

The Evolution of Classroom Design: 1804 - 2022

by

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Abstract

Keywords: School Architecture, Inclusive Design, Neurodiversity, Learning Environment, ADHD

Since 1804, the way we designed schools has gone through significant changes. Societal, philosophical and legislative actions have influenced these changes. Through a historical comparative analysis of eight significant typologies of schools, we can showcase how these changes have influenced the students' quality of education.

Toronto's public schools have failed to adapt to our new understanding of neurodivergent people. Since the 1980s, Attention Deficit Hyperactivity Disorder (ADHD) has become more widely recognizable to the general public and professionals, yet we do not consider this new knowledge when designing schools. To address this issue, we must examine how we can use architecture to create a better learning environment for diverse needs.

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Preface

A mission to create a positive school experience for future students with ADHD drove my research and design project. While I cannot change the way, society treats people with ADHD, I can try and change the way our environment is designed to accommodate and welcome neurodivergent people. The way schools are currently designed is actively detrimental to neurodivergent students' education; every aspect of their design, from lighting to layout, poses problems. Through innovative design, I hope to lessen some challenges of School and actively help them succeed.

While this thesis focuses on designing for neurodivergent people, everyone can learn something and be helped by the concepts explored in this thesis.

1 - Introduction

“Millions of students will struggle in school today. Just as they do every day. In classrooms in your school, these students will feel discouraged, misunderstood and alone. Not because they can’t learn but because the way they learn doesn’t align with the way they are taught. Too many of our schools are unequipped for the diversity in learning that unfolds in classrooms.”¹

1.1 Introduction

The school classroom has been the core learning environment for most children in Ontario since 1804. Classrooms are essential to children's education as a good classroom is a safe space to learn and grow. The classroom's physical environment affects the quality of education a student receives. Classrooms create a community that empowers and supports children in their education. A poorly designed classroom can exasperate preexisting behaviour problems and learning issues. The classroom's architectural design and spatial arrangement can affect students and learning. The average child spends about six hours every day during the week in school. Of those 6 hours, most of that time is spent in the classroom. Children spend many of their formative years in schools starting from a young age, which means that their learning environment influences every aspect of a child's personal development.

Children's education is essential to society, as successful education positively impacts society at multiple scales, from economic and societal growth to positive individual success and empathy. Modern society requires children

to develop crucial problem-solving skills that will benefit them throughout their lives, and the majority of these skills are learned and values shaped in school. Two of the most significant influencing factors on individuals are their family and education. The school environment highly influences the shifts and changes in an individual, and so through education, we learn skills, morals, values and beliefs.

There are two main ways of learning, informal and formal. Informal is generally self-directed learning, whereas formal education takes place within institutions. It is even more important in modern society as today's economy and employment opportunities require higher levels of education for most jobs.

Students are taught in school the values that each society deems valuable and essential. The next generation then questions and develops these beliefs in a constantly evolving cycle. It is vital in fostering self-reliance and competence in people. With effective schooling, students are taught how to critically view the world they live in and not just blindly follow along.

Lastly, the importance of children's

education provides opportunities that can address and remediate social inequality and inaccessibility. The Ontario Human rights committee remarked:

“Many, if not most, consultees expressed their preference that students with disabilities be included in regular classrooms. The Commission heard that inclusion in the regular classroom facilitates greater interaction between students of varying abilities, develops positive attitudes and relationships, and is less likely to stigmatize people with disabilities. For example, Community Living Ontario wrote: “If a child with a disability begins life with an expectation of inclusion, she is much more likely to seek out, and be accepted in, inclusive environments and activities later in life. It is equally true that when a student that does not have a disability is educated in an inclusive environment, inclusion will most likely remain her cultural expectation throughout life.”²

The evolution of the architectural design of classrooms responds to pedagogical, societal and legislative changes that have occurred over the past two centuries. The “architectural design of school buildings, in a broad sense, may be viewed as an expression of the attitude of people towards education.”³ As the values of our society change, so do what is required and expected from our schools. The classroom generally consists of an enclosed room, desks, and chairs. This has remained constant throughout the history of schools in Ontario, even though their organization and designs have changed. Schools have been designed around the classroom; this is where the students spend most of their time during their education. As a result, the design of the classroom environment is essential and plays a significant role in the quality of the students’ education.

There are several neuro-diversity issues that the contemporary public schools in Ontario struggle to accommodate, such as lack of awareness, funding problems and preexisting stigma. This thesis examines how the new classroom environment can address issues related to neurodiversity and, in particular, Attention Deficit Hyperactivity Disorder

(ADHD).

This thesis is divided into six chapters; the first chapter is an overview of the ideas explored in this thesis and an investigation of the research methodology and the theoretical framework. The second chapter is a comparative historical analysis of relevant school typologies’ evolution and looks at the prevalence and impact on the Toronto public school system. These case studies are analyzed through spatial, material, and sensory changes, which are further investigated by analyzing photographs, floor plans, and axonometric drawings to visually explore the different classroom typologies’ dynamics. The third chapter examines neurodiversity in our society and the TDSB school system while also giving an overview of Attention Deficit Hyperactivity Disorder. The fourth chapter is an in-depth analysis of an existing TDSB public school Pierre Laporte Middle School, slated for future demolition and is the site of this thesis’s design project.

The last chapter explores the design of the new school as it is reimaged in this thesis as an accommodating school sited on the location of the old Pierre Laporte Middle School. The school is designed with an emphasis on antecedent intervention. The design project creates a nurturing environment in which students in general but specifically students with neurodivergencies such as ADHD are proactively helped before the problem becomes overwhelming.

1.2 Research Methodology

Before exploring how the classroom design can be made more inclusive, the evolution of different typologies of the school building must be analyzed. This was done to understand how we arrived at our current classroom format and how each design affected students' quality of education. These typologies will be evaluated through case studies to reveal how societal and theoretical changes have affected the design of the classroom's enclosure and the furniture used within the environment.

The scope of the analysis of different school typologies will be generally limited to the years between 1804 and 2022. This analysis will explore both the positive and negative impact these typologies have had on the students and their quality of education. This thesis examines the impact through quantitative and qualitative data. Quantitative data through observable scientific studies, such as the tangible impact of ventilation and natural lighting changes. As well as qualitative data obtained through primary and secondary accounts of the effects of the different environments on the students.

The literature review provided evidence

to support the contention that students need various options in both furniture and environment types. By developing an understanding of the knowledge learned from the evolution of the architecture of schools since 1804, it is possible to apply this information to a new understanding of the contemporary school design tools required to address a variety of issues, including ADHD, effectively.

Theoretical Framework

This thesis framed the exploration of the impact of the classroom environment on students with ADHD through the theoretical framework of the optimal stimulation theory, Mostafa's Sensory Design Matrix, Universal Design for Learning method, and Space as a Third Teacher. This literature review identified specific design theories that provided a lens for how an analysis of the sensory environment of the built environment of the classroom affects students' education. These frameworks acted as the lens that focused and guided the research.

Sensorial Experience of the Environment

The way we experience the environment is intrinsically linked to the senses. “Thoughtfully planned or not, each environment also influences the people who use it in subtle or dramatic ways.”⁴ This influence affects its users in various ways and with varied intensity and impact. An example of this can be seen in Figure 1. In this example, the users’ sensory experiences of their environment are listed.

The impact of experiences through our senses also applies to how we learn. “As human beings, all successful learning experiences come from our ability to prove and make sense of the information that is derived from our seven senses.”⁵ Beyond the inherent sensory experience of any environment, some neurodivergent people are more sensitive or react differently than the neurotypical people to some external stimuli. “There are many children and adults who report sensory integration disturbance. Sensory dysfunction can be present in individuals with learning disabilities, autism, schizophrenia, and bipolar disorder, among others.”⁶ These sensory dysfunctions can have a varied impact on a student’s ability to learn and

even on a teacher’s capacity to teach. The impact of the sensory experience can vary depending on the student. From a student with ADHD being unable to focus on the lesson because all the external noise is overwhelming the capacity; to process new information to being unable to participate in a lesson because the buzzing and flickering of the fluorescent lighting are giving them a headache.

Definition of the eight senses:

1. Visual- Sight
2. Olfactory – Smell
3. Auditory – Hearing
4. Tactical – Touch
5. Gustatory – Taste
6. Vestibular – The sense of your bodies relation to the world
7. Proprioception (also known as Kinesthesia) – Is the ability to sense your body, movements, and position in space.
8. Interoception – Is the sensation experienced within the body.

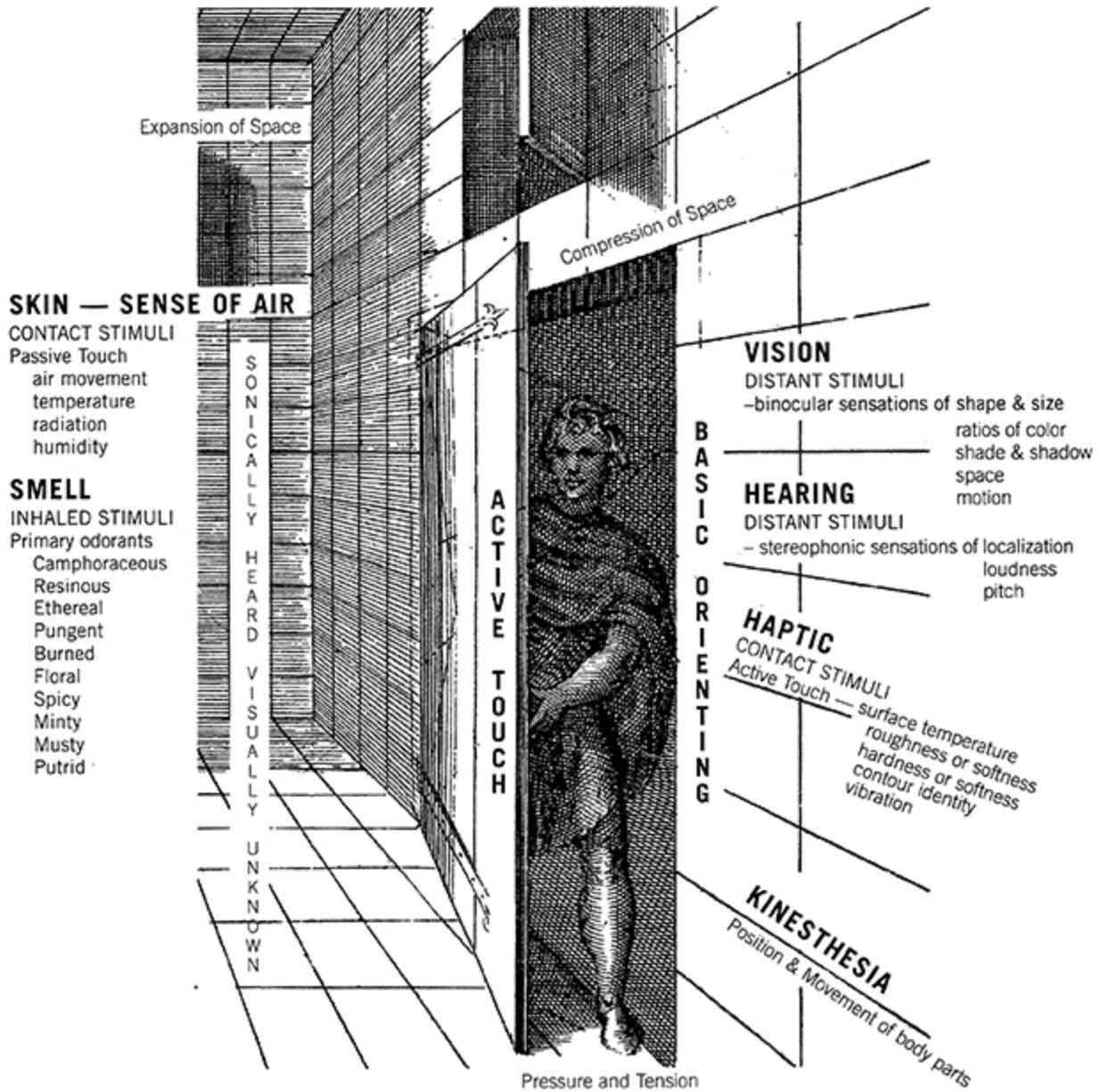


Figure 01 | Ranges of the Senses, from Sensory Design.

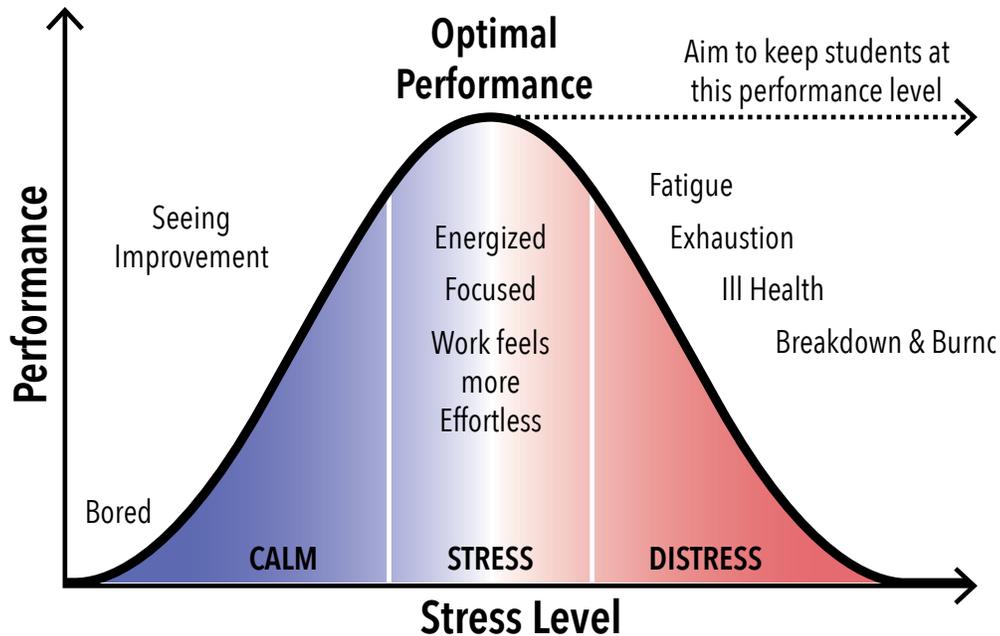
Optimal Stimulation Theory

The goal of the Optimal Stimulation Theory is to create a balanced environment in terms of external stimuli. “An environment may temporarily overstimulate or bore, calm or agitate those in it. (...) Spending an extended period of one’s life in an environment deemed unpleasant will eventually exact a toll.”⁷ This does not mean removing all stimuli must remove all distractions, such as colourful boards and posters, and adding blinds on the windows to eliminate distractions and help students pay attention. “The literature indicates, however, that this blank physical arrangement fails to improve the attention and academic performance of children with ADHD (Zentall, 1983).”⁸ Therefore, a balance must be met to create the optimal balance between external and internal stimuli to make a nurturing classroom environment. There must be areas for higher levels of stimuli, where students can play and work with their excessive energy and areas for rest. Furthermore, more than one sense is affected by external stimuli and is vulnerable to overstimulation and becoming a cause of distraction.

“In addition to being sensitive to visual novelty, the child who appears inattentive is also especially sensitive to changes in sound. Classroom noise produces negative effects on the performance of children with ADHD because auditory processing cannot be shut out as easily as visual stimuli (Zentall, 1983). Further research, though, revealed that, like visual stimuli, not all noise is detrimental.”⁹

When a student is doing a new, unfamiliar, or complex task, added external noise is detrimental to their level of attention as it can “produce inattention and increase errors.”¹⁰ These added external stimuli overwhelm their ability to process and understand new information. Students with ADHD often have auditory processing disorders, making it especially important to consider the noise level in classrooms where the vast majority of teaching is auditory.

Whereas when they are doing an activity, they have done before, “the addition of moderate levels of classroom noise yields better results and attention to a task than quiet conditions. (Zentall, 1983).”¹¹



Silence can be just as much of a distraction as high noise levels.”¹² We can deduct from this that “the complete removal of sensory stimuli from the physical environment of children with ADHD is unwarranted.”¹³There are many ways we can use architectural design to aid distracted students effectively. “It is unrealistic to try remove all visual stimuli from a classroom and construct soundproof walls, as a way of providing structural adaption for a class with an ADHD population.”¹⁴ We must strive to create an adaptable environment to achieve the right balance of external stimuli depending on the tasks. In order to achieve this balance, it is essential to consult the sensory design Matrix created by Magda Mostafa.

Figure 02 | The Yerkes-Dodson Human Performance and Stress Curve

Sensory Design Matrix - Magda Mostafa

“I do believe architecture has tremendous power to help individuals with autism, and other disabilities for that matter, gain independence. In as much as it hinders their independence, appropriate architecture can help regain it. (...) The built environment provides the large majority of sensory input- light, acoustics, textures, colours, spatial configurations, ventilation etc. By manipulating the design of the environment, we can manipulate that all-so-important sensory input.”¹⁵

Mostafa’s Autism Sensory Design Index is a guideline for designing with seven design criteria principles. These design criteria were determined through in-depth research, including surveys, interviews, and focus groups.

These design principles are:

1. Acoustics
2. Spatial sequencing
3. Escape spaces
4. Compartmentalization,
5. Transition spaces
6. Sensory zoning
7. Safety

In addition to being used as a design guideline, the index can also be used to assess a building as a post-occupancy tool.

“I do believe architecture has tremendous power to help individuals with autism, and other disabilities for that matter, gain independence. In as much as it hinders their independence, appropriate architecture can help regain it. (...) The built environment provides the large majority of sensory input- light, acoustics, textures, colours, spatial configurations, ventilation etc. By manipulating the design of the environment, we can manipulate that all-so-important sensory input.”¹⁶

ARCHITECTURAL ATTRIBUTE		SENSORY ISSUE														
		Auditory			Visual			Tactile			Olfactory			Proprioceptive		
		Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference
Structure	Closure	1	2		1	2	1	2	1		1	2		2	1	1
	Proportion	3	4	3	3	4								4	3	
	Scale	5	6	5	5	6								6	5	6
	Orientation					7									7	7
	Focus	8													8	8
Balance	Symmetry	9	10		9	10	9							9	10	9
	Rhythm					11									11	11
	Harmony				12	13	13	12							13	13
	Balance				14	15	14							14		14
Quality	Colour				17	18			18							
	Lighting	18			19	20										
	Acoustics	21	21	21												
	Texture		22					22	23							
	Ventilation										24	25	24			
Dynamic	Sequence				26	28	26		26						26	26
	Proximity				27		27								27	27
	Routine	28			28		28								28	28

Figure 03 | Sensory Design Matrix.

Universal Design for Learning (UDL)

This thesis used Universal Design for Learning to explore how we can approach designing the architecture of schools and classrooms so that the quality of the environment and the nature of the relationship with the environment for students with ADHD are considered.

The idea of Universal Design for Learning (UDL) is “of a set of principles providing teachers and other staff with a structure for creating adaptable learning environments and developing instruction to meet the diverse needs of all learners.”¹⁷ The design must work together with teachers to create a positive educational environment. Without creating a nurturing environment, even the most aware and skilled teachers cannot effectively aid all of their students.

The architecture must work together with the curriculum, teachers’ education, and societal changes to create a nurturing and welcoming environment for all students.

Research Question:

In which ways can we design an inclusive school that stimulates and supports students with ADHD in their education?

How can the way we design a school respond to the complex needs of students with ADHD to create a supportive learning environment?

Universal Design for Learning Guidelines



Provide Multiple Means of

Engagement

Purposeful, motivated learners



Provide Multiple Means of

Representation

Resourceful, Knowledgeable Learners



Provide Multiple Means of

Action & Expression

Strategic, Goal-Directed Learners

Provide Options for Self-Regulation

- Provide expectations and beliefs that optimize motivation
- Facilitate personal coping skills and strategies
- Develop self-assessment and reflection

Provide Options for Comprehension

- Activity or supply background knowledge
- Highlight patterns, critical features, big ideas, and relationships
- Guide information processing, visualization, and manipulation
- Maximize transfer and generalization

Provide Options for Executive Function

- Guide appropriate goal-setting
- Support planning and strategy development
- Enhance capacity for monitoring progress

Provide Options for Sustaining Effort and Persistence

- Heighten salience of goals and objectives
- Vary demands and resources to optimize challenge
- Foster collaboration and community
- Increase mastery-oriented feedback

Provide Options for Language, Mathematical Expressions, and Symbols

- Clarify vocabulary and symbols
- Clarify syntax and structure
- Support decoding text, mathematical notation, and symbols
- Promote understanding across languages
- Illustrate through multiple media

Provide Options for Expression and Communication

- Use multiple media for communication
- Use multiple tools for construction and composition
- Build fluencies with graduated levels of support for practice and performance

Provide Options for Recruiting Interest

- Optimize individual choice autonomy
- Optimize relevance, value and authenticity
- Minimize threats and distractions

Provide Options for Perception

- Offer ways of customizing the display of information
- Offer alternatives for auditory information
- Offer alternatives for visual information

Provide Options for Physical action

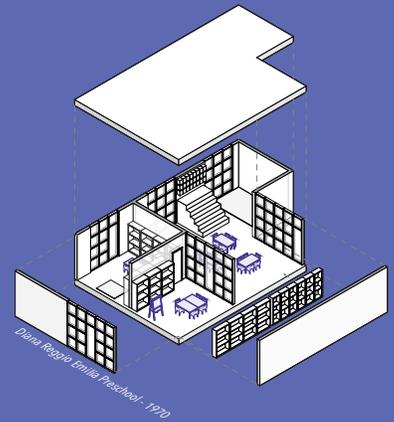
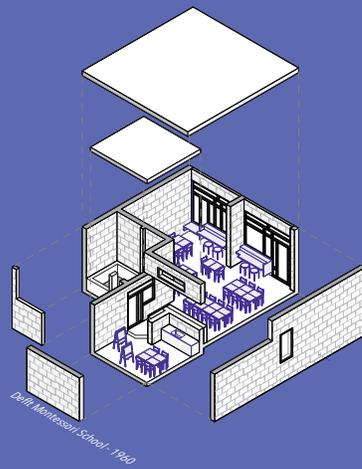
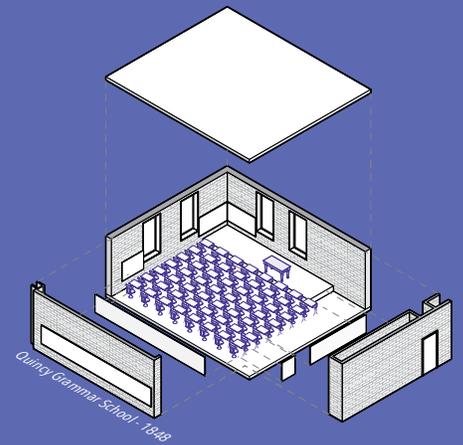
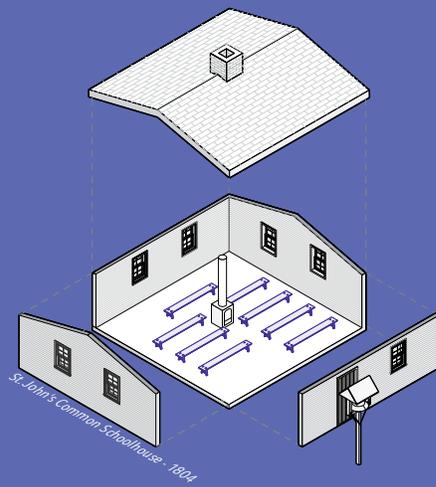
- Vary the methods for response and navigation
- Optimize access to tools and assistive technologies

Figure O4 | Universal Design for Learning Guidelines.

Endnote

- 1 Barringer, Mary-Dean, Craig Pohlman, and Michele Robinson. *Schools for All Kinds of Minds: Boosting Student Success by Embracing Learning Variation*. 1st ed. San Francisco: Jossey-Bass, 2010, ix.
 - 2 Elementary and Secondary Education | Ontario Human Rights Commission’.
 - 3 N.L. Engelhard Jr., *Trends in School Architecture and Design*, pg. 171
 - 4 Curtis and Carter, *Designs for Living and Learning*.
 - 5 Moyes, *Building Sensory Friendly Classrooms to Support Children with Challenging Behaviors*, 9.
 - 6 Ibid.
 - 7 Curtis and Carter, *Designs for Living and Learning*.
 - 8 Carbone, “Arranging the Classroom with an Eye (and Ear) to Students with ADHD,” 77.
 - 9 Ibid.
 - 10 Ibid.
 - 11 Ibid.
 - 12 Ibid.
 - 13 Ibid, 78.
 - 14 Ibid.
- 15 ‘An Interview with Magda Mostafa’
Ibis.
“Universal Design for Learning.”

