will not be used nor published in my study. If at any time, for any reason, you wish to withdraw from the study you may do so by stating that you would like to withdraw from the study and no negative repercussions will occur. When my research is complete and my thesis has been written I will provide your school with brief summaries (1-3 pages) of my thesis and your school will contact you when it is available and distribute it to you if you wish. My final thesis will be posted to the University of Manitoba's MSpace website and a link will also be provided when it becomes available.

Following this consent form is a copy of the questions that I will ask during the interview, the photos will involve different spaces in your school such as classrooms, libraries, and study spaces.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the

research is being done in a safe and proper way. This research has been approved by the Join Faculty Research Ethics Board. If you have any concerns or complaints about this project, you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122. A copy of this consent form has been given to you to keep for your records and reference.

Participant's Signature _____ Date_____

Researcher and/or Delegate's Signature _____ Date _____

Interview Questions: Students

Age:

Gender:

School:

I would like you to look at these photos of this space (Display photos of area previously photographed at secondary school). We will repeat these instructions times total for each photo set of the classrooms, library, and break out rooms.

1. What do you like/dislike about this space? Why?
2. When you are in this space are you able to focus and stay on task? What do you find distracting, if anything?
3. Are you comfortable working in this space?
4. How do you use this space? Individually? With a teacher? In group work?
5. How easy is it to use the space for you?
6. Is there anything specifically that I should have taken a picture of in this space?

This question will not be repeated: Would you like to be sent a copy of the thesis when it is complete?