2 - The Evolution of the Classroom Design



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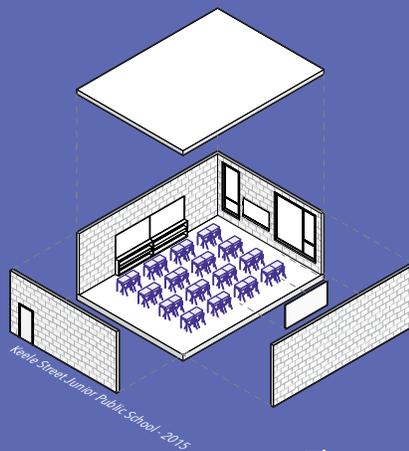
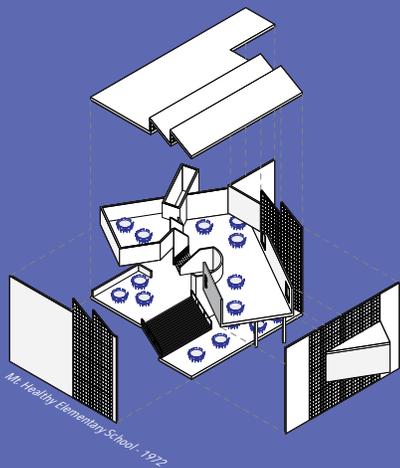
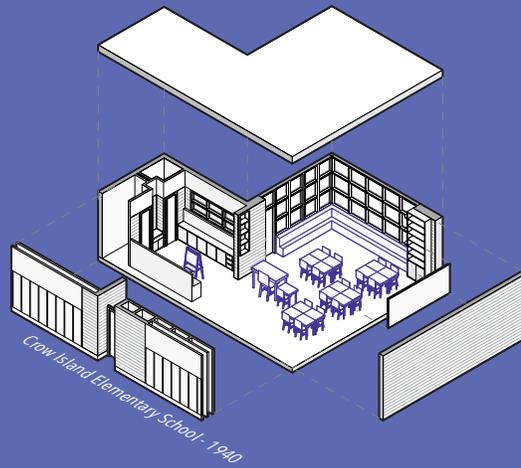
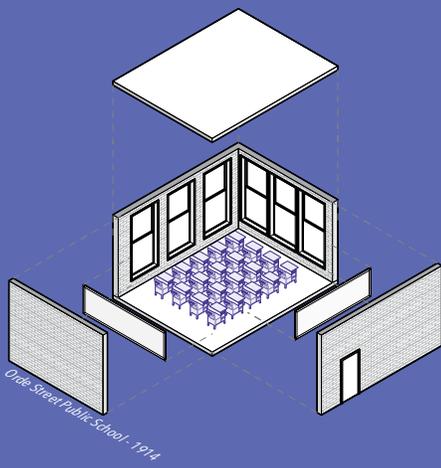


Figure 05 | Case Study Axonometric

2.1 One-Room Schoolhouse

St John's Common Schoolhouse – 1804

Thorold, Ontario, Canada
Unknown Architect

The early nineteenth century marked the beginning of a formal public education system in Ontario.¹⁸ Children lived mainly in small villages and communities where they gained knowledge primarily through generational education passed down within households.¹⁹ The children acquired their values and life skills as they started at a young age by working alongside their family on their farm or acting as apprentices.²⁰ By the early nineteenth century, there was a shift in the way society viewed education in Ontario, “there was a growing sense that the informal education approaches communities relied on were insufficient in preparing children for adult life.

Gradually, communities banded together to build and run schools for their communities that the children in the community could attend for minimal cost (or sometimes free-of-charge).²¹ This resulted in the creation of many one-room schoolhouses in different communities. The impact of creating these schools was noticeable; no longer were children destined to be and live the life of their parents. Their lifestyle and employment opportunities

grew as their access to education did.

The One-Room Schoolhouse was the most common school typology throughout Ontario in the 19th century. The general design of this school was very similar across the country, changing slightly depending on the region where it was built, as the schools were generally built with local lumber, materials and expertise.

The earlier schoolhouses were generally small log buildings, which evolved into the iconic red brick buildings. As populations grew and more rural areas became villages, more schools were required to educate the growing population, which led to larger schools being built. No longer was education dependent solely on the knowledge passed on through family units and apprenticeships. The introduction of the schoolhouse marked one of the first steps to achieving the idea of universal access to education.

Children of all ages and genders learned together from one teacher in the one-room schoolhouse. In these schoolhouses, they acquired the values and life skills needed to live and work in their society. As there were no



Figure 06 | St. Johns Common School, Thorold, ON.
Figure 07 | St. Johns Common School, Present

formal curriculum requirements or standards, the students' educations varied from school to school, depending on factors such as their teachers' knowledge, the resources available, and the teaching style.²¹ The furniture in these schools tended to be either benches or plank desks, with wood stoves or fireplaces generally heated them. The one-room schoolhouse represents the earliest phase of establishing the education system in Ontario, and the St. John's Common Schoolhouse is an example of this classroom type.

St. John's Common School is a log cabin one-room schoolhouse built in 1804 in Thorold, Ontario. It was the first free non-denominational school built in Toronto.²² In 1826, it was recorded as having 29 students ranging from six to seventeen years.²³ It was a functional school until 1844 when the village's growing population required a larger schoolhouse to be built.

A feature of this school, and the majority of other one-room schoolhouses, is the school bell, used for summoning the students to school and calling them back from breaks. The St. John's Common School was made of local timber, as were the benches that would have been used inside the classrooms. Teaching was generally done orally and supported by using slate boards with chalk. With windows on all sides of the classroom, there was much natural light, which was particularly important as they did not have electricity at this point. As the schools were heated with a fireplace, the schoolhouse was not heated equally.²⁴

The layout of the school was designed to maximize classroom space. There were no corridors or lobbies and no transition space between the exterior and the interior. Furthermore, because of the shape of the classroom, there were no other learning environments available. This also meant that the classrooms could become very noisy, with no access to quiet places for students to isolate themselves to better focus on their work. The only consideration for designing the classroom sensorial environment was to make the school habitable and usable. They made sure that there was enough natural lighting to see and write on their slate boards. That there was enough heat to make sure they were not freezing and had

enough seats, so everyone had one.

The classroom would generally contain approximately twenty students per teacher. There was a hierarchical relationship between the students and their teacher; the teacher taught, and the pupils listened. This was further emphasized by the layout of the furniture, with all eyes focused on the teacher. This was important as all students were taught together; there was no division depending on grades or ages, which meant that to be effective, the teacher had to see and be within hearing distance of all the children. The furniture layout and the lack of division also meant that the older students helped teach the younger students.

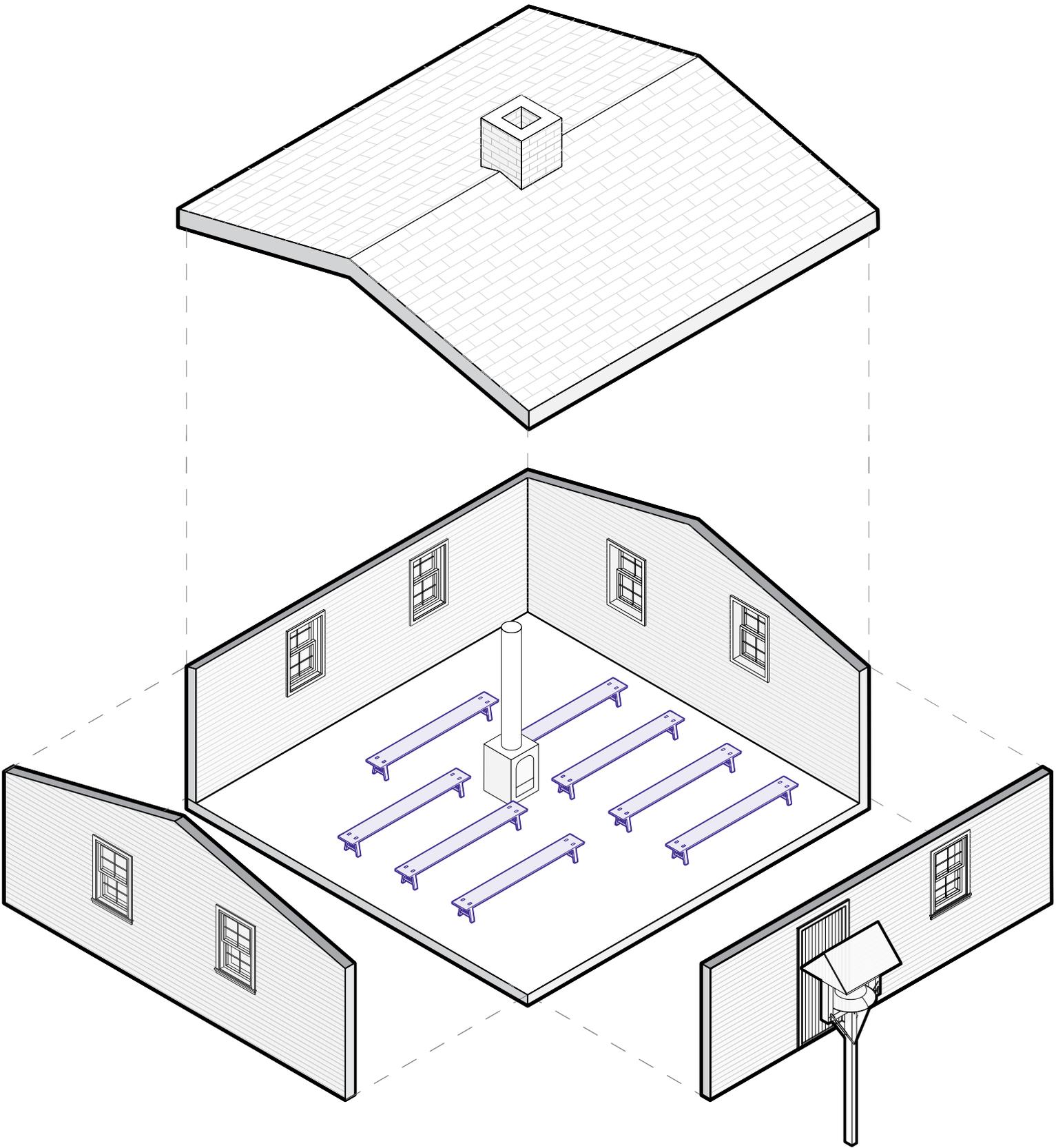


Figure 08 | St. John's Common Schoolhouse – Exploded Classroom Axonometric Drawing.

2.2 Graded Schools: 1830s – 1930s

Quincy Grammar School - 1848

Boston, Massachusetts, United States

Gridley James Fox Bryant

Graded schools developed when an elementary school education became compulsory, which meant that more schools needed to be built to accommodate the large influx of students. This school typology was promoted by Horace Mann. Mann, the first secretary of the Massachusetts Board of Education, promoted the new educational model of graded schools.²⁵ He was inspired by how students were separated by age in the new Prussian method of education.²⁶

The Quincy Grammar School, built in 1848, was Boston's first graded school, and it provided a precedent for the rest of Boston's 19th-century educational movement.²⁷ Initially, it was a four-storey building; the 1938 New England Hurricane later destroyed the fourth floor. The first three floors contained four identical classrooms connected by a single loaded corridor; the fourth floor was an assembly hall designed to accommodate 700 students.²⁸

As seen in Figure 9, the architects attempted to maximize the number of students per classroom. "Buildings shape the lives of the people who inhabit them. They pattern

everyday activities and organize how we relate to each other. The layout of a school building is revealing of how educators viewed the process of education and how they understood the relationship between children and teachers".²⁹

The only transition space was the entrance and the corridors connecting the classrooms. The classroom dynamic was similar to the one-room schoolhouse, with the teacher in a hierarchical position before the students. This division is further emphasized through the design decision to place the teacher's desk upon a platform. They placed the teacher higher and above the students, teaching down at them and not with them, as was later done in the Montessori and Reggio Emilia Schools. This uniformity and rigid order were further evident in the classroom design, as seen in Figure 11.



Figure 09 | Quincy Grammar School.
Figure 10 | Grammar School, Class V. Div. II. Quincy District. 1892.

The Quincy Grammar School was described in 1874 by its principal, John D. Philbrick, as follows:

1. It was large. Up to this time, a grammar school with 400 pupils was considered very large. This building had 660 seats in the school rooms exclusive of the halls.
2. It contained a separate schoolroom for each teacher, 12 in all, and of course, recitation rooms were not needed.
3. It contained a hall large enough to seat comfortably all the pupils that could be accommodated in the schoolrooms, and even more.
4. It contained a clothes room attached to each schoolroom.
5. It contained a separate desk and chair for each pupil, this being probably the first grammar schoolhouse, here or elsewhere, as far as I know, into which this feature was introduced.
6. It was four stories high – the first of this height – the hall covered all of the fourth storey.

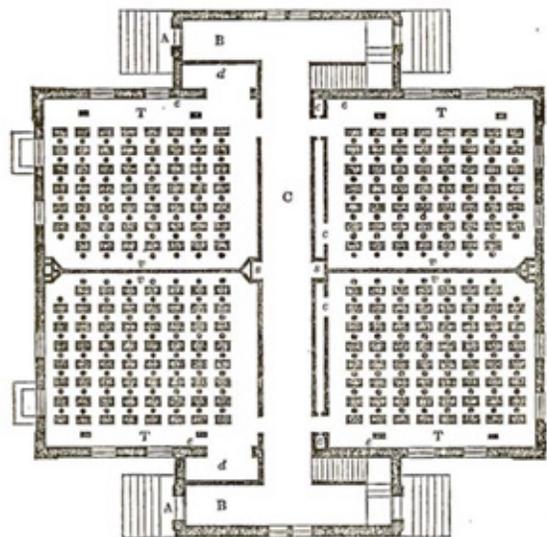
All the grammar school houses since built in this city are of this type. Modifications and improvements, more or less important, have been from time to time introduced, but the type has not changed.³⁰

The ‘egg carton’ school typology was designed so that each classroom was uniform and large enough for 55 students; they were all connected by a small corridor. Each classroom has the same furniture; the desks and chairs were bolted to the floor, as seen in figure 11.³¹ This rigid classroom design emphasized the unidirectional instruction method and the values they wanted the students to develop. The designer gave considerable thought to natural lighting, ventilation, and heating. They built windows with revolving slat blinds for ease of changing the level of light in the room.³² Furnaces heated the classrooms; they were placed strategically in the basements.³³

The Quincy Grammar School was hugely influenced by Horace Mann and was one of the first schools that showcased his educational standard.³⁴ It was widely considered a success at the time, so much so that six years later, it

was the standard model used in all of Boston’s grammar schools.³⁵ By examining this case study, echoes of the contemporary classroom can be seen throughout. While the building style, materials and construction techniques have changed, as has the technology, the box’s general layout and the desks remain.³⁶

While the school design in terms of health and comfort has improved, the overall spatial distribution of the classroom remains unchanged.³⁷



Plan of First Floor.

- A, A, Front Door.
- B, B, Entries.
- C, Corridor or Hall.
- T, T, T, Teachers' Platform 24 feet by 5½.
- r, r, r, r, Hot-air flues.
- v, v, v, v, Preston's Ventilators for controlling the flues in the partition wall, which communicate with the iron smoke pipes near the top of the building. This plan is adopted in the first story only.
- e, e, e, e, Indicates the location of the flues of Emerson's Ventilators in the second, third and fourth stories.
- s, Sink.
- c, c, c, c, Closets.
- d, d, Closets 10 feet by 11 feet

Figure 11 | Quincy Grammar School – Floor Plan

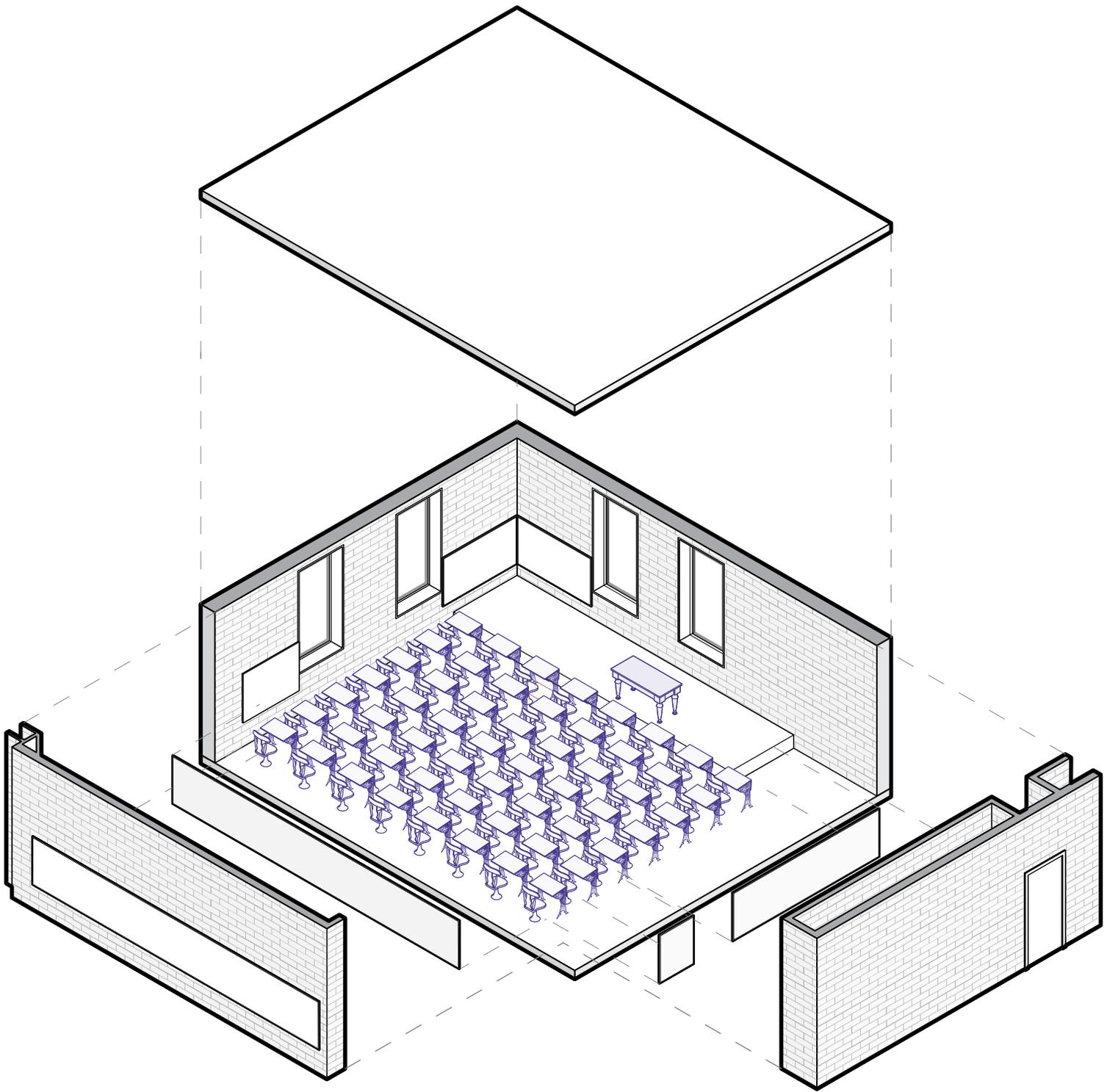


Fig. 12 | Quincy Grammar School – Classroom Exploded Axonometric.

Swansea Public School - 1891

Toronto, Ontario
James Augustus Ellis

Swansea Public School is an example of the 'egg carton' graded school typology within the TDSB that has been adapted over the years. Built in 1981, it has grown more than double its original size, as seen above in figures 13 and 14; it currently has around 950 students enrolled.

Figure 15 is a photograph of one of the original classrooms from 1891. When it is compared to figure 16, it can be seen that the fundamental characteristic of the rooms has stayed the same. The most significant difference is that the decor, technology, and furniture have changed. All the students still have their own desks, but now they are movable and can be arranged in clusters. This is an improvement as it encourages different learning ways such as group activities instead of the solely unidirectional learning of the original class. Beyond that, the original design of the classroom remains the same. This case study highlights how the TDSB school is just a collection of different typologies of schools adapted with varying levels of success.

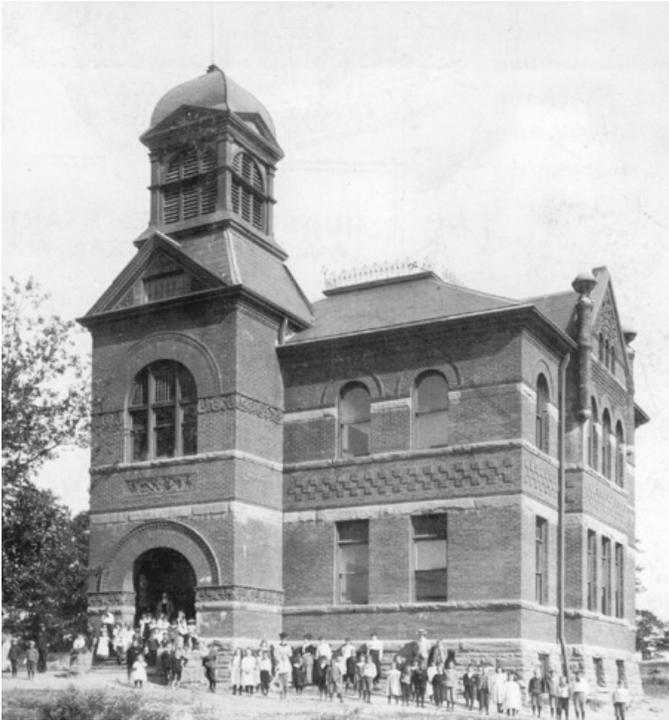


Figure 13 | Swansea Public School - 1891
Figure 14 | Swansea Public School - 2019
Figure 15 | Original Room - 1930s
Figure 16 | Same room but in 2020 - Room 101

2.3 Open-Air Schools

Orde Street Public School – 1914

Toronto, Ontario, Canada

C.H. Bishop

Open-air schools were designed to create a positive and healthy environment for children to combat the rise of tuberculosis in the early twentieth century. The living conditions of the 1900s increased the rapid spread of the tuberculosis epidemic due to industrialization, poor sanitation, and overcrowded communities.³⁸ The toll of this epidemic was further compounded as they had no cure. By the early twentieth century, around 70% of children had tuberculosis in some form.³⁹ This led to new, open-air schools designed to help these children, as their current schools were poorly ventilated and inadequately lit.⁴⁰

The Orde Street Public School, built in Toronto, marked a noticeable design shift from the old grammar and common schools. In March 1917, over 50 students were sent to the Orde Street Public School to learn and live in the third-floor open-air classes.⁴¹ These children were selected as they were believed to be either at risk of catching tuberculosis or had already caught it and needed a space to recover.⁴² The whole school was designed around creating a healthy growing and learning environment for

its students. The school became a home for the students; the students learned, ate during the day and slept in the classrooms at night.

In addition to the tuberculosis epidemic, the school's design was also influenced by "William Wirt's 'Work-Study-Play' model,"⁴³ otherwise known as the Gary Plan and the 'platoon system.' His plan proposed creating schools where students were divided into ' platoons.' While one would be studying classic subjects such as English or Mathematics, the other would be doing more active subjects such as arts and physical education.⁴⁴ This "system led to a greater emphasis on recreational and vocational activities in school, lengthened school hours from six to eight, created class levels based on age, and encouraged teachers in subject-area specialization."⁴⁵ William Wirt was inspired by other progressive educational reformers such as John Dewey and Fredrick Taylor.⁴⁶

The impact of this newer pedagogy can be seen in the floor plans of the Orde Street Public School. The classrooms were divided into several smaller spaces and play/activity rooms. The integration of the 'work-study-play' model



Figure 17 | Orde Street Public School.
Figure 18 | Orde Street Public School – Open Air Classroom.

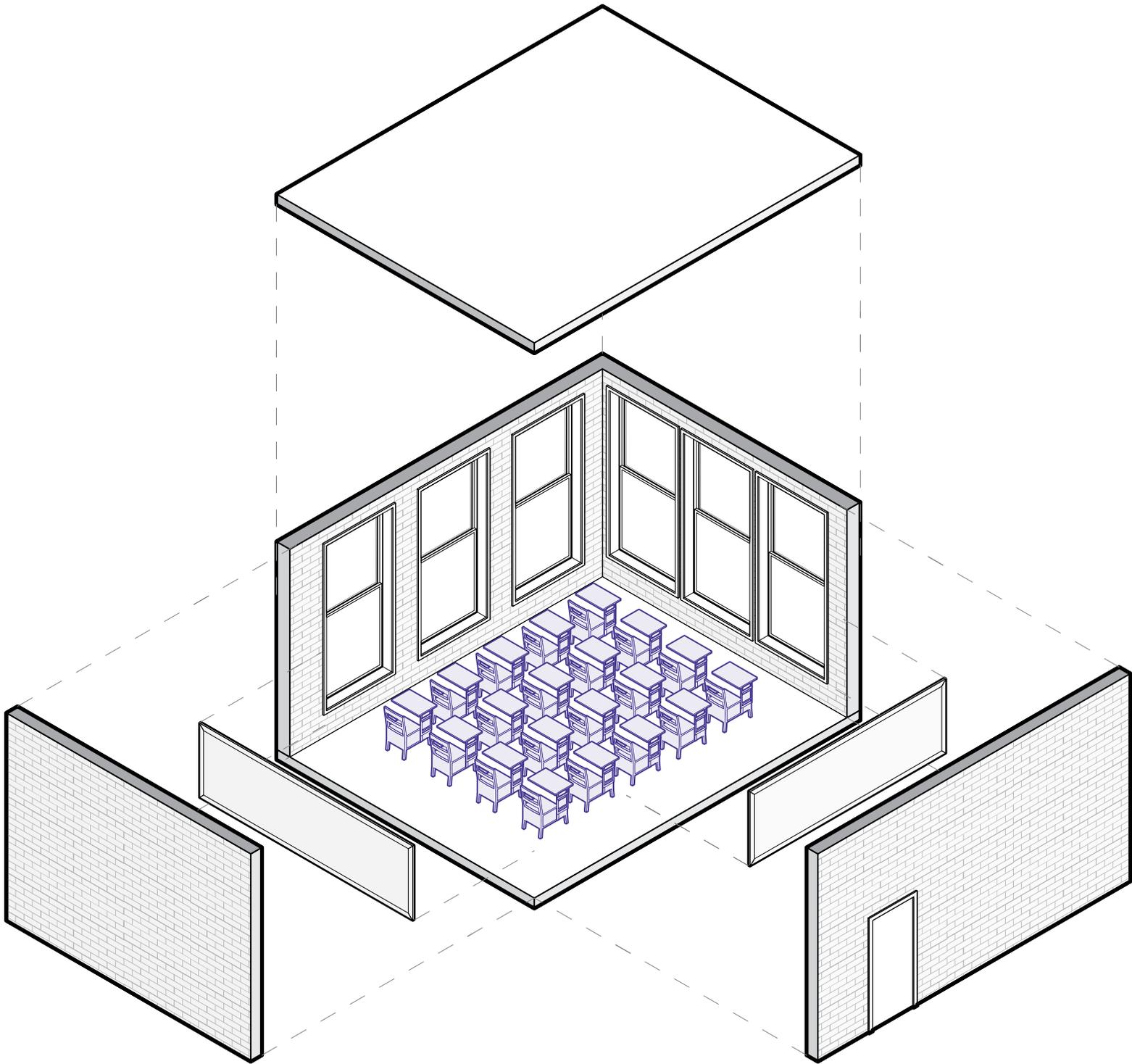


Figure 19 | Orde Street Public School – Classroom Exploded Axonometric – During the day.

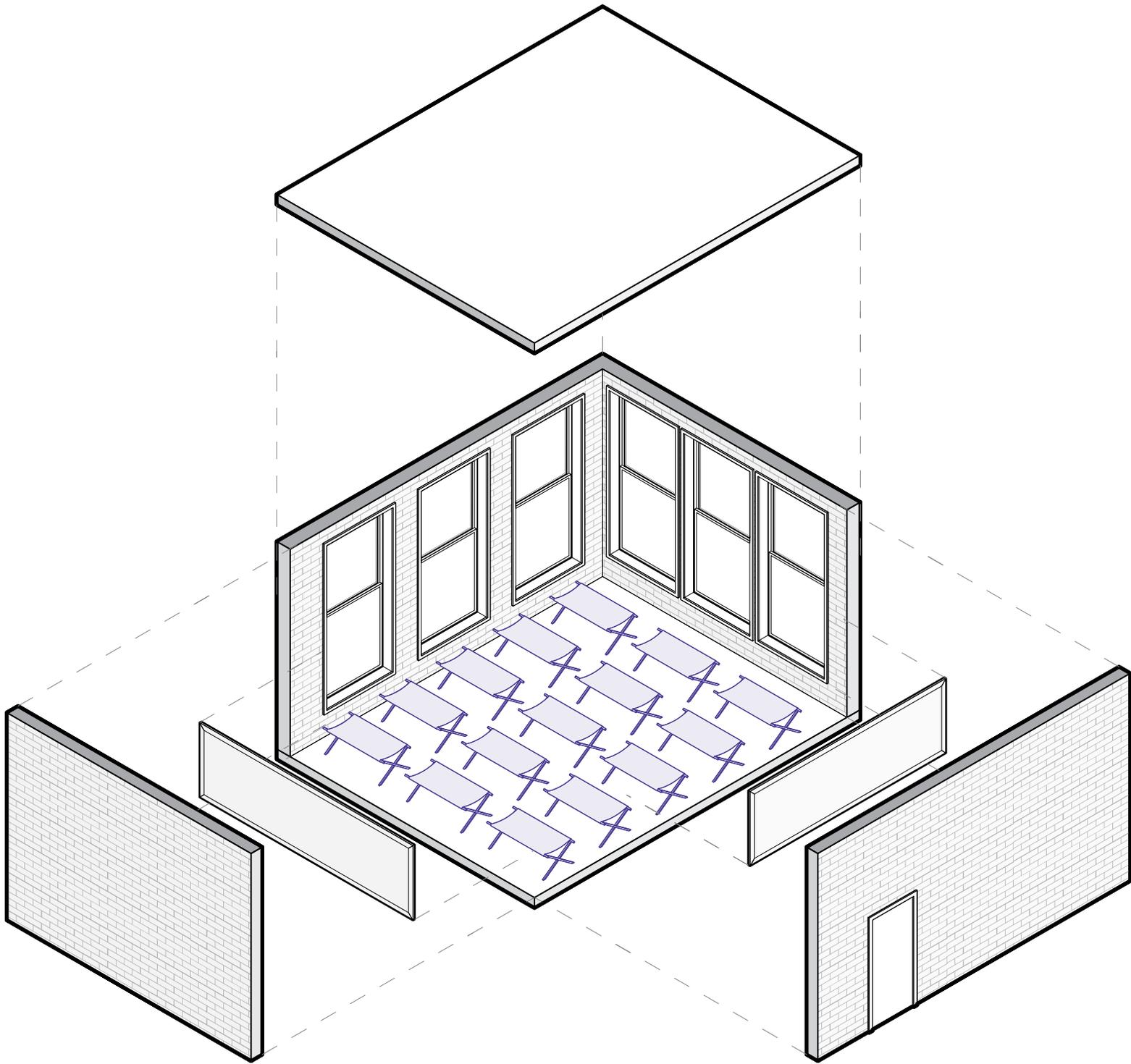


Figure 20 | Orde Street Public School – Classroom Exploded Axonometric – During the night

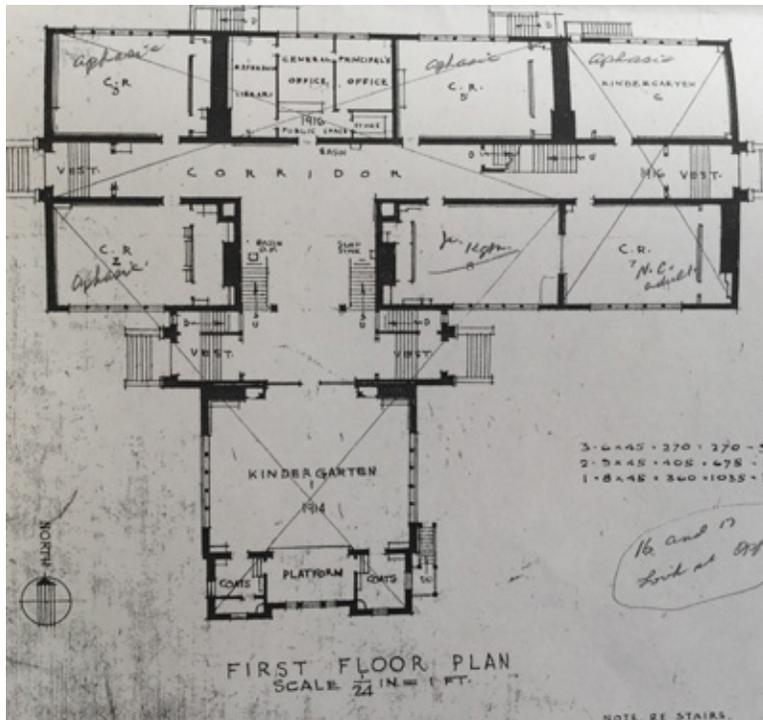
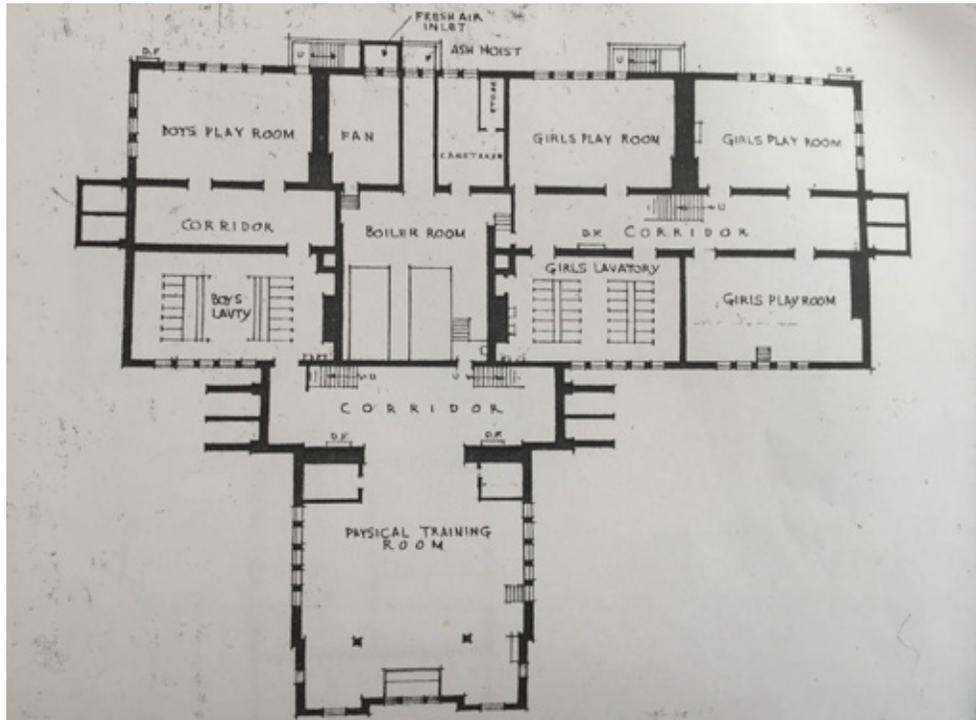


Figure 21 | Orde Street Public School – Basement
 Figure 22 | Orde Street Public School – First Floor

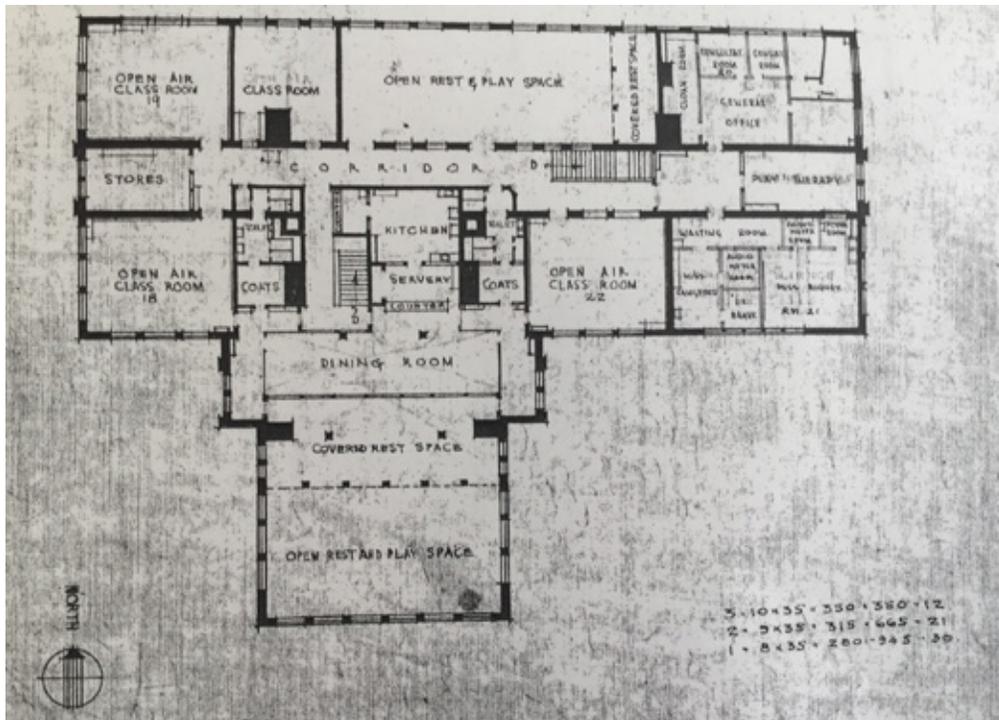
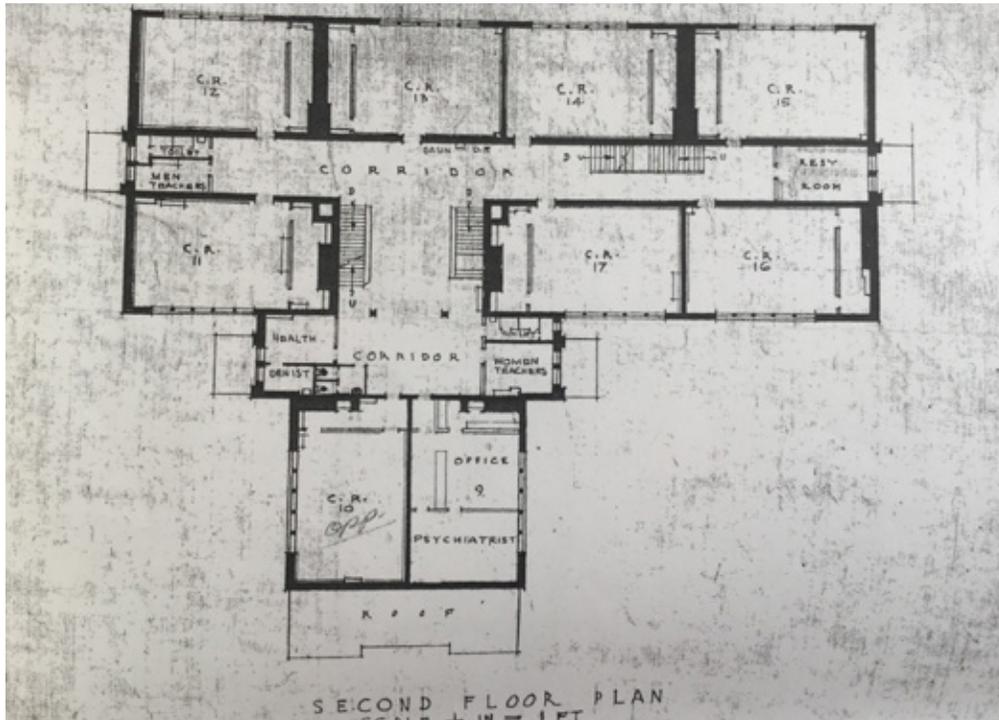


Figure 23 | Orde Street Public School – Second Floor
 Figure 24 | Orde Street Public School – Third Floor

into this open-air school created the opportunity for many different learning environments.

As seen in Figure 24, the school's third floor held all the open-air classrooms and play spaces. Each of the classrooms had large windows that could be opened for fresh air and gave plenty of natural light. The chairs in all of the classrooms were moveable, which allowed for two outcomes. Firstly, the chairs could be moved at the end of the day to make way for the cots. Second, they could rearrange the chairs depending on the day's activities. The chairs also had an adjustable wrap-around desk, and the desks could be adjusted to the best height for the students. This marked a significant change from the grammar schools, where the desks were fixed to the floor.

In addition to the open-air classrooms, there were two separate open rest and play spaces. These spaces had two sections, one completely open to the outside and the other partially covered with a roof. These spaces were dedicated for play and rest and not actively used as classrooms. This was also the beginning of the movement to add green and natural elements to the learning environment. No longer were students taught strictly in the classroom. Nature was an active part of their learning experience, and an example of this was the addition of field trips and classes outdoors. This was a significant step in adapting to the environment for many different types of learners; unlike in the grammar schools and one-room schoolhouses, where one teacher was in charge of all aspects of a student's learning, the Orde School spread out its education to different teachers and environments.

Beyond the layout of the open-air classrooms, the kitchen and dining room were the centre of the third floor, as the students lived at the schools. The consensus of the era was that the three most significant elements needed to help these children were natural lighting, clean, fresh air, and good nutrition. The students all ate their meals in the dedicated dining room and slept in the same open-air classrooms that they studied in during the day. They also built the corridors extra-large for health reasons as the teachers did a daily line-up to give them check-ups.⁴⁷

While the third floor was dedicated as the

open-air floor, the 'open-air' design concept can be seen throughout the school. Other than the corridors, every room had plenty of windows for both natural lighting and ventilation. In addition to the classrooms, the importance of health was evident in the wide array of rooms dedicated to wellbeing, from a psychiatrist to a dentist's office.

In keeping with their focus on the wellbeing of their students, Orde Street Public School created Toronto's first classrooms dedicated to visually impaired children, called the 'sight-saving class.'⁴⁸ This was motivated by the Toronto School Board's directive to allocate resources better to educate students with disabilities.⁴⁹ What made these classes unique was the materials used and their design. They were designed based on the prevailing view of the medical community at the time, which believed that if impaired students strained their vision, it would worsen their condition.⁵⁰ They counteracted this by reducing the glare created in the classroom by removing any reflective surfaces from the furniture, instruments, and walls. The writing on the blackboard was done clearly and legibly in a large size. Lastly, the desks were designed to adjust depending on the student to aid their posture and avoid squinting.⁵¹ This marked a significant shift in the way classrooms were designed with disabilities, and it marked a positive change in the way students with disabilities were regarded and taught.



Figure 25 | Orde Street Public School – Sight Saving Classroom.
Figure 26 | Orde Street Public School – Sleeping in the Classroom

2.4 Montessori Schools: 1907 – Present

Delft Montessori School – 1960

Delft, Netherlands

Herman Herzberger

The Montessori School typology marked a significant change in the approach to education, including the design of the classroom environment. The major shift was from buildings being designed for efficiency and creating the next generation of factory workers to designing for the emotional and physical wellbeing of each child. Unlike in the evolution from one-room schoolhouses to graded schools in which the classroom stayed relatively uniform, and the exterior changed, the Montessori design changed both the interior and the exterior environment.

Montessori schools are an educational pedagogy created by Maria Montessori, an Italian physician and educational reformer in the early twentieth century. The method is focused on creating a positive child-centred learning environment designed to create a sense of independence in children and hands-on, self-directed education.⁵² Montessori's methods were influenced by her work "with children who were mentally disabled, observing that they responded well to sensory-rich environments and learned best when engaged in purposeful

activities."⁵³ Montessori⁵⁴ compiled her beliefs in a book that laid the groundwork for what became known as the Montessori method. The Montessori method differed from the typical school pedagogy in its focus on independence and autonomy for its students. "In Montessori classrooms, children make creative choices in their learning, while the classroom and the highly trained teachers offer age-appropriate activities to guide the process".⁵⁵

The Delft Montessori School, designed by Herman Herzberger in 1960, was designed following the Montessori methods. Special attention was focused on the entrance to the school. The main entrance (Figure 28) became a public communal space for students and their parents to gather, with the belief that a "meeting ground for people with a common interest, serves as an important social function."⁵⁶ Additionally, the space between the corridor and the classroom also became a transition zone. This allowed the children to shift into the learning mindset. The transitional space was further emphasized by each class having their own cloakrooms and having the students

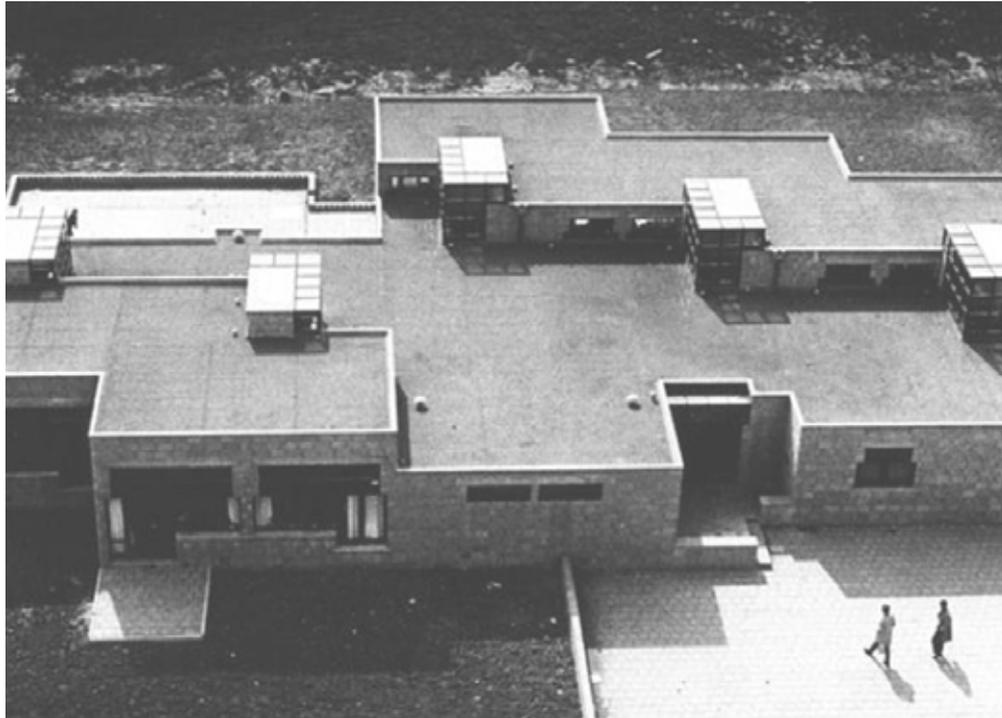


Figure 27 | Delft Montessori School - Overview
Figure 28 | Delft Montessori School - Entrance

climb a couple of steps to get into the classroom. This spatial shift encouraged a psychological shift within the student entering the learning environment. In addition to transitional space, a third space was created in the hallway. The hallway was no longer a single loaded corridor with the sole purpose of transitioning between classes. The hallway was a communal educational space with an active influence on their learning.

In conjunction with ventilation and natural lighting, environmental and green spaces were also vital for this school. Each student was given a plant to care for in class to teach them about the environment and personal responsibility.⁵⁷ While not particularly abundant with nature, the play area outside the school was divided by perforated building blocks, which created different playing environments, such as sandpits and gardens.

There was also a conscious decision to move away from the monumentalism of former school typologies. Herzberger believed that

“the building must not be too beautiful, lest it be a place for children to keep and not one for them to use. Its materials must be those not easily marred, and permitting some abuse, the finish and settings must form harmonious background with honest child effort and creation – not one which will make the children’s work seem crude. Above all the school must be childlike – not what adults think of children. At the same time, it should be dignified and playful, but not playing down to children”.^{58 59}

This choice was also reflected in the architecture of the classrooms. The design of Montessori classrooms also encouraged autonomy in their students by having each classroom have its own small cloakroom and exterior play space.

The classroom was designed around the child, from the material to furniture choices. The furniture was scaled to the children’s size, made from comfortable materials, and easy for the children to move. This can be seen particularly in the block chairs. These chairs were adaptable and easy for the children to use as they had a handhold and could be used on all sides. These

chairs were also located within the corridors of the Delft schools to create a learning and playing environment outside the classroom, where children could use them in whatever way they wanted. All these material furniture choices encouraged students to feel a sense of autonomy and self-confidence.⁶⁰

In addition to the materials and furniture choices, the classroom layout also aided in creating a learning environment for different activities. The classroom had two levels divided by a low bookcase and a different floor level. The lower level was mainly used for more active activities and messy learning as it had a sink and storage and desks, which could be used for activities such as painting. The general learning occurred mainly in the upper area, with movable desks and chairs. The division allows “the children in the other section [to] do work that requires more concentration, undisturbed by the others who are engaged in less arduous activities.”⁶¹ In addition to the different floor levels, the ‘L’ shaped classroom aided students with attention difficulties in concentrating by reducing and segmenting the other sensory stimuli. The floor level change let the teacher monitor and watch over the students no matter where they were in the class; while creating a physical divide between the zones. These design decisions created many different learning environments with varied sensory inputs.

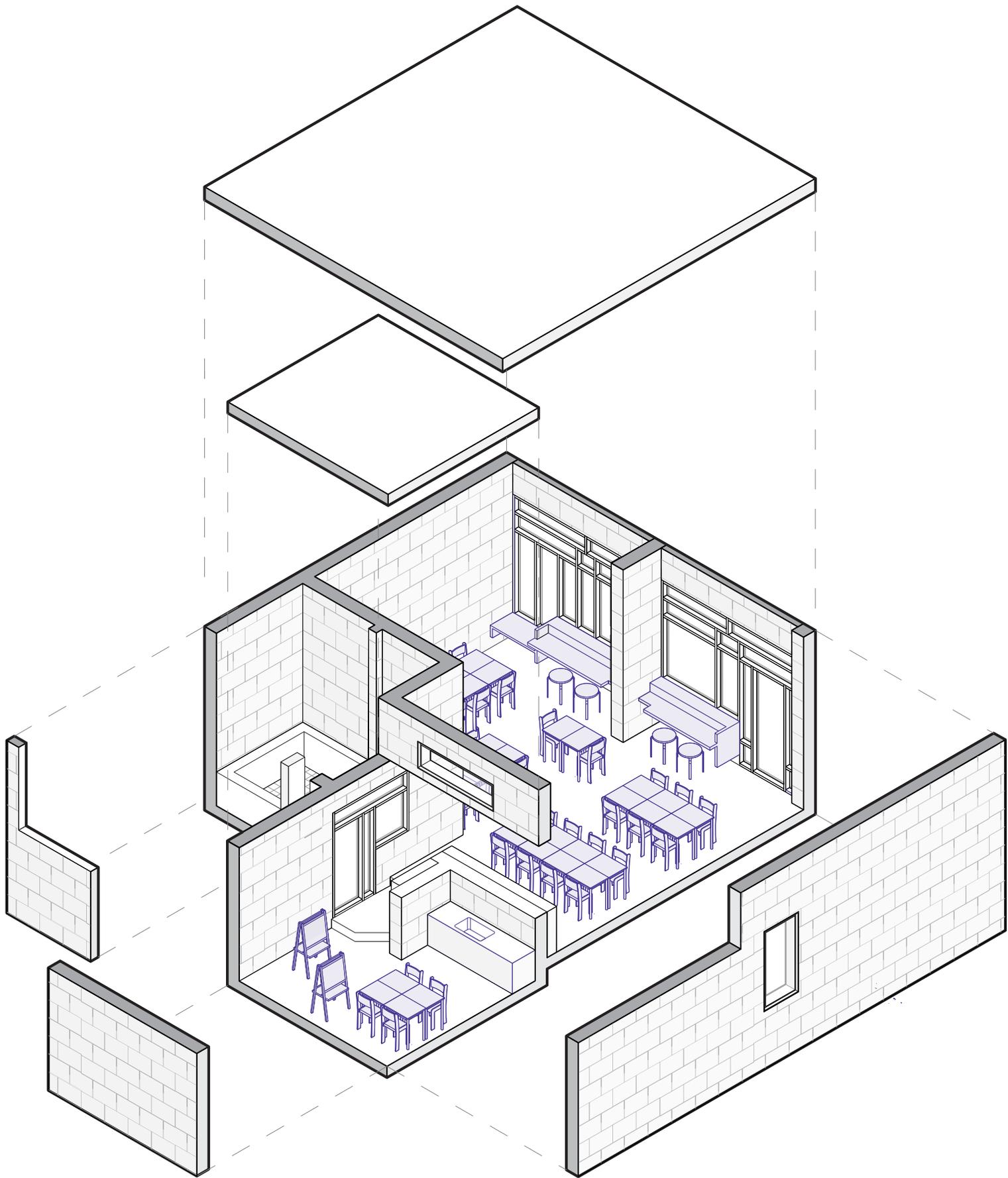


Figure 29 | Delft Montessori School – Classroom Exploded Axonometric

Equinox Holistic Alternative School - 2009

Toronto, Ontario

The majority of Montessori schools in Toronto are private and independent schools. Equinox Holistic Alternative School is a part of the Toronto District School Board's (TDSB) alternative schools. While not officially a Montessori school, it is inspired by the Montessori method and takes inspiration from Reggio Emilia and Waldorf teaching philosophies. In addition to these teaching methods, they use a holistic philosophy while still following the Ontario Ministry of Education curriculum. The school's aim is very much in keeping with the Montessori method of teaching for the whole child seen in the Delft School, with the expectation that the outdoors and nature are fully integrated into the program at the Equinox school. The environment is critical in the kindergarten class as it is one of Canada's first full-day outdoor programs.



Figure 30 | Equinox Holistic Alternative School - Exploration
Figure 31 | Equinox Holistic Alternative School - Inquiry

2.5 Finger Plan Schools: 1940s

Crow Island Elementary School - 1940

Winnetka, Illinois, United States

Perkins + Will, Eliel and Eero Saarinen

Finger plan schools were designed around creating effective daylighting and ventilation. They were inspired by the progressive education movement of the 1940s, an education movement that was a response and a critique of the old teaching pedagogies. Finger plan schools were known for having all of their classrooms connected by long corridors. These classrooms tended to be 'L' shape; the unique shape allowed for the opportunity for multiple learning environments within one classroom, such as the addition of a lab or craft area. These schools tended to be one-storey only and flat-roofed. A well-known example of a finger plan school is the Crow Island Elementary School, designed by Perkins + Will and Eliel and Eero Saarinen.

Crow Island Elementary School was built during the school building boom of the 1940s, in which the finger plan model became popular.⁶² Many schools were subsequently modelled after Crow Island Elementary School, particularly after World War II, when the 'baby boom' increased demand.⁶³

The layout of the Crow Island Elementary

School was designed around the classroom. As seen in Figure 34, the classrooms were all identically 'L' shaped and connected through a single long corridor. There was a lobby at the main entrance to the school, which served as a transition space for the students between the outside and the learning environment. Unlike the Montessori schools, in the Crow Island Elementary School, the corridor was not used as a communal gathering space. Instead, it was used as a simple corridor, only used to move between classes, similar to the old grammar schools.

The classroom shape and size created an informal scale that allows each classroom to develop individuality based on the teachers and the students.⁶⁴ In addition to the form, the intimacy of the classroom was further emphasized by a lower ceiling of nine and a half feet high.⁶⁵ The ceilings were also acoustically treated using "acoustical materials to allow interaction at a manageable noise level and interior fittings that are scaled to the children's size are key elements in the design."⁶⁶ The layout of the classrooms was also designed to

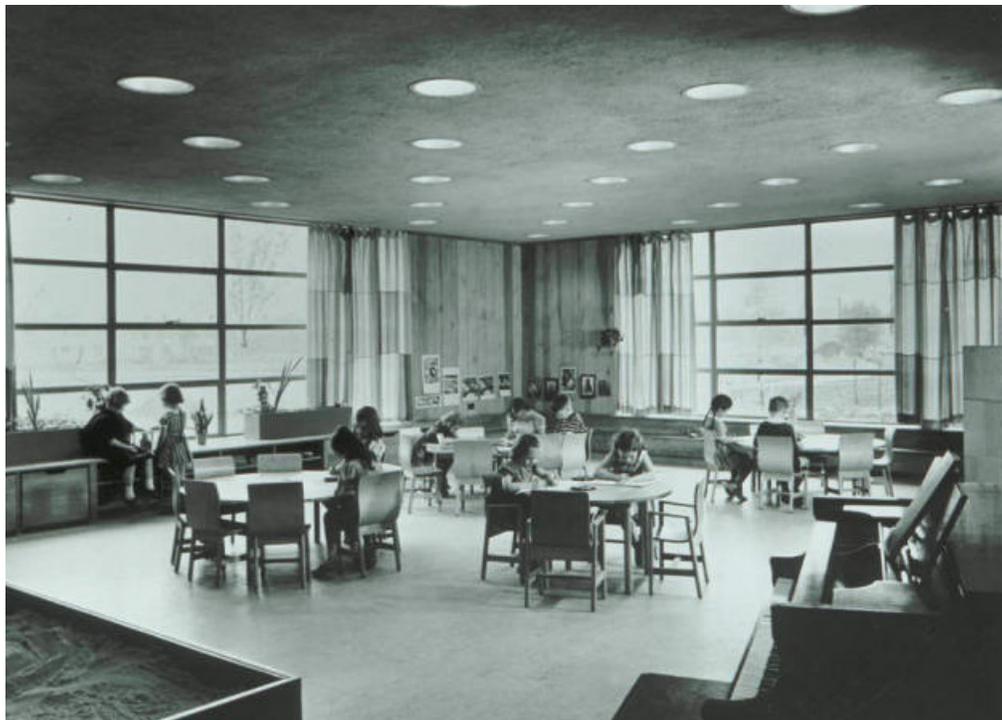


Figure 32 | Crow Island Elementary School – Courtyard View
Figure 33 | Crow Island Elementary School – Interior View

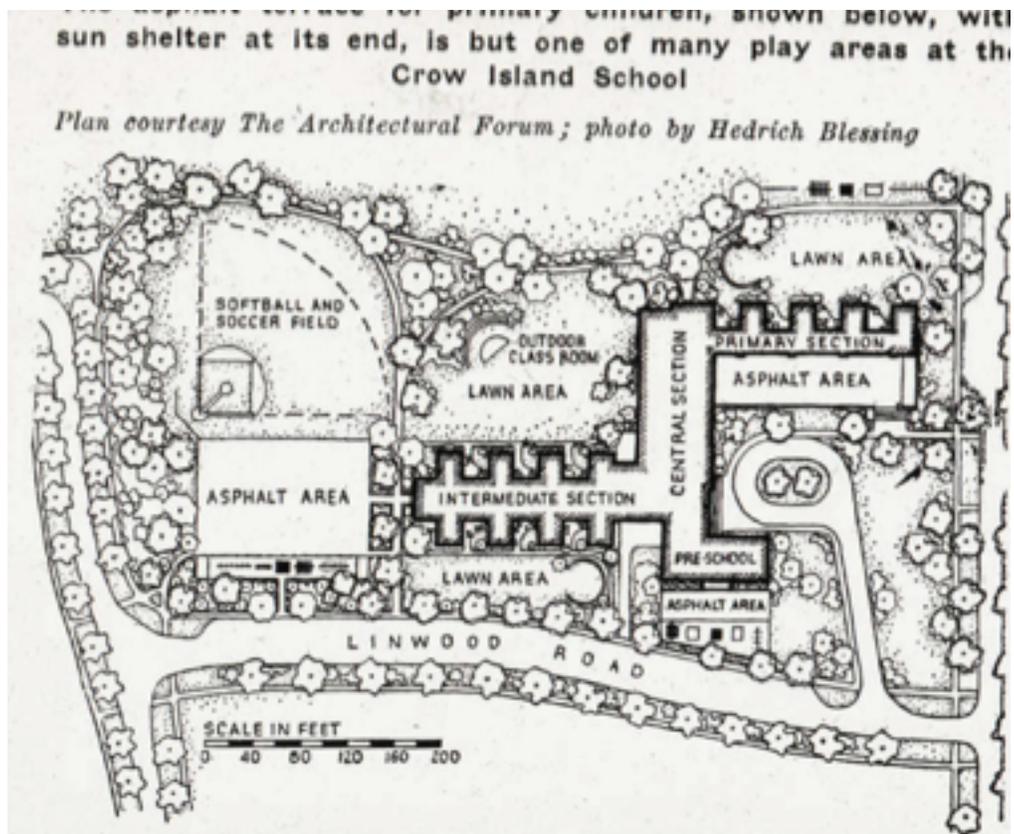
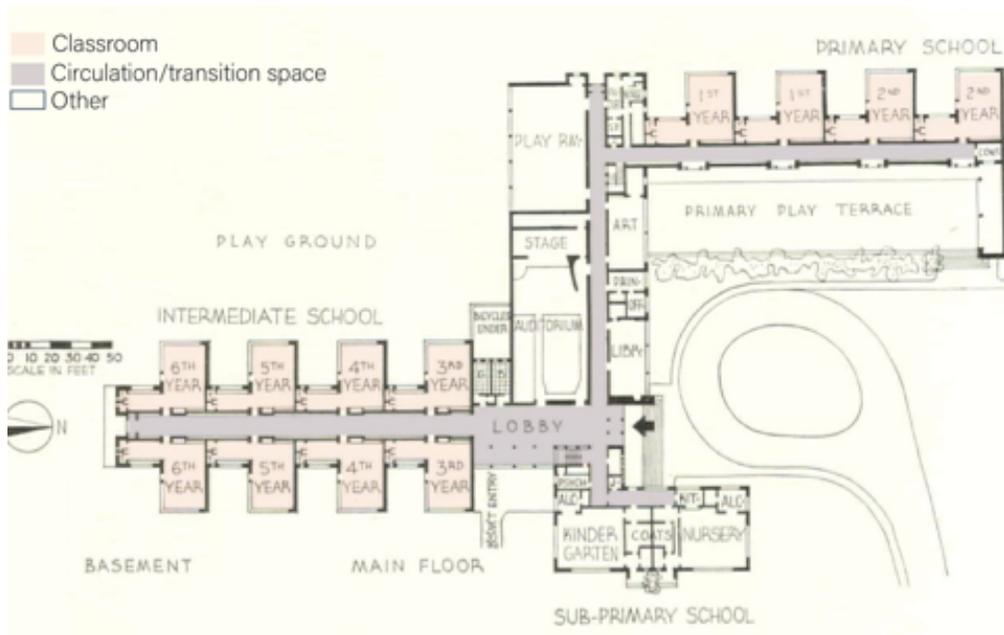


Figure 34 | Crow Island Elementary School – Floor Plan
 Figure 35 | Crow Island Elementary School – Site Plan

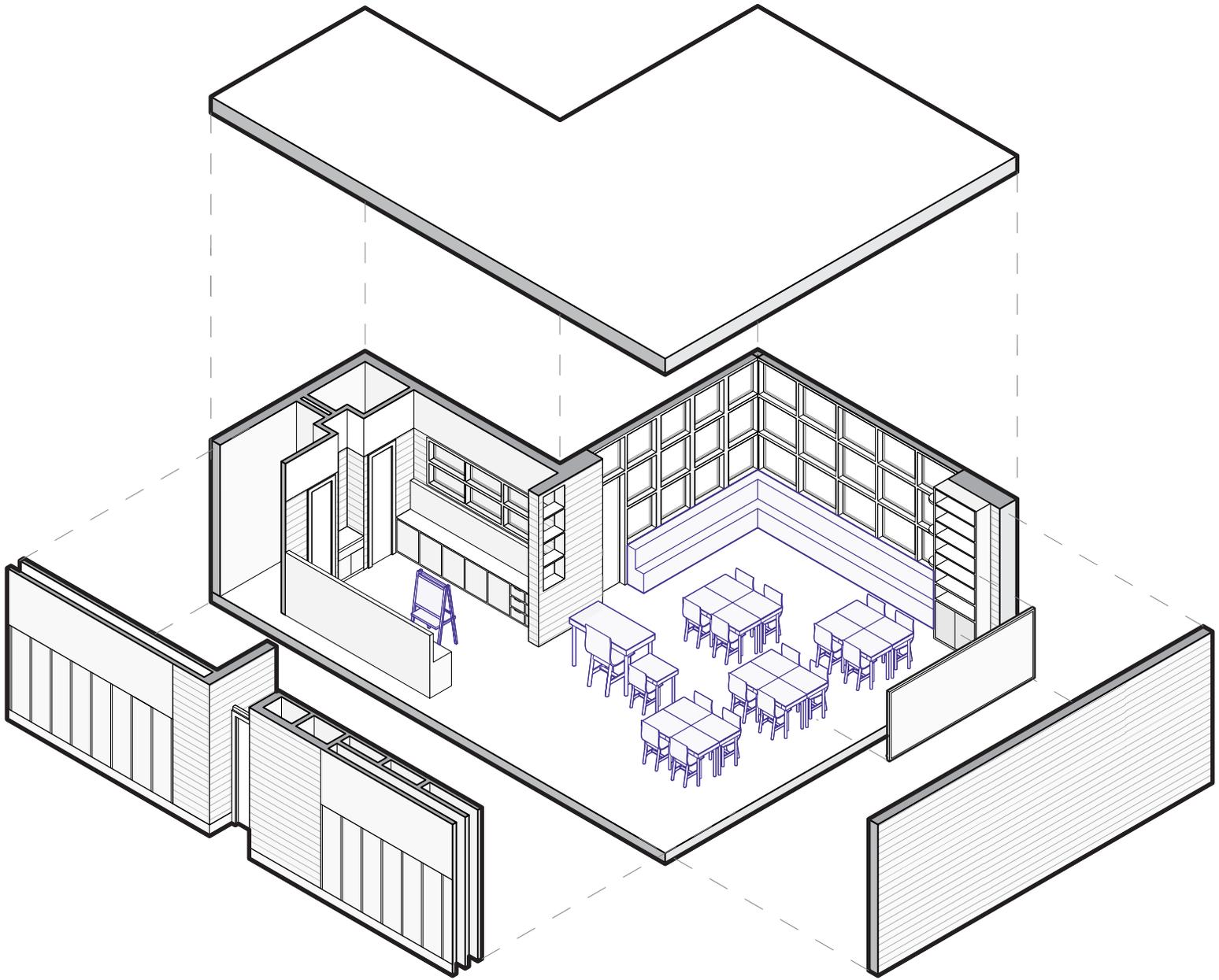


Figure 36 | Crow Island Elementary School – Axonometric

allow access to maximize the natural lighting and fresh air. The classrooms each had a door straight to the outside, with each classroom also having its own play area. This connection to the outside was further emphasized with the curtain wall in the main section of the classroom. The classroom shape creates different zones, separating the 'wet' and central areas.

To further add individuality to different classrooms of a similar shape, "Lily Swann Saarinen designed the bright print used in the curtains for each classroom. The classroom doors were painted either red, yellow, or blue, and the colour was continued in any unpanelled areas in the classroom."⁶⁷

The furniture was scaled to the size of the children and adaptable for a variety of activities. The wet area of the classroom is dedicated to hands-on learning; this ranges from art and crafts to science experiments. The furniture in the classes was the same throughout the school; the difference between them was the size as they were scaled to the age of the students. The desks were easily moveable in the primary zone of the classroom, with additional seating provided with window benches. Everything in the classroom is child-scaled, from the bathroom to the blackboards and the light switches.⁶⁸ One unique feature in the Crow Island Elementary School that was not seen in any earlier case studies was lockers in-built outside the class, replacing the old coatroom.⁶⁹



Figure 37 | View of workroom and attached bathroom, 1940.

Figure 38 | Outdoor Activities

2.6 Reggio Emilia Schools: 1960s - Present

Diana Reggio Emilia Preschool - 1970

Reggio Emilia, Italy

The Technical office of the Municipality of Reggio Emilia, in collaboration with Tullio Zini

The Reggio Emilia approach is an educational pedagogy used in primary and preschool education, and its student-centred focus is similar to Montessori Schools. The pedagogy is centred around six main principles: emergent curriculum, in-depth projects, representational development, collaboration, the teacher's role, and the classroom as a teacher.

⁷⁰ A fundamental element of the Reggio Emilia method is participation and communication with everyone involved, from architects, parents, students, and teachers. "Since the end of World War II, (...) the city of Reggio Emilia has been developing an educational system for young children through the collaborative efforts of parents, teachers, and the general community, under the guiding influence of Loris Malaguzzi".⁷¹ Similar to the Montessori method, in the Reggio Emilia schools, children are active participants, not passive objects, in their education.

"Within the Reggio Emilia approach, the child is viewed not as a target of instruction, but rather as having the active role of an apprentice (Katz, 1993), working alongside others in the discovery and construction of solutions to meaningful questions and problems; learning is not something that is done to the child, but rather something she does (Firlik, 1994)."⁷²

The Diana Reggio Emilia Preschool is a school in Italy for children from three to five years old. It is an early and successful example of the Reggio Emilia pedagogy and was picked as one of the best schools in a 1991 Newsweek article, 'The Ten Best Schools in the World.' Opened on March 7th, 1970, it is a one-story building that looks similar to a greenhouse in terms of design. The classrooms are centred around an internal courtyard that contains two gardens. As seen in Figures 41 and 42, the interior courtyard is in the heart of the school; it acts as a communal gathering and learning space. It is the first place seen from the entrance and acts as a transitional zone between the outside and the classrooms. It also brings in fresh air and natural lighting into



Figure 39 | Diana Reggio Emilia School – Entrance
Figure 40 | Diana Reggio Emilia School – Classroom

the center of the school.

The school can accommodate 78 students, which are divided into three classes based on ages; 3, 4, and 5 years old. All three classrooms are similarly 'L' shaped with minor differences; the biggest is that the three-year-old's class does not have its own library.

The use of curtain walls throughout the school adds to the greenhouse feel of the school, as no matter where a person stands in the school, they would have a view of nature. The use of glass creates lots of opportunities for natural lighting. The curtain walls also allow the teachers to overview the children without imposing on them.

Varied learning environments are created through the shape of the class, the division and the use of the furniture. Each class has an attached mini atelier and a small library connected to the main room but still distinctly separated. The furniture creates at least three different levels within the room. The highest level is made with bleachers, which can be used in many different ways and creates an opportunity to improve motor functions. The next level is the tables and chairs, which can be moved and combined depending on the activity. The last level is created with the rugs; they are placed strategically near windows to view the outdoors and create a place to play and read. This is similar to the Delft Montessori School's use of different levels, but except for the bleacher, the Diana School's class is more accessible. The furniture is designed so that the children can move them themselves; for example, the chairs all have a hand grab. This fosters independence within the children. Furthermore, the different furniture and areas available promote various activity types, from self-directed learning to group activities.

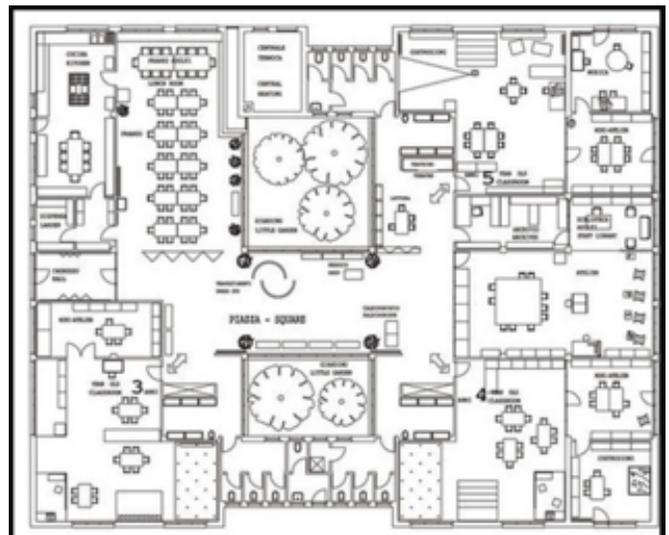
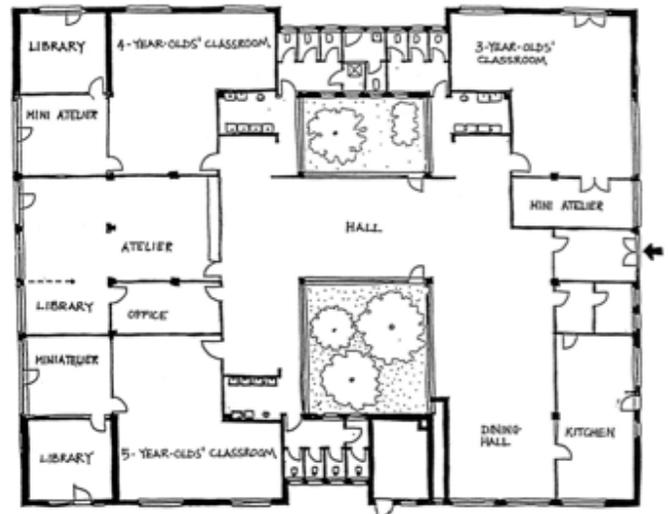


Figure 41 | Diana Reggio Emilia School – Floor Plan
Figure 42 | Diana Reggio Emilia School – Floor Plan

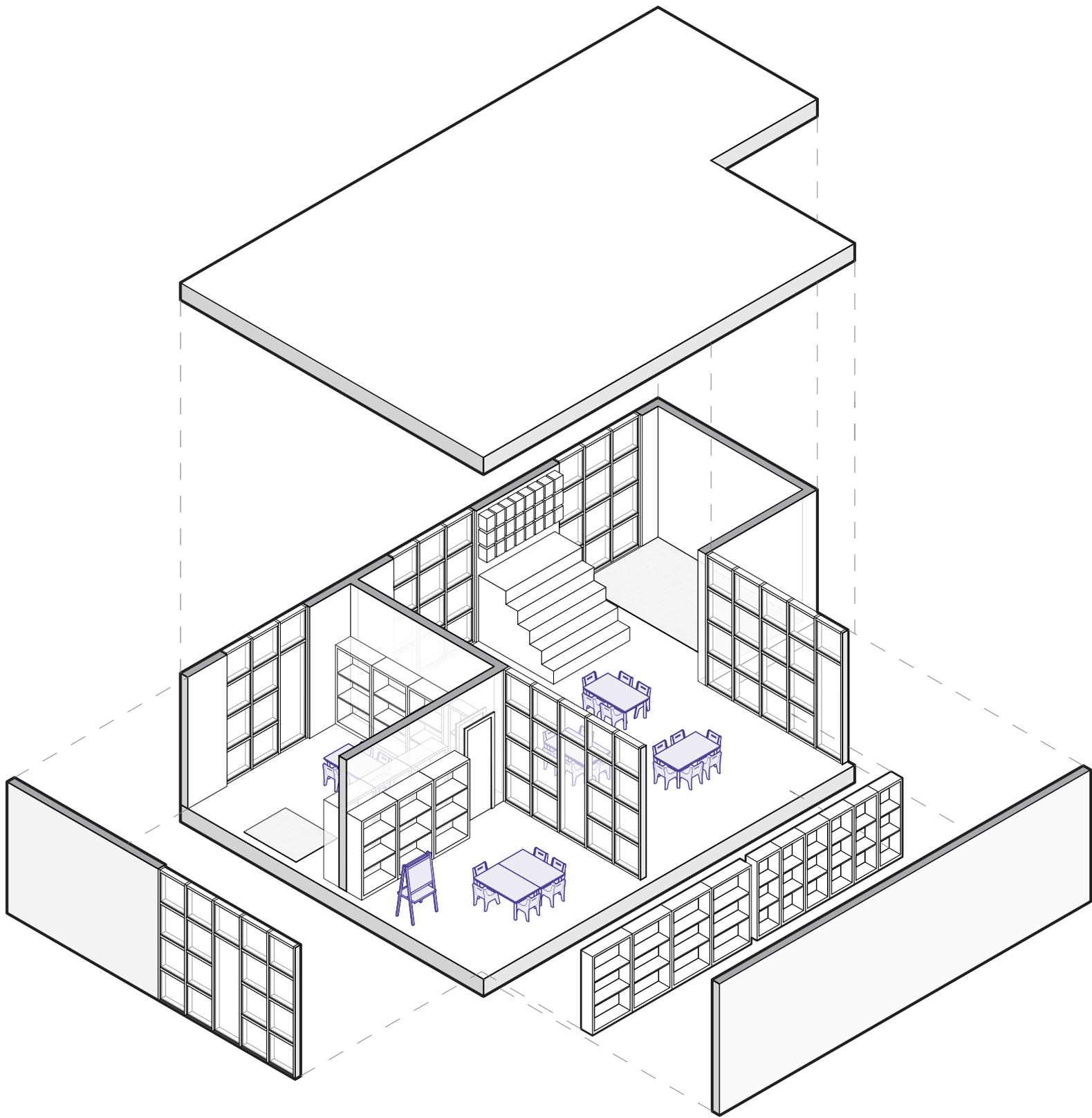


Figure 43 | Diana Reggio School – 4 year olds Classroom
axonometric

Fairmount Public School

Toronto Ontario

Built in 1951, renovated in 1953, 1956, and 1962.

While the only official Reggio Emilia Schools are in Italy, its philosophy continues to inspire schools in Toronto. Fairmount Public School is a school for grades JK to eight, and only the school's kindergarten is officially inspired by the Reggio Emilia method. The rest of the school is an Arts-Based Curriculum(ABC). The school chose to use Reggio Emilia in the kindergarten as it works well with the ABC method.

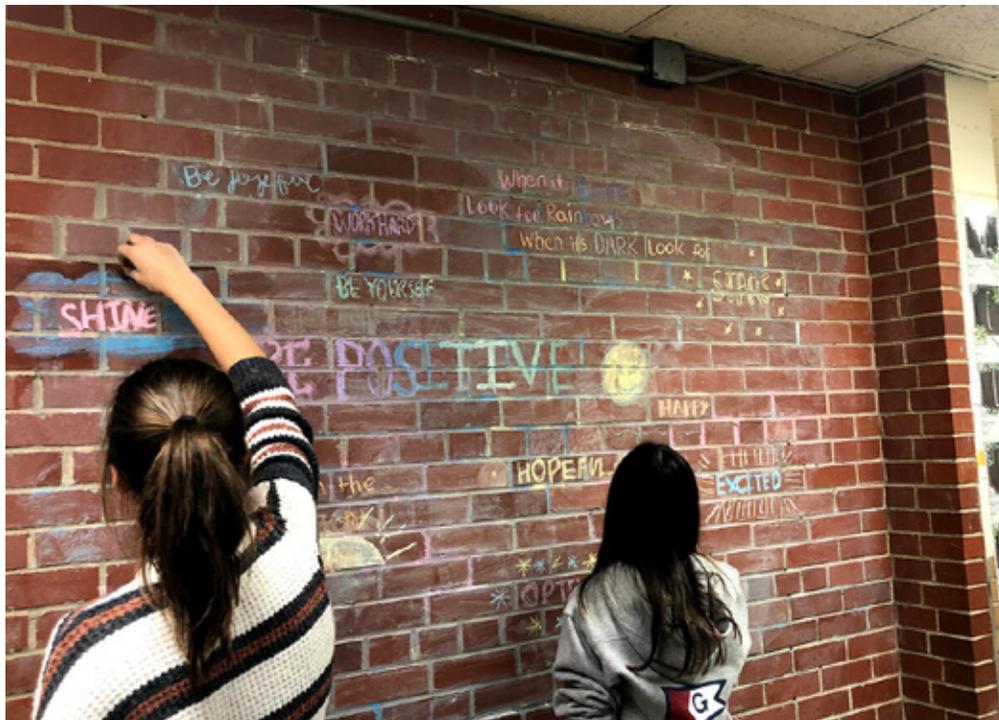


Figure 44 | Fairmont Public School - Entrance
Figure 45 | Fairmont Public School – Interior View

2.7 Open Plan Schools: 1960-70s

Mt. Healthy Elementary School – 1972

Columbus, Indiana, United States

Hardy Holtzman Pfeiffer Associates

Open-plan schools were reminiscent of the one-room schoolhouse typology, just on a much larger scale. They developed as a direct challenge to the cellular or ‘egg carton’ schools. They were designed to create an educational environment free of walls and that grouped students using other architectural strategies to create a different environment in an open space. They were very innovative and used many flexible design elements. This was supposed to inspire creative and adjustable settings to thrive. Proponents of open-concept education argued that it offered more learning opportunities than traditional schools through self-directed learning, which fosters autonomy in the students.⁷³

While compelling in theory, the open-plan schools started failing almost as quickly as they were built. As a result, many schools were subsequently renovated to create classrooms that were more in keeping with the traditional classroom. The biggest challenge for the open concept schools was auditory and visual distractions. The lack of training teachers received in learning to teach in an

open-plan school further compounded this issue, leading to teachers attempting to teach the traditional unidirectional method in an untraditional environment.⁷⁴ By the end of the 1970s, open-concept schools were considered a failed experiment; the pedagogy is making a resurgence in some contemporary schools.

The Mt. Healthy Elementary School, built-in 1972 by the Hardy Holtzman Pfeiffer Associates, was one of Columbus, Indiana’s first open concept schools. The architect stated that “the building was planned to reflect the future, which is actually a combination of the present and the past, with the best parts of both.”⁷⁵

Because of the open-plan design of the school, there are not many doors or fully enclosed areas. The architects used different floor levels and juxtaposed geometric shapes and materials to create zones to create this different teaching environment. Furthermore, the larger areas of the school are created through implied separation, which was done by strategical placement of enclosed rooms and furniture placement.⁷⁶ One of the most significant benefits to open plan designs, especially seen in this



Figure 46 | Mt. Healthy Elementary School – Exterior View
Figure 47 | Mt. Healthy Elementary School – Interior View

case study, is that it results in the largest ratio of usable teaching space to total building area other than in one-room schoolhouses.⁷⁷ The school was designed with no corridors space; all circulation is used for learning activities and educational intent.⁷⁸

As seen in figure 48, the school's layout is designed for the classrooms to be based on three main clusters. "These cluster areas correspond to standard academic divisions: Lower Primary (Kindergarten through Second Grade), Intermediate (Third and Fourth Grade), Upper Primary (Fifth and Sixth Grade), and Special Education Classes."⁷⁹ The separation between the groups of students was created more through psychological design barriers, as discussed earlier, than physical walls between classrooms. This was done to create different educational environments within each cluster. The architects designed their environments with "three specific categories: large group instruction, small group discussion, and individual study."⁸⁰ Through this mindset, the teachers and students can develop and learn the best way to learn and teach.⁸¹

Like the Delft Montessori School, levels are used further to divide the separate learning areas (Figure 49). This was also done in an attempt to lessen the noise levels. This space division was emphasized by juxtaposing the levels creating intimate and comfortable area divisions without creating clear divides.⁸² The furniture used is all movable and adaptable.

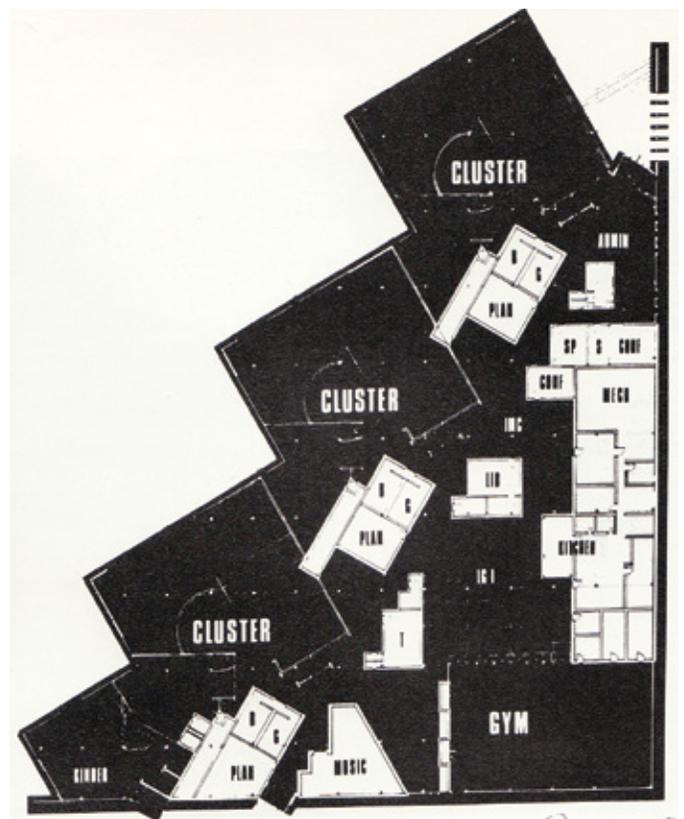


Figure 48 | Mt. Healthy Elementary School – Floor Plan Diagram

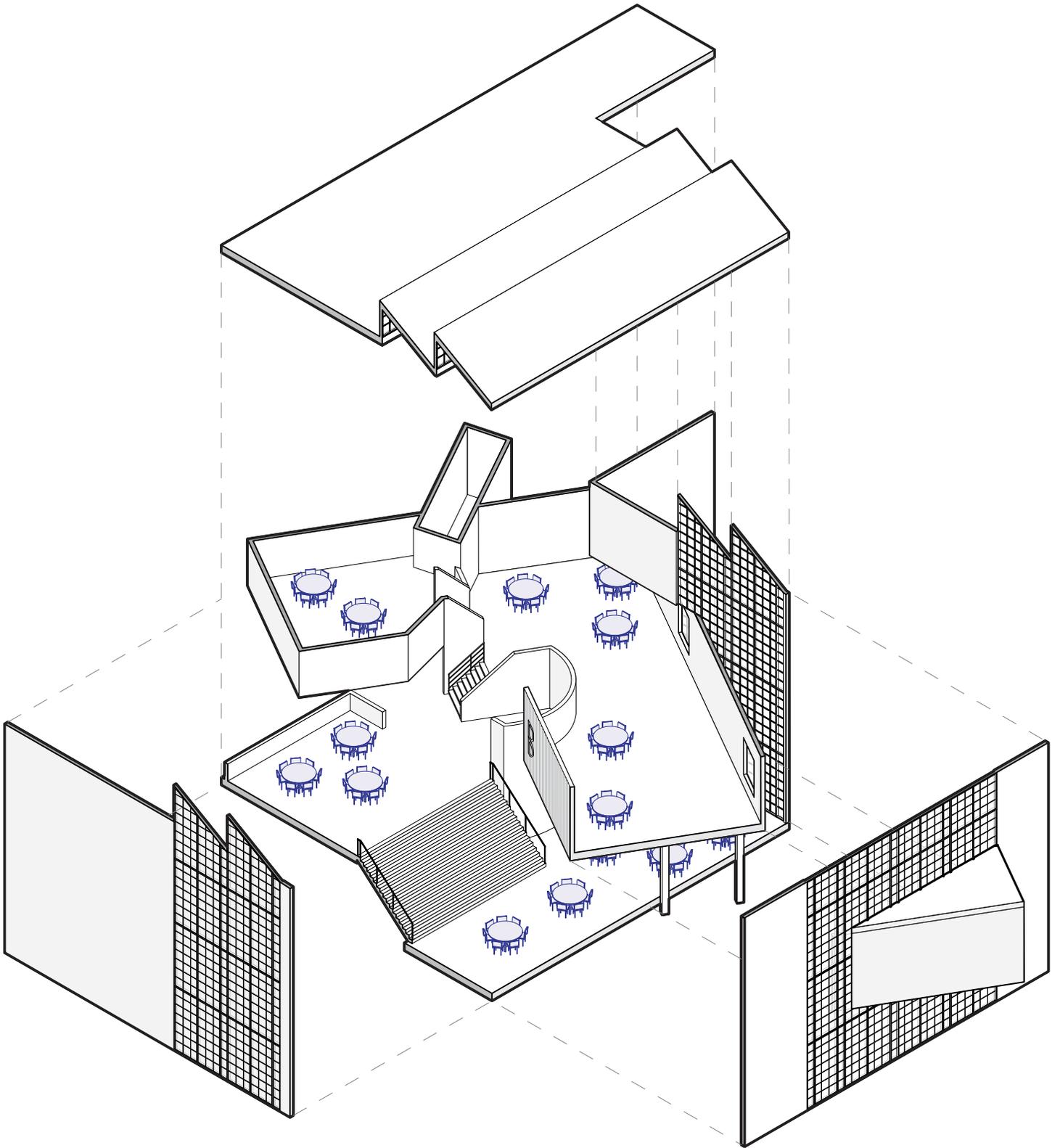


Figure 49 | Mt. Healthy Elementary School – Classroom
Exploded Axonometric

Pleasant Avenue School – 1960

Toronto, Ontario

Original Architect Unknown, 2021 addition done by Kearns Mancini

Pleasant Avenue Public School, built in the 1960s, became an experimental open-concept school. The school acted as a test to see how open-concept schools could work and be an example for other schools. Pleasant Avenue Public School was unique because they videotaped the experiment and archived the footage; the tape was named, Learning to Learn. Another critical aspect of the experiment was the level at which the teachers were involved. Because they were part of each step, they could change their teaching styles and work with the architecture instead of against it.

While revolutionary and very influential on other open-concept plans in Toronto, by the 1970s, the experiment became a resounding failure as a combination of factors led to its downfall. By the 1970s, there were many criticisms that the public had of the open-concept school typology.⁸³ The biggest complaint, an issue seen in the Mt. Healthy Elementary School, was the excessive noise. These complaints led to the majority of the schools being repurposed and renovated to reinstate the previous traditional classroom.⁸⁴⁸⁵

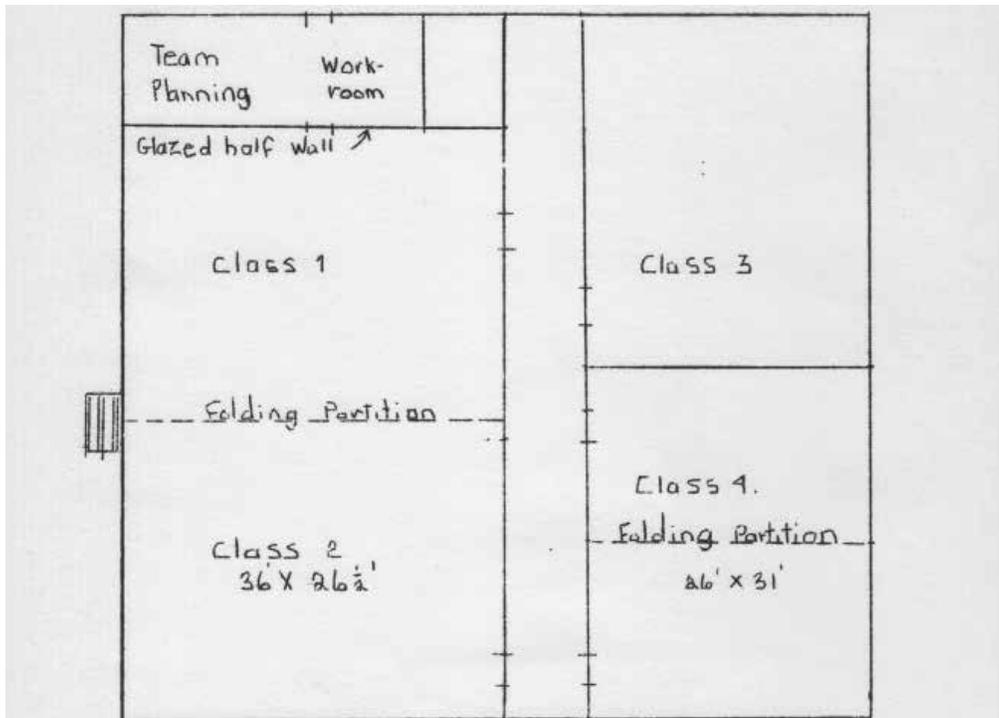


Figure 50 | Pleasant Avenue School, 1960
 Figure 51 | Floor plan – Open Concept.

2.8 Contemporary Public School

Keele Street Junior Public School – 2015

Toronto, Ontario, Canada
Moriyama & Teshima Architects

The changes in the design of contemporary public schools can be split into four areas. Firstly, new subjects were introduced to school curriculums, which resulted in the need for new types of spaces such as gyms and science classrooms. The second was the “develop[ment of] new materials and methods of construction. Thirdly was the impact created by a broad recognition of the changing place of the school in the community”.⁸⁶ Lastly, pedagogical, social and political changes influenced how society perceived education. “These changes, however, merely tend to improve and expand traditional school design. The classroom unit still remains”.

⁸⁷

The layout of the contemporary public school in Figure 56 is very reminiscent of the classrooms of the one-room schoolhouse and the grammar school. A difference is that the furniture is moveable so that the desks can be reorganized for different learning environments, but it is still limited to the box of the classroom. Unlike the Montessori or finger plan classroom, there is no place for rest or other learning experiences, and it is designed

solely for unidirectional learning. The biggest difference is the new technologies within these classrooms, such as a smartboard, whiteboard, and computers. This is an important difference as students need to become digitally proficient in contemporary life and work environments.



Figure 52 | Keele Street Junior Public School – Exterior View
Figure 53 | Keele Street Junior Public School - Classroom



Figure 54 | Keele Street Junior Public School – Exterior View
Figure 55 | Keele Street Junior Public School - Classroom

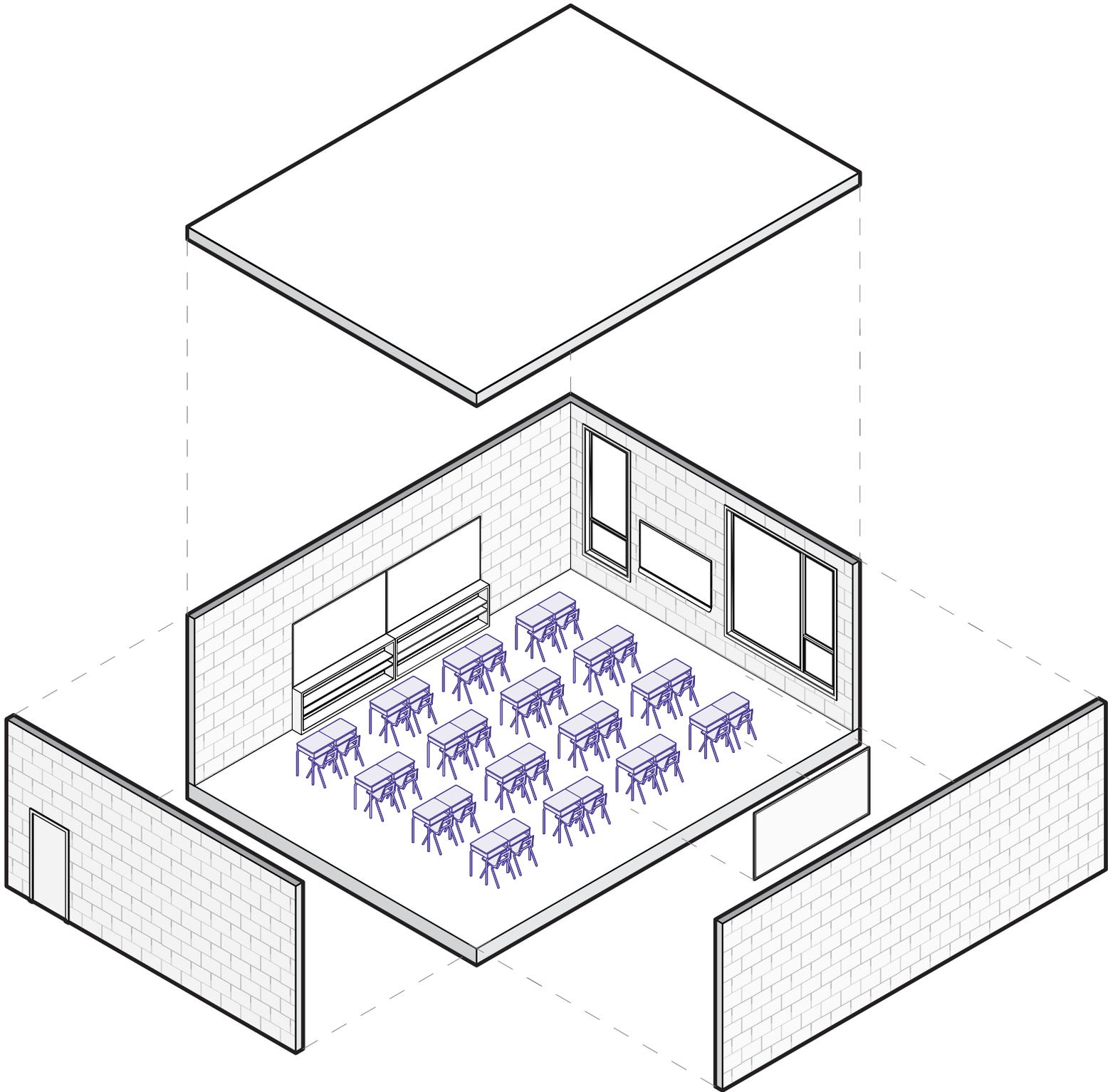


Figure 56 | Keele Street Junior Public School – Classroom Exploded Axonometric.

2.9 Conclusion – Comparative Analysis

These school typologies were associated with different interpretations of how to design for the educational values that society held at the time. As seen in the case studies, a balance must be met in creating a flexible and fixed environment. Too much freedom in the design and students can experience problems, such as the hyper-sensitivity generated by the open-plan schools. Too much rigidity in the classroom design (such as in the Grammar schools and our current public schools) can create a hypo-sensitive environment, with no area for individual learning.

Public schools have become a patchwork of many different typologies that have been poorly adapted to our modern lives and new understandings of neuro-diversity. School curriculums and pedagogies have changed faster than our infrastructure can adapt. Schools across all the eras discussed in the thesis are still used in the Toronto District School Board (TDSB). This thesis argues that to incorporate neuro-divergent students effectively, changes need to be made in the design of public schools' classrooms. Several strategies, mainly set in

place by the teachers, have been used to support neurodivergent students, such as rearranging classroom layouts. Still, they have not addressed the range of diversities exhibited by their students, nor have they been implemented in a thoughtful, research-based process. One of these specific neuro-diversities, ADHD, is the focus of this thesis.

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3 - Neurodiversity in the Classroom

3.1 Overview of Attention Deficit Hyperactivity Disorder (ADHD)

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder.⁸⁸ ADHD is a complex disorder that affects every aspect of a person's life, and it "is evident in a number of different places, at school and at home."⁸⁹ Our understanding of ADHD has become increasingly sophisticated over the past few decades. "No longer do we think of ADHD primarily as a disorder of attention/distractibility (ADD), plus impulsivity and hyperactivity (ADD-H). New evidence points to ADHD as an impairment of self-regulation or executive functioning."⁹⁰ There are three subsets of ADHD that are recognized.

The DSM-V categorizes ADHD into three presentations (subtypes):

1. ADHD, Combined Presentation
2. ADHD, Predominantly Inattentive Presentation
3. ADHD, Predominantly Hyperactive/Impulsive Presentation

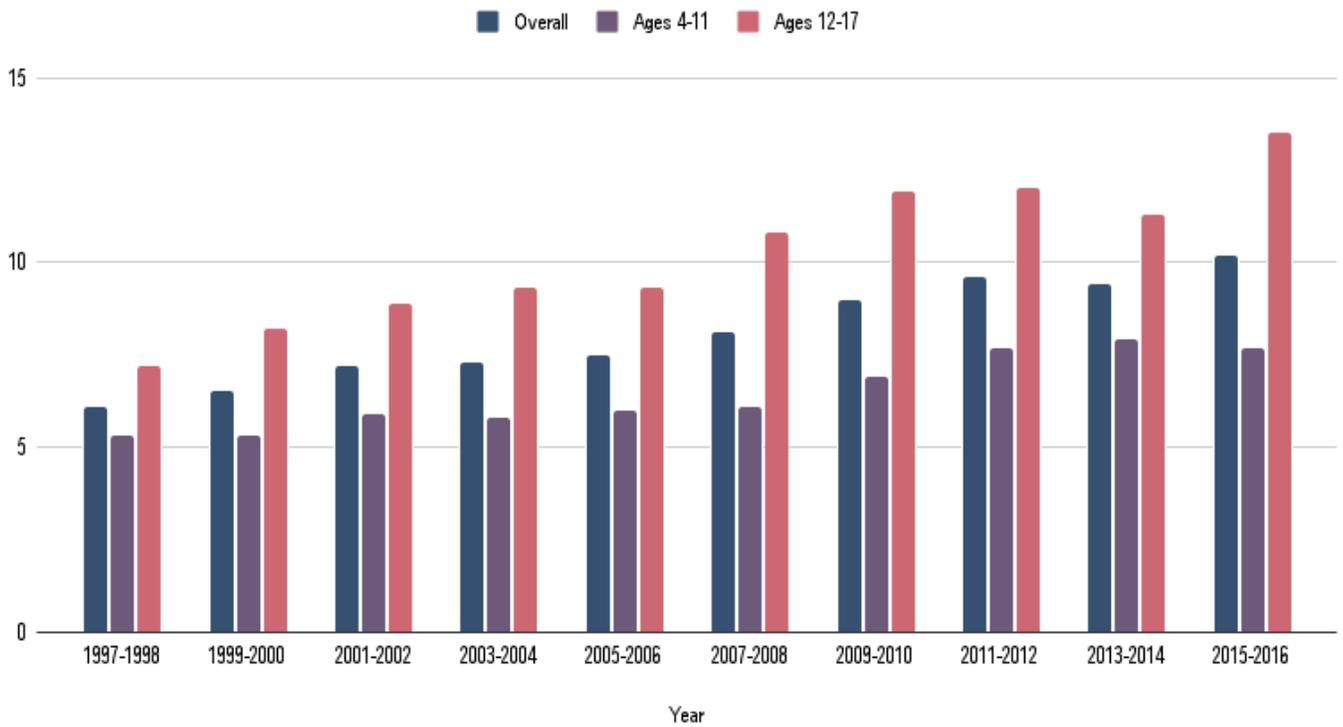
Our understanding of neurodevelopmental disorders has changed and developed over

the past two hundred years, and doctors and educators have started to understand the impact ADHD has on individuals. "ADHD is not new; it has been described in literature and medically documented for more than two centuries."⁹¹ People with ADHD face many daily internal and external challenges exacerbated by how our society is designed. It was not until 1987 that ADHD was officially recognized in the DSM-3, and not until 2013 that the way it affected adults was included in DSM-5. This means that even within the professional field, the understanding of ADHD has been changing and developing.

Demographics of ADHD

Millions of people worldwide are diagnosed with ADHD, and each year testing and detecting methods are improving. Even with this new understanding of ADHD, it "remains under-recognized and underdiagnosed."⁹² There are many academic risks recognized with untreated and undiagnosed ADHD, "Children, adolescents and adults with untreated ADHD are at a greater risk for: learning difficulties, less academic success, school dropout, and fewer

Overall Prevalence Children Diagnosed with ADHD per Year Depending on Their Age Group (Percent)



Overall Prevalence Children Diagnosed with ADHD per Year Depending on Their Gender (Percent)

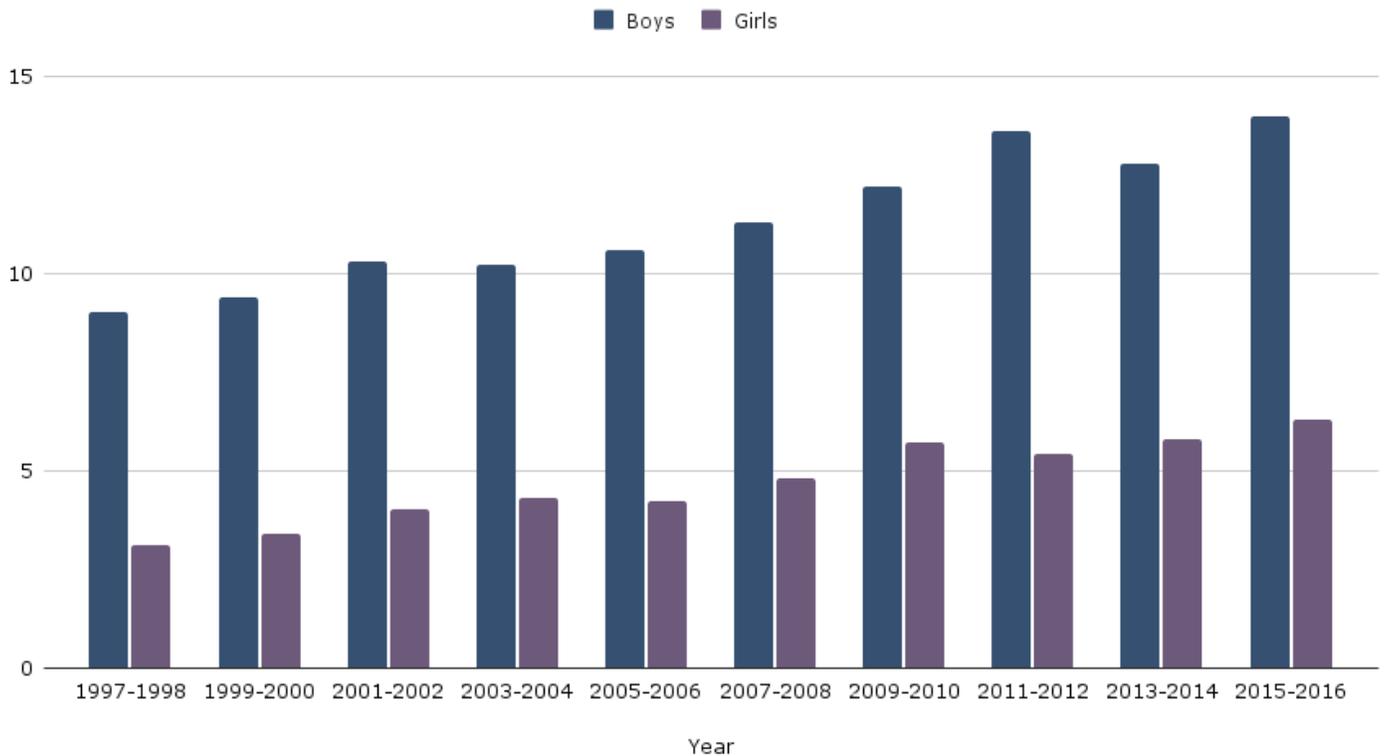


Figure 57 | “Facts / Stats (Facts and Myths) – Centre for ADHD Awareness Canada’.
 Figure 58 | “Facts / Stats (Facts and Myths) – Centre for ADHD Awareness Canada’.

years of schooling.”⁹³ As a result, the design of schools must continue to adapt to this new paradigm to accommodate better students that are being overlooked and under-serviced.

When people think of ADHD, they tend to imagine a young boy who is loud, rambunctious and has trouble sitting still. Rarely do people picture ADHD as “bright, daydreamy, girls unable to get their school work done or forty-year-old moms struggling to keep their families and households organized, their employers happy and their volatile emotions in check.”⁹⁴ All of these could be a description of someone with ADHD. Still, the considerable variability in how it presents is one of the many reasons it is misunderstood and underdiagnosed. This is a particular problem for girls and women with ADHD, as this lack of awareness has led to boys being “three times more likely to receive an ADHD diagnosis than girls.”⁹⁵

This discrepancy is not necessarily because girls are less likely to have ADHD. Instead, it is because of a myriad of reasons, including the way symptoms appear in girls and society’s expectation of girls, even from a young age, to act a certain way. This leads to girls being overlooked by parents and teachers and therefore not getting diagnosed until they are older and able to self-identify. “It’s very common for adults with ADHD to learn about it through their kids.”⁹⁶ This problem goes beyond not getting the help they need in school. When ADHD goes undiagnosed and untreated, it can lead to depression, low self-esteem, anxiety, self-hatred, and many other problems. Moreover, these problems carry over and get further exacerbated in adulthood.

Despite being one of the most common neurodevelopmental disorders affecting students’ learning, our education system struggles to recognize and support students with ADHD. “A conservative estimate indicates that roughly 5% of Canadian students have ADHD, but the actual prevalence could be as high as 9%. There are generally 1 – 3 students with ADHD in every classroom.”⁹⁷ However, it is only since 2017 that all provinces in Canada have recognized ADHD.⁹⁸ There is no consistency across the country in both awareness and accommodations. Because of these disparities, the level of help and accommodations a student can access

varies greatly. Ontario’s Provincial Advocate for Children and Youth has recognized that “even the most dedicated and skillful teacher cannot help all students in a classroom when the ‘whole school’ environment is not designed and equipped to be welcoming and supportive of the unique needs of all learners.”⁹⁹ Furthermore, these studies only address students formally diagnosed with ADHD, ignoring all the other potential students who are also struggling. all students in a classroom when the ‘whole school’ environment is not designed and equipped to be welcoming and supportive of the unique needs of all learners.”¹⁰⁰

Impact of ADHD Through a Lifetime

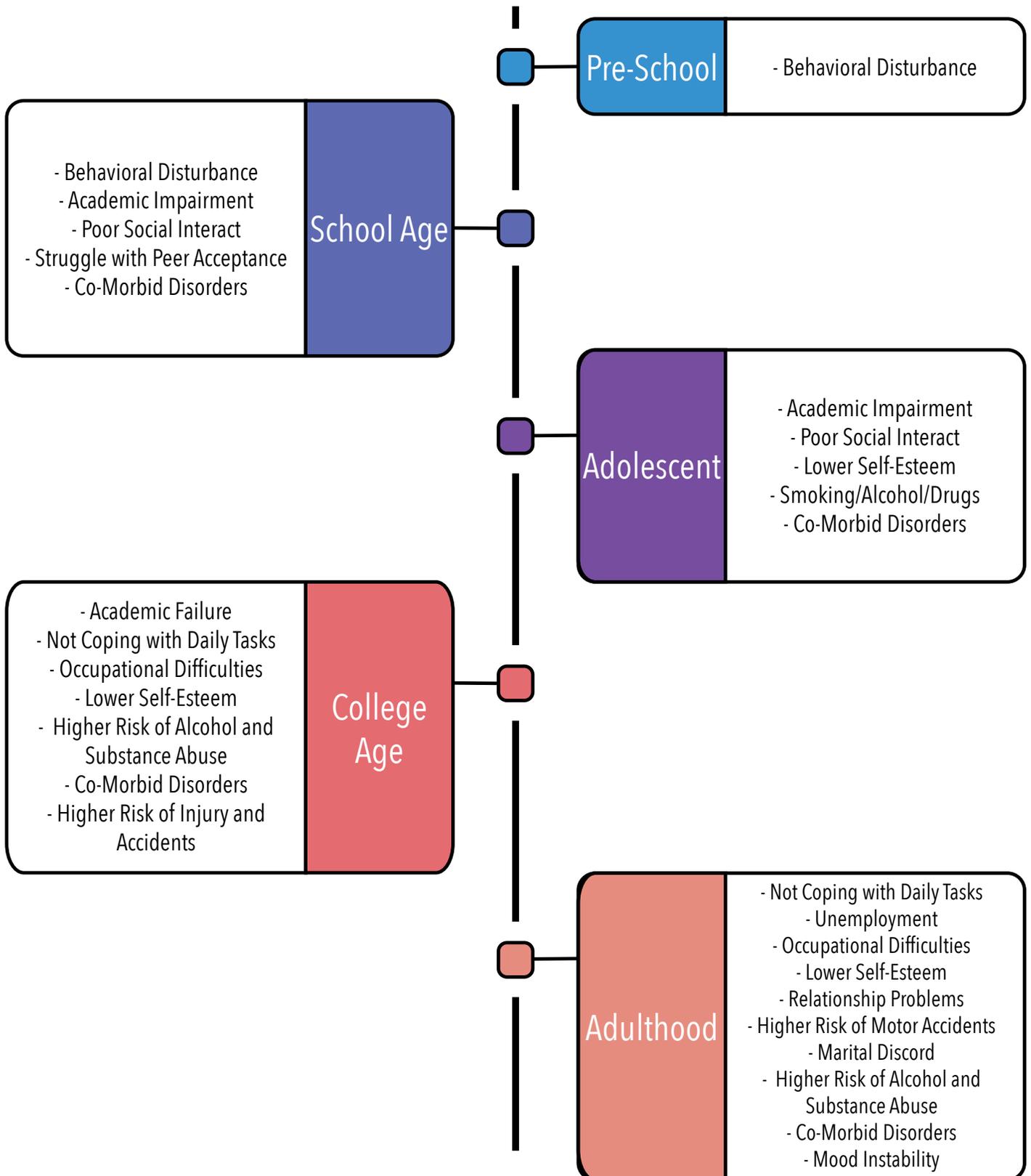


Figure 59 | Diagram based on Asherson, Philip. "ADHD across the Lifespan,"

3.2 Neurodiversity in Toronto Public Schools Standard Practice for Inclusive Education

The Ontario Human Rights Commission “noted in its Disability Policy ‘in some circumstances, the best way to ensure the dignity of persons with disabilities may be to provide separate or specialized services’. However, education providers must first make efforts to build or adapt educational services to accommodate students with disabilities in a way that promotes their integration and full participation. It is the Commission’s view that, before considering placing a student in a self-contained, or specialized classroom, education providers must first consider inclusion in the regular classroom. In most cases, appropriate accommodation will be accommodation in the regular classroom with support. However, every student with a disability is unique.”¹⁰¹

Inaccessible education school theories, there are three main models for how we educate neuro-diverse students. The model used depends on many factors such as official diagnosis, the severity of the learning disorder, funding, and resources available. The three models

are; mainstreaming, integration, and separate schools. There are many advocates and critics of all three models, and this thesis focuses on mainstreaming and integration.

“Mainstreaming is the practice of educating students with special needs in regular classes during specific time periods, based on their individual skills. The mainstreaming model began to be used as a result of the requirement to place children in the least restrictive environment.”¹⁰² Students who are being mainstreamed often have access to a separate classroom, such as a resource room, in which they learn during the time they cannot be in the general classroom. The benefits of mainstreaming are that the students can get better “academic achievement, higher self-esteem, better social skills.”¹⁰³

There are also some disadvantages, including the quality of the education available depending on the resources their local public school has access to and the program’s cost.

Integrated classrooms are similar to mainstream classes as they are classrooms where

neuro-typical and neuro-divergent students all spend all of their classes in general classrooms with no exterior resource rooms. Theoretically, this model would work best as it helps students with disabilities integrate with the general population. In practice, though, it can negatively affect everyone in the classroom as it might not be adapted or designed with them in mind.

“Many, if not most, consultees expressed their preference that students with disabilities be included in regular classrooms.”¹⁰⁴ There are many reasons for this, but the main one is the most beneficial model for students with disabilities and those without. As one parent stated in their support of integration:

“School is a training ground for life. Students learn academics and skills, but they also learn about people, all kinds of people, and how to relate to them. If students are ‘different’, do we include them by having a place for them at the back of the school, perhaps with a separate lunch schedule? Have them arrive after school begins and depart before school officially ends? Have them enter and exit in their own separate door? Have them travel exclusively on their own segregated buses? How can other students gain understanding and acceptance if students with exceptionalities are treated in such a separate fashion?”¹⁰⁵

The biggest obstacle to the classroom being fully integrated is the cost, lack of resources, and the way classes are designed. “Resources that have been reduced to the minimum cannot create an inclusive environment.”¹⁰⁶ This thesis attempts to design a classroom adapted for students with ADHD that would allow for the integrated classrooms to work more efficiently and successfully.

Legislation Regarding Accessibility and Inclusion in Schools

In 2001, Ontario created and passed The Ontarians with Disabilities Act (ODA). The Canadians further expanded upon this with the Disabilities Act, passed in 2015, which meant that the rights to equal access to education for people with disabilities were no longer dependent on provincial legislation. With these societal changes now backed by legislative changes, it is time to look at designing our schools to work for people with ADHD. Shifts in school typology happen when legislation works with societal understanding to come together and rethink schools’ designs.

Endnote

- 88 Passmore, Stuart. The ADHD Handbook, 2015, 1.
- 89 Passmore, Stuart. The ADHD Handbook, 2015, 3.
- 90 Greenbaum and Markel, Helping Adolescents with ADHD & Learning Disabilities.
- 91 “Facts / Stats (Facts and Myths),” Centre for ADHD Awareness Canada
- 92 Ibid.
- 93 ‘General Info - CADDAC’.
- 94 ‘ADHD in Women and Girls - CADDAC’.
- 95 ‘ADHD Symptoms Differ in Boys’ and Girls’.
- 96 Ibid.
- 97 LaBerge, ‘ADHD Unrecognized as a Serious Learning Risk in Many Canadian Schools’.
- 98 ‘B.C. May Finally Identify ADHD as a Learning Disorder’.
- 99 Policy on Accessible Education for Students with Disabilities, 47.
- 100 Ibid.
- 101 ‘Elementary and Secondary Education | Ontario Human Rights Commission’.
- 102 ‘Mainstreaming’.
- 103 Ibid.
- 104 ‘Elementary and Secondary Education | Ontario Human Rights Commission’.
- 105 Ibid.
- 106 Ibid.

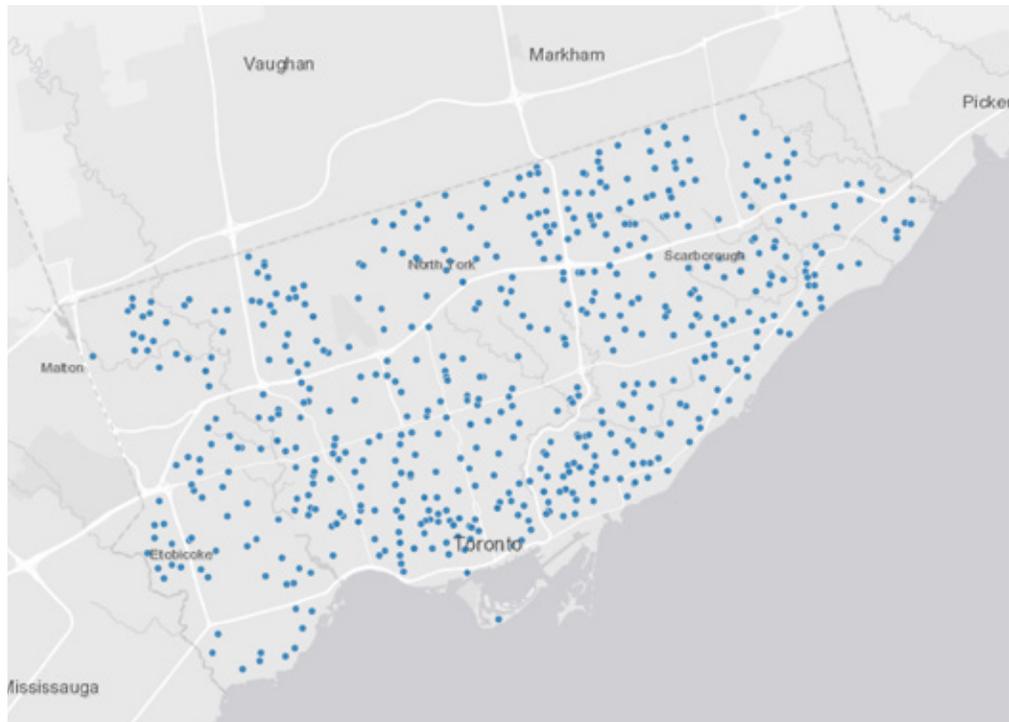
4 - Site Analysis

4.1 TDSB Schools

Before choosing a site for the project, the thesis first examined the existing Toronto District School Board schools. The Toronto District School Board (TDSB) is one of the largest school boards in both Canada and North America. It encompasses around 583 schools, 473 elementary schools (including 18 alternative schools and six special education self-contained schools), 110 secondary schools (including 20 alternative schools, six special education self-contained schools, and four safe school programs five adult schools). This thesis looks at how we can use this system already set in place to introduce inclusive design practices to the classroom through the design project of a new school. Using the TDSB has a more profound impact than fixing one school or creating a completely self-contained school.

When selecting a site for the inclusive school, the TDSB existing building was examined through their Facility Condition Index (FCI). The FCI is estimated by calculating the cost of building a new school for the same number of students and dividing it by its repair backlog.¹⁰⁷ This offers a unique opportunity to

create a new type of school to address these issues. “Almost half of TDSB school buildings were built more than 60 years ago.”¹⁰⁸ This offers a unique opportunity to create a new type of school to address these issues.



	SCHOOL	ADDRESS	GRADES	FCI %*	YEAR SCHOOL BUILT	REPAIR COST (\$, M, Sept. 2019)
1	Winchester Junior and Senior Public School	15 Prospect St, Toronto, ON	SK-08	136	1963	7
2	Jesse Ketchum Junior and Senior Public School	61 Davenport Rd, Toronto, ON	JK-08	113	1915	15
3	Timberbank Junior Public School	170 Timberbank Blvd, Scarborough, ON	JK-06	111	1970	8
4	Pierre Laporte Middle School	1270 Wilson Ave, North York, ON	06-08	108	1970	9
5	Earl Grey Senior Public School	100 Strathcona Ave, Toronto, ON	07-08	105	1960	11

Figure 60 | 'Schools TDSB'. Accessed 23 December 2021.
 Figure 61 | Rieti, John, Angelina King, and Katie Swyers, TDSB FCI Table

4.2 Pierre Laporte Public Middle School – 1973

Toronto, Ontario
Shore & Moffat

Pierre Laporte Public Middle School opened in 1973, enrolls around 406 students and has a capacity of 444 students.¹⁰⁹ It is located in an inner suburban location in Toronto and teaches children from grades six to eight. The school has a Behavioral and Gifted Program and a large demographic of English as a Second Language students.¹¹⁰

Pierre Laporte Middle School was chosen as the site for multiple reasons: the FCI school and the site. It has an FCI number of 107.73; many repairs are needed to repair the school, (figure 61).¹¹¹ The site is located on a large plot of land and a large adjacent park that provides plenty of opportunities to integrate natural elements into the school's design. Similar to the Crow Island School and the Diana Reggio Emilia School, the different outdoor environments provide plenty of outdoor learning opportunities. Furthermore, the large land size allows the school to be designed to maximize light, and natural ventilation, which is beneficial in the Orde Public School.

The school has 70 parking spots for staff and visitors. For the students, there are many

options for transportation. There is a pick-up and drop-off area for parents. There is a TTC bus stop right in front of the school (Figure 64). The site that the school is located on is around 3.5 hectares. Most of the outdoor space is a field dedicated to a football field (figure 68). A small portion of the land is paved over and used as a basketball court (figure 67).

Roding Public Park

Attached to the site is a large, 8-hectare public park, Roding Park, which offers many learning opportunities for the school. The site has valleys and hills, forested areas and wetland-like areas (figures 69 and 70 below). These different environments create outstanding learning and exploring opportunities for children. Beyond the natural elements, there is a baseball diamond, four outdoor bocce courts, two tennis courts, children's playgrounds, and outdoor fitness equipment within the Roding Public Park.¹¹²



Figure 62 | Pierre Laporte Middle School – Exterior View
Figure 63 | Pierre Laporte Middle School – Exterior View





Figure 64 | Pierre Laporte Middle School – Site Plan
Figure 65 | Pierre Laporte Middle School – Site Plan
Figure 66 | Pierre Laporte Middle School – Site Plan



Figure 67 | Pierre Laporte Middle School, Paved Playground
Figure 68 | Pierre Laporte Middle School, Field



Figure 69 | Roding Park, Wetland/Marshy Area
Figure 70 | Roding Park, Forested Area

Endnote

107 'Toronto District School Board > About Us > Accountability > Renewal Needs Backlog and Facility Condition Index > Facility Condition Index'.

108 Ibid.

109 'Toronto District School Board > About Us > Accountability > Renewal Needs Backlog and Facility Condition Index > Facility Condition Index'.

110 'Renewal Needs Backlog'.

111 Ibid.

112 Recreation, 'Roding Park'.

5 – Designing an Inclusive School

Classroom Explorations - Part 1: Square

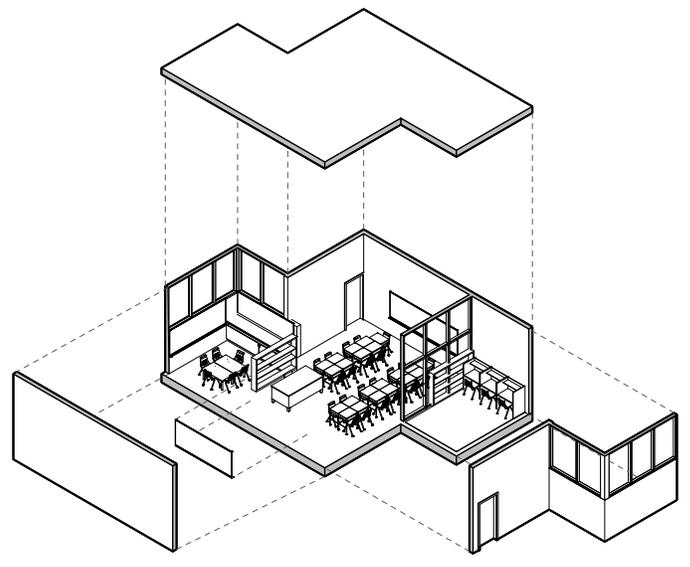
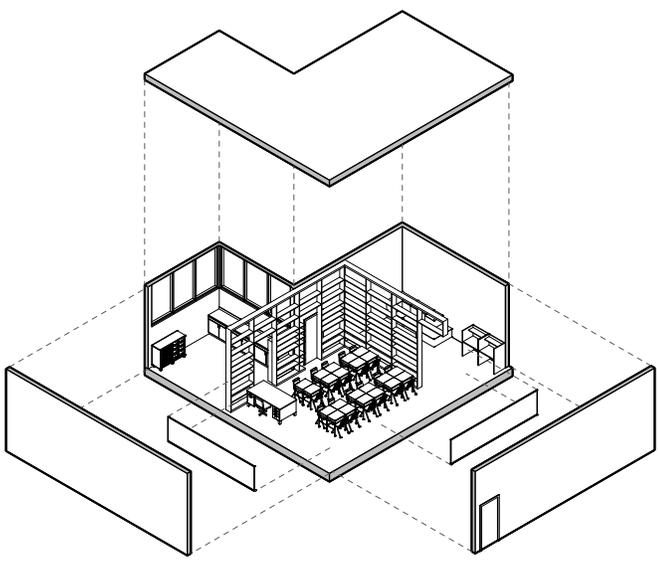
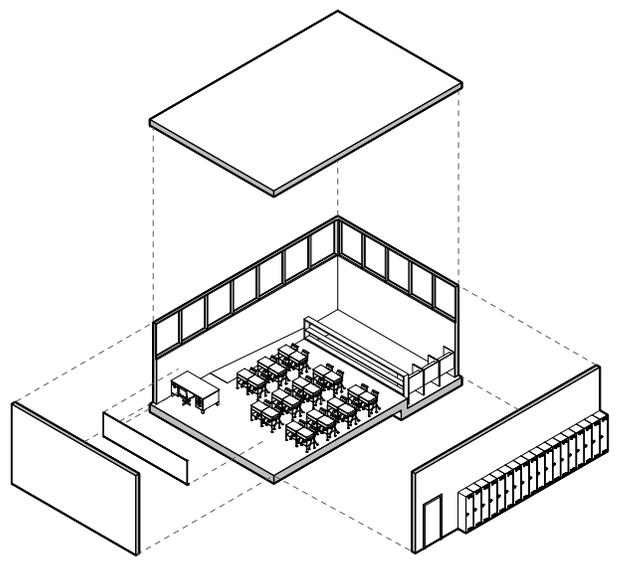
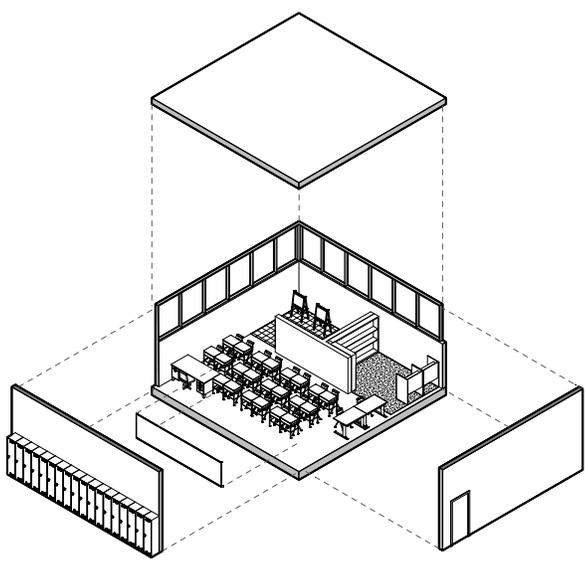
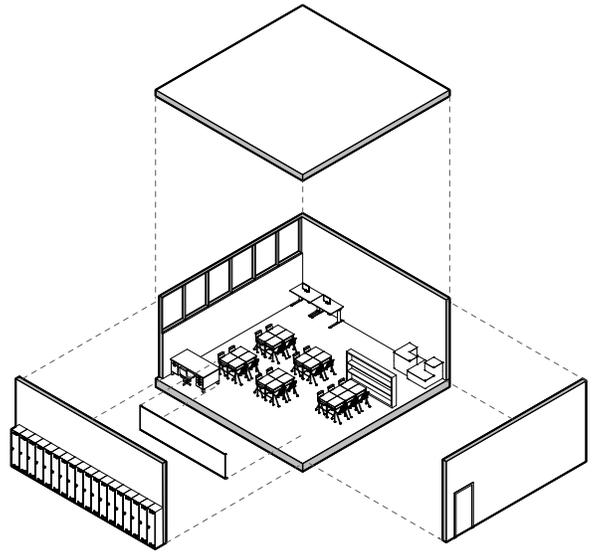
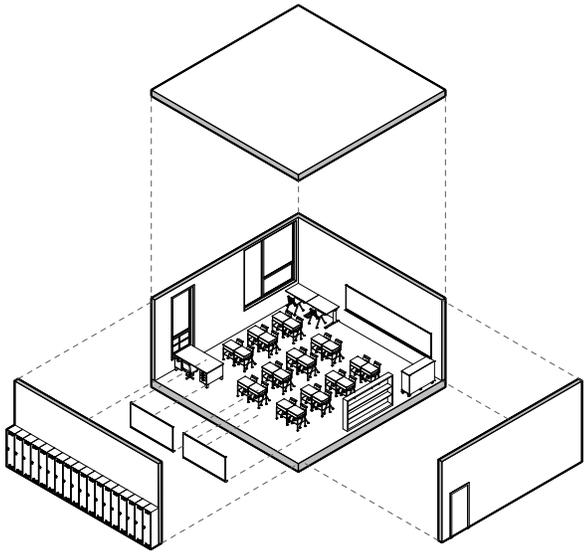
This thesis began the design process by starting with the Keele Street Public School classroom and then worked through iterations to see how different architectural decisions impact the classroom environment. Additionally, a couple of guiding standards were used. These include designing for 23 students as this is the average classroom size in a TDSB school and using the TDSB guidelines for their schools. Through around 25 iterations, the design of the classroom came into shape.

One of the first design changes was adding clerestory windows to the classroom. Clerestory windows are used as they provide plenty of natural lighting while obstructing distracting views from outside, which helps students stay focused. This type of window also limits glare. The other significant change was moving the bookshelf to create a nook in the back of the classroom.

The next step was to create effective transition zones. Transition zones between areas with different activity levels allow students to recalibrate properly. As well as creates adjacent rooms for rooms such as cafeterias and

classrooms with high concentration levels where a student can relax. This gives students agency to remove themselves to moderate sensory overload without making them leave the class entirely. There are many ways this can be done architecturally. This thesis experimented with a couple of ways to achieve this, such as using partitions, creating nooks, and using different floor levels and scales.

The changing of the floor level to create a separate space was inspired by the Delft Montessori School case study. At the same time, the 'L' and 'Z' shapes of the later classrooms are inspired by the Crow Island School. Creating a separate room with a curtain wall creates another separation layer, allowing for more control over the nook. The curtain wall creates both a noise and a visual divide. The curtain wall still allows the teacher to see into the room to supervise.



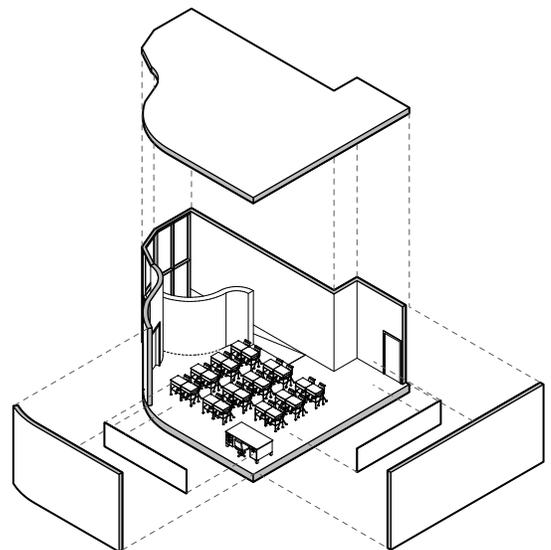
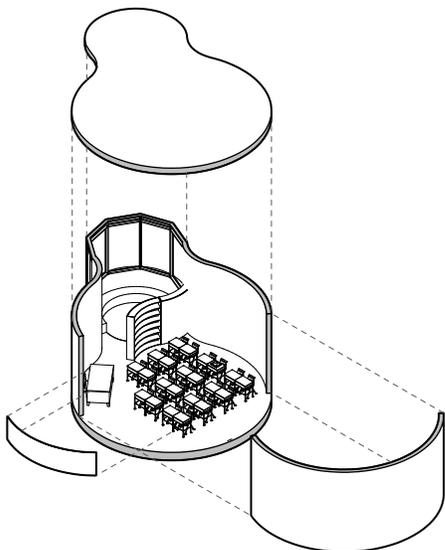
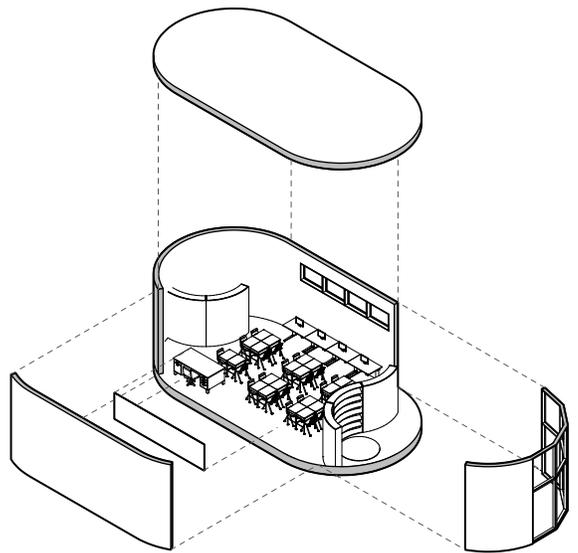
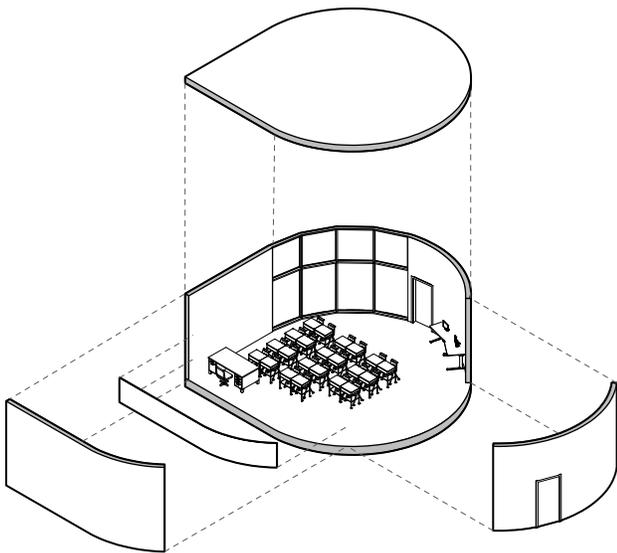
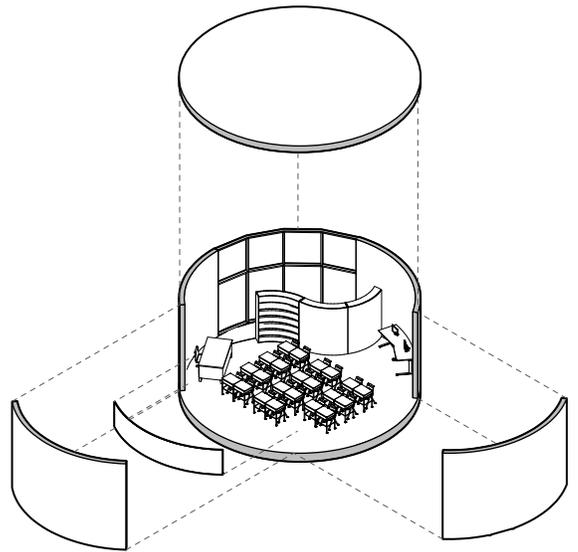
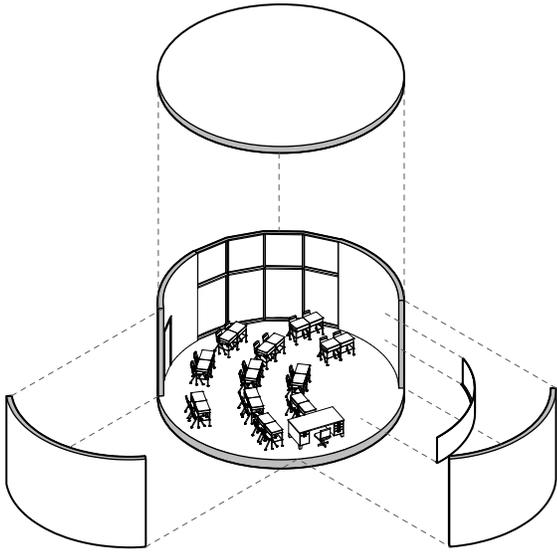
Classroom Explorations - Part 2: Circular

The circle-shaped classroom allows for different opportunities than the square and rectangular classes. One of the most significant downsides of the circle shape is that it makes sensory zoning harder. This was overcome by experimenting with ovals and adding a separate circle to the central class circle. The other challenge with circular and curved walls is that choosing furniture is more complicated. It would require more custom furniture, which would be more expensive and would allow less flexibility in terms of the movability of the furniture.

When designing the lighting for an environment with people who have sensory disorders, it must be explicitly chosen. This impacts many neurodivergent people, from ADHDers to autistic people. The traditional lighting fixture in classrooms is fluorescent, and fluorescent fixtures can be very irritating and distracting. In order to create a more inclusive classroom, different lighting must be used. A good option would be to use varied lighting strategies, which allows the light level to be adjusted depending on the activity. A good lighting strategy uses dimmable indirect LED fixtures with natural

daylighting and task lighting.

Acoustics is another area in which neurodivergent people can be hypersensitive too. Therefore, the way the classroom is acoustically treated can hugely impact the quality of education.



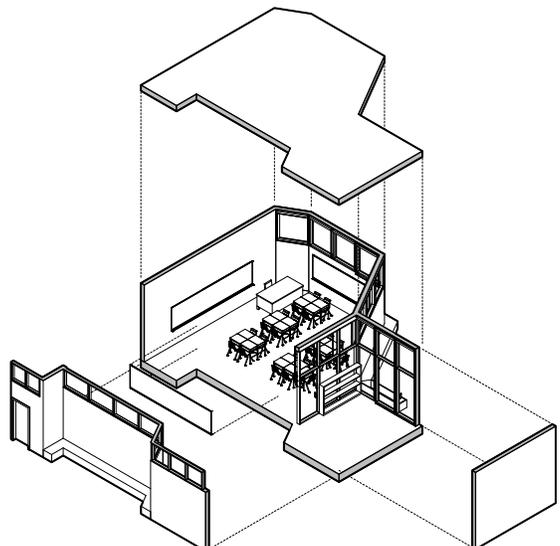
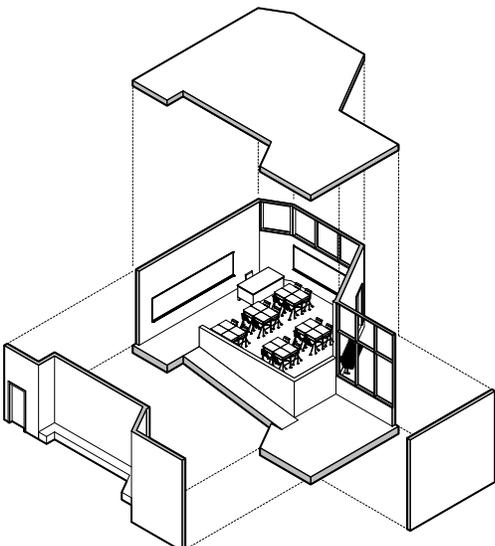
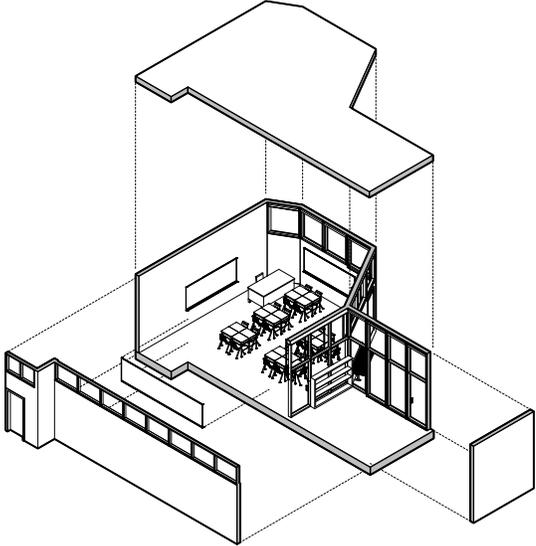
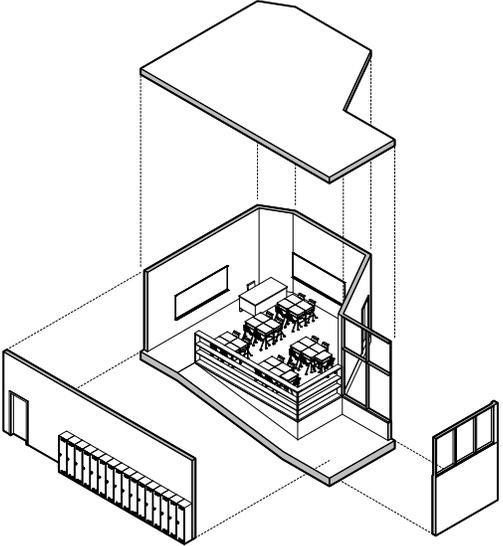
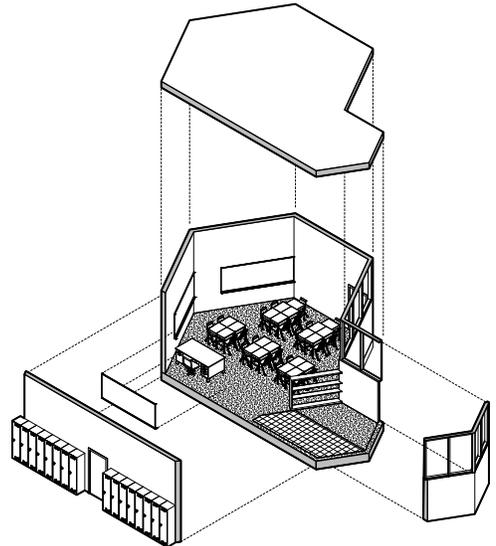
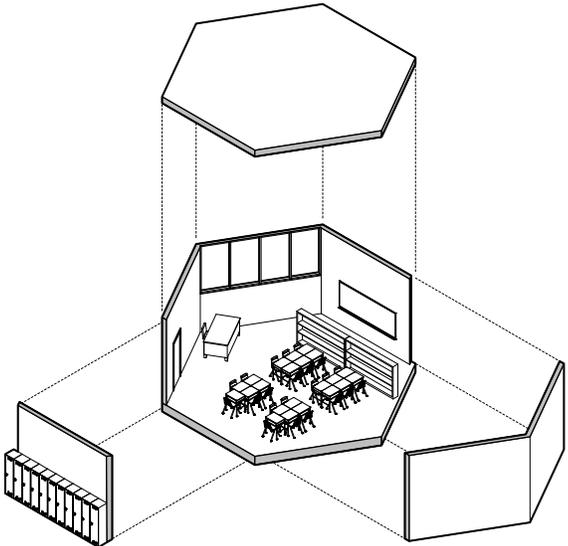
Classroom Explorations - Part 3: Geometric

The more geometric-shaped classroom experiments comprised the stricter square classes and the more freeform circular ones. This led to creating a hybrid “L” shaped classroom. The later experiments with how we can accumulate the classes led to more experiments with the shape of the class. Once the way the classes interact and the space created between them is considered, the shape of the exterior of the classroom must be reconsidered. This process can be seen in Figure 73.

The classroom began with figure 73 when this classroom shape was determined to be the best for the typical homeroom classroom. It started with having a ramp and a bookshelf to create a separate nook in the classroom. This was then changed to being on the same level but divided by a curtain wall; this was decided to reduce the noise level while still allowing the teacher to supervise.

The entrance was accentuated and extended, creating a nook on the outside of the classroom. This exterior nook was further emphasized by extending the interior one. The other significant change was the windows.

Clerestory windows were added to the central zone, both on the wall facing the exterior and the hallway. This creates a visual link through the classroom and adds more natural lighting. The interior nook was left with complete curtain walls, but blinds were added so that the students could choose how bright they would like it to be—giving them further agency over their surroundings.



Creating the Third Spaces within the School

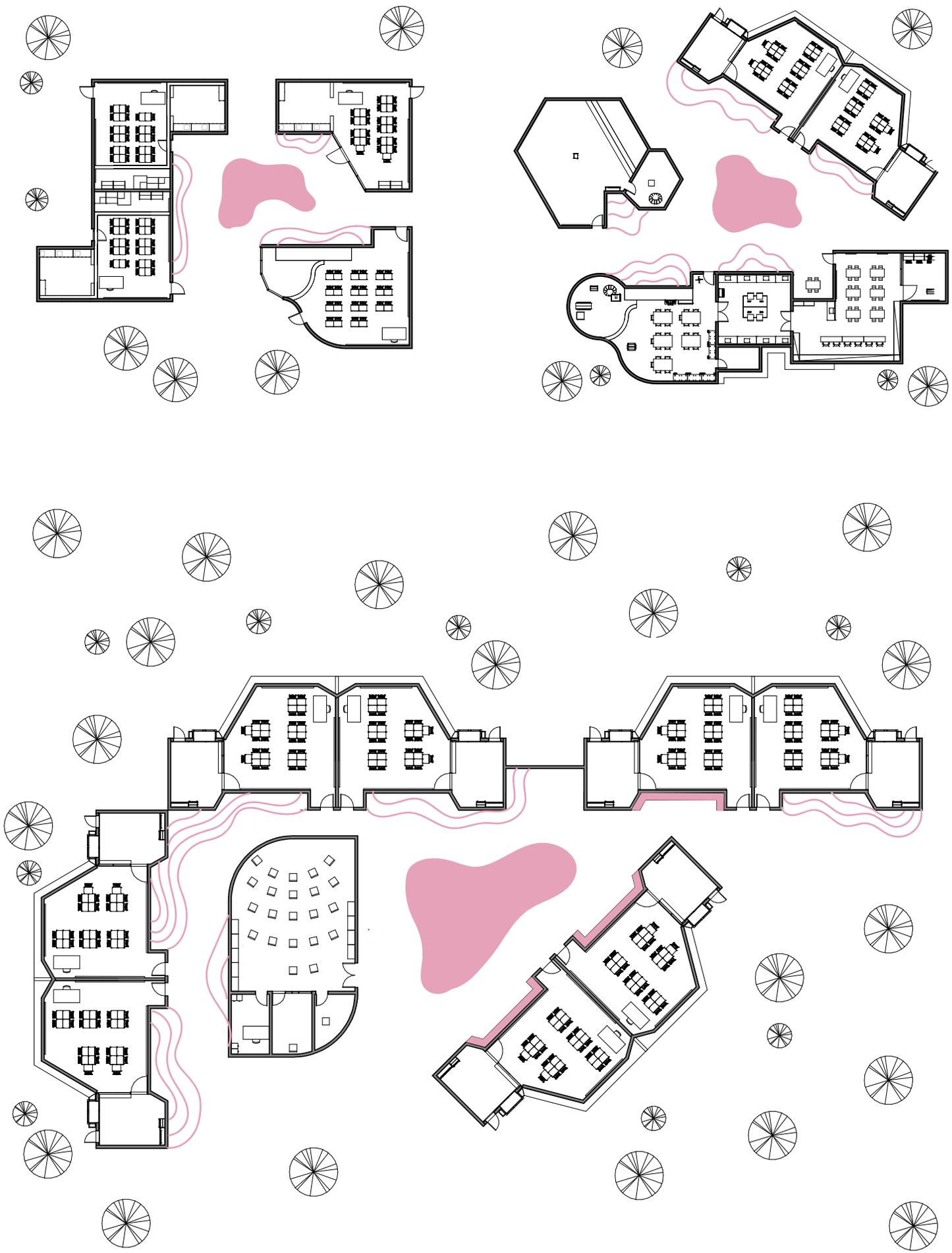
After experimenting with the classroom design, it was time to explore how the classroom combines to create a school. There are many goals to achieve when combining the classrooms. The three main ones are how the accumulation creates a third space in the corridor, how the classroom links to the outside, and how transition zones are managed and created. The way entrances and transitions are designed is essential, as covered earlier when designing the classroom.

The idea of the third space leads to the accumulation of creating different zones in the school's corridors. This thesis attempted to break away from the single-loaded corridor of the old graded and contemporary schools. No longer is the hallway just a tool to get someone from one class to another.

This was inspired by the concept of the third space and by the case studies for the open-plan, Montessori, and Reggio Emilia schools, in which the corridor is another learning environment outside of the classroom.

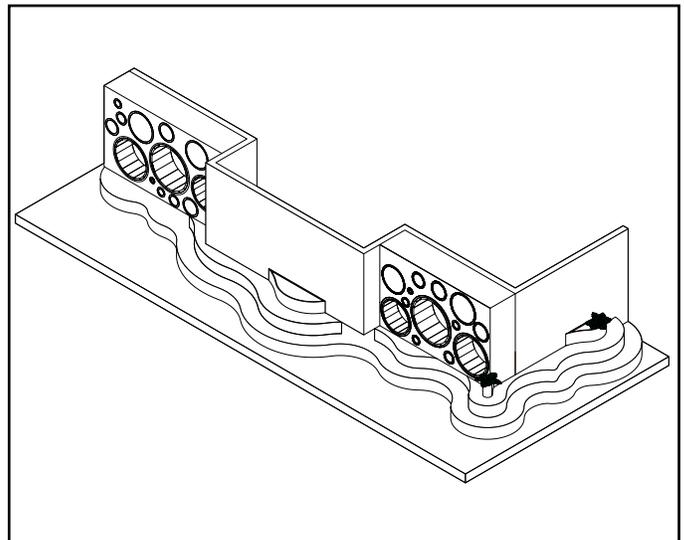
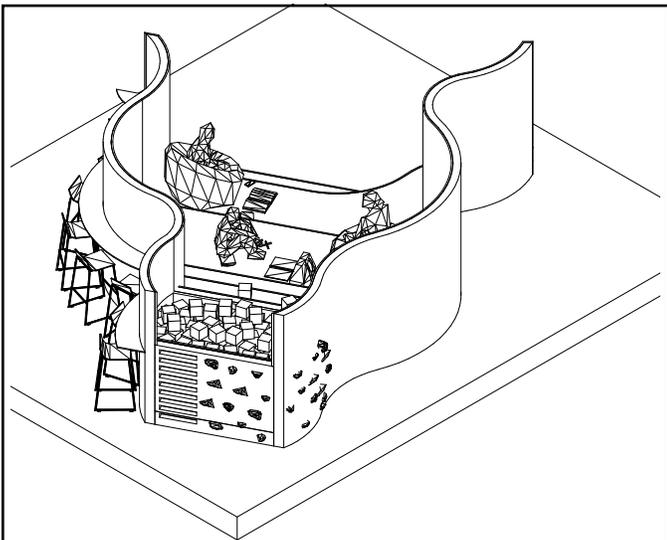
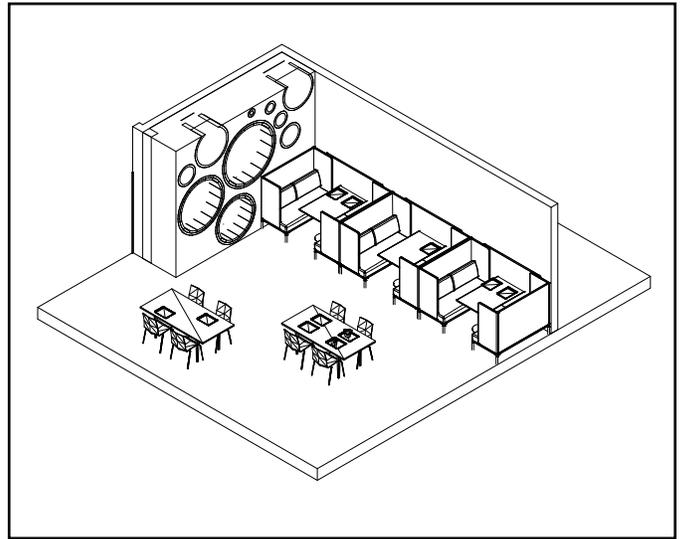
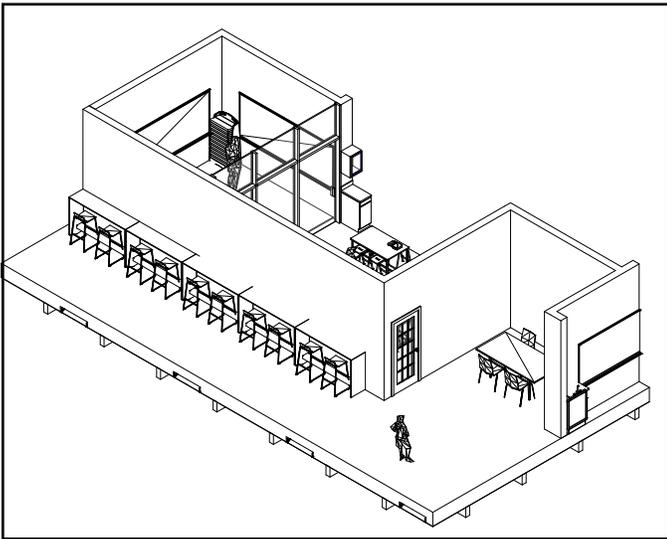
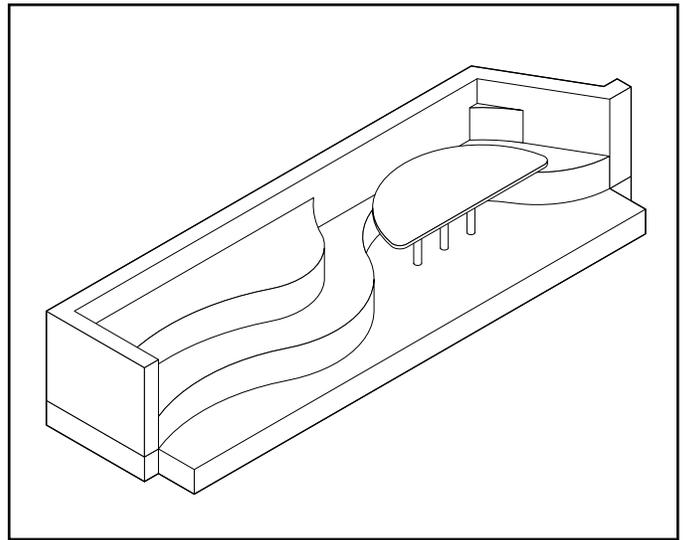
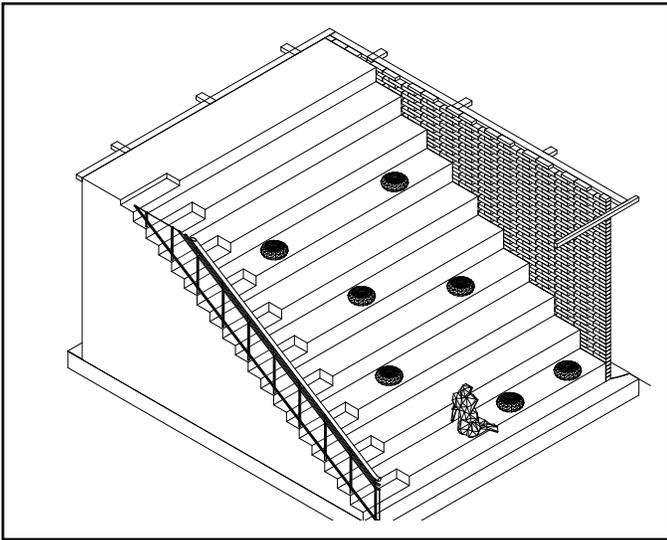
These spaces are areas that promote independence and agency to the students by

providing the choice of which environment they feel will aid them in learning. They get to choose how they want to learn and what sensorial level would be best for them. All of this led to extensive experimentation; a couple of them can be seen in figures 74.



Potential Third Spaces

The third space explored was divided using sensory zoning. The main four zones created are transitional, active/play, social/communal, and relaxing (figure 75-6).



Potential Third Spaces

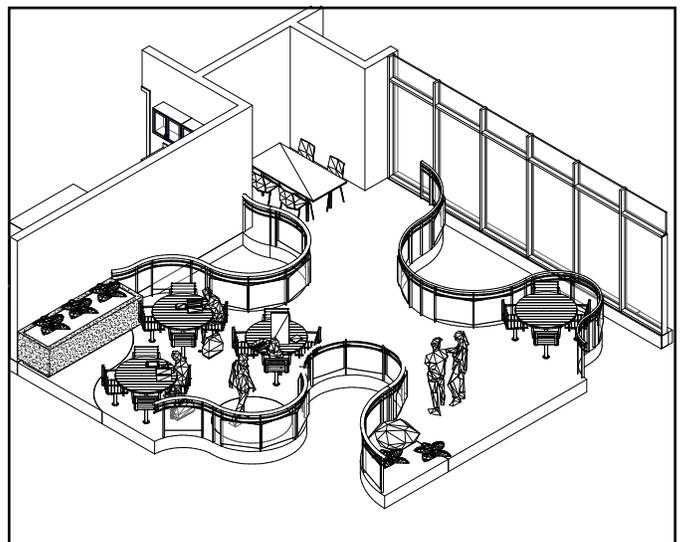
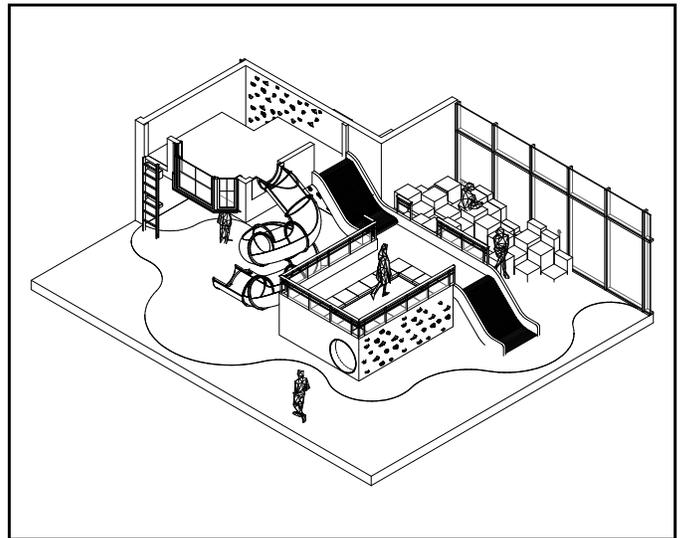
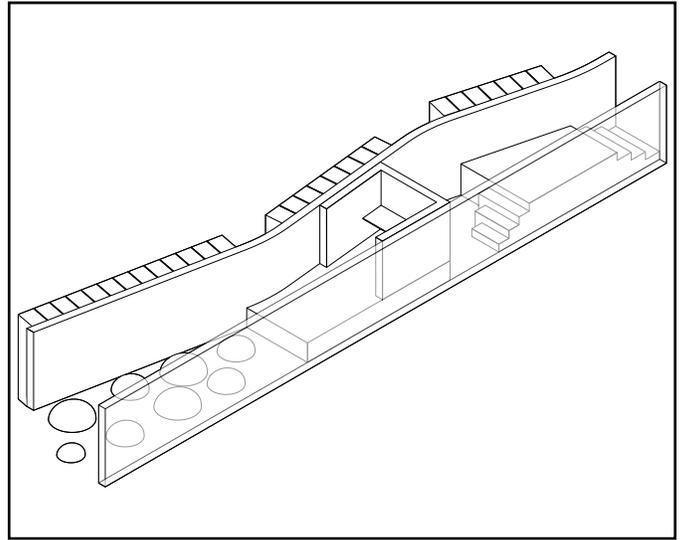
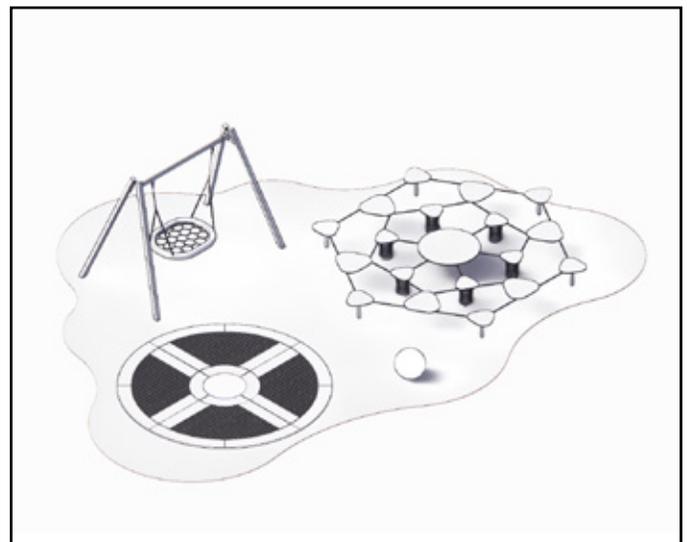
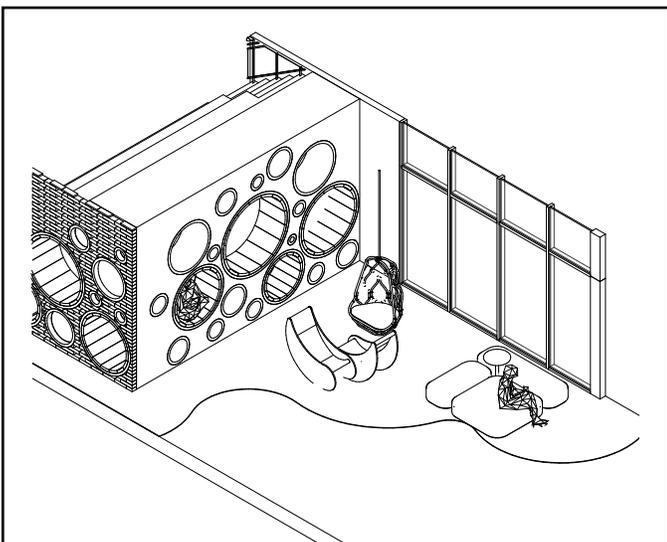
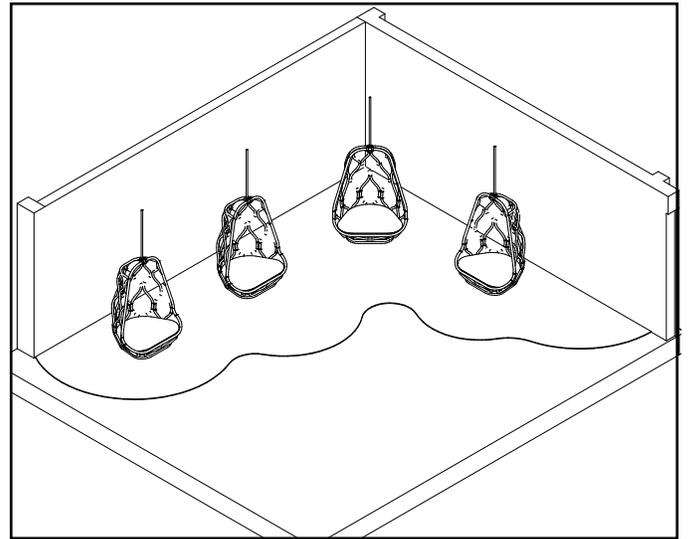
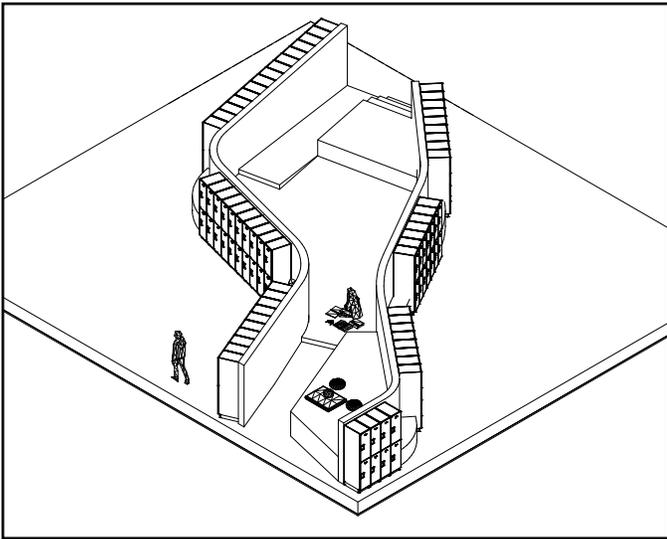
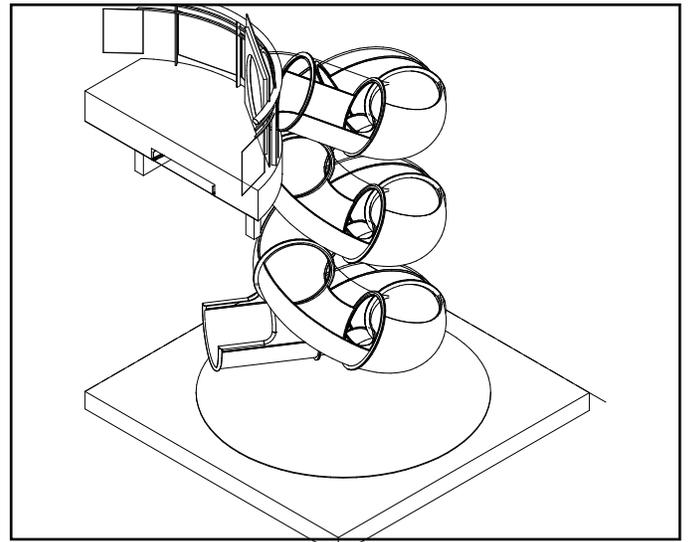
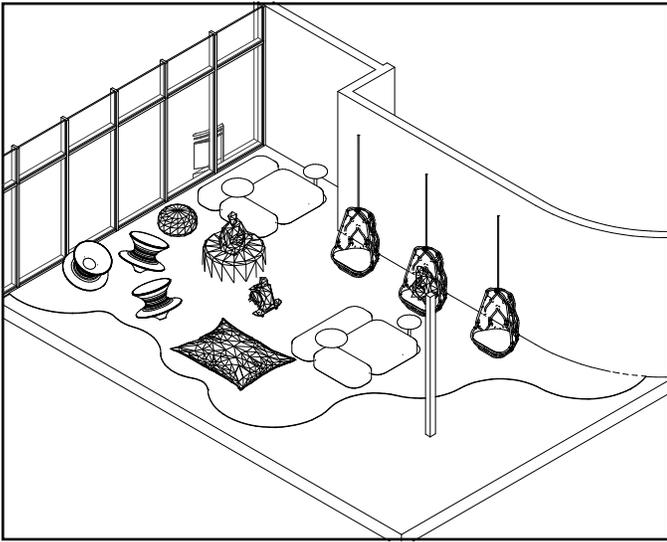


Figure 76 | Third Space Diagrams



Designing the Site - Exterior Third Space

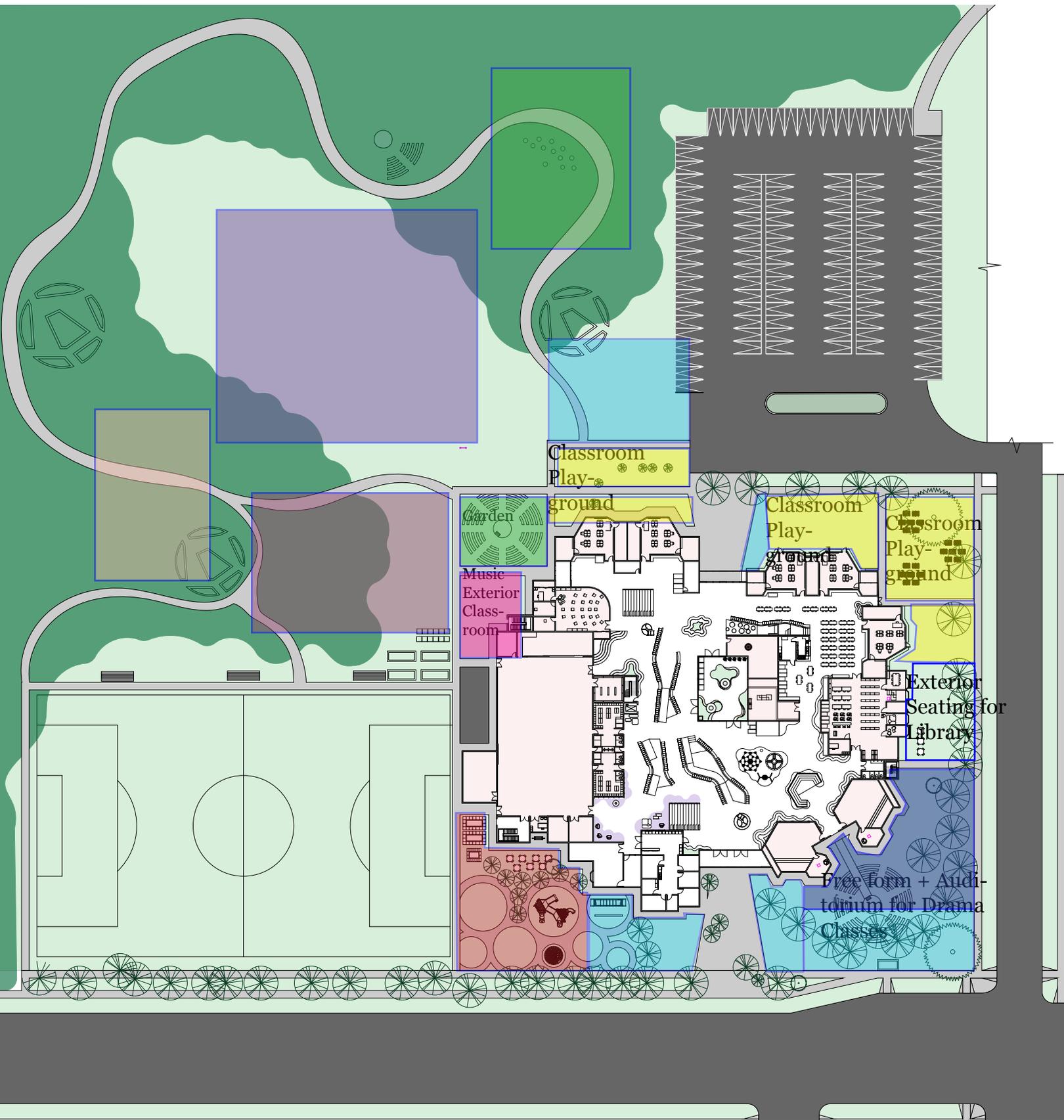
The site plan design process began by dividing the site into different zones for various activities, with the intent to create play and learning environments that would be inclusive to everyone, from neurodivergent people to people with physical disabilities to everyone else. This was done through careful experimentation of the different factors that come into creating site features, the materials used, the height of the structures, the type of playground equipment, the type of paths, and more. This experimentation was done through the lens of universal design to create a zone where the most people's needs would be met. In addition to artificial equipment, the goal was to use and highlight the site's natural elements as learning opportunities.

After dividing the site, this thesis explored the different learning activities and play types. It was decided to focus on creating zones for active and quiet activities and more intuitive active open-ended play rather than static play areas.

Activities such as sand and play tables, playhouses, and swings offer emotional and social growth opportunities and promote

sharing and group work. Whereas playground equipment such as teeter-totters, slides, swings, monkey bars, and spring are opportunities for motor skills growth. Lastly, to promote sensory growth, equipment such as a sound panel, sand or water play structures, and gardens can encourage artistry and sensory awareness and have sensory interaction by incorporating tactile, auditory and visual elements.

Natural components of the site are just as important as artificial ones, and they offer meaningful play opportunities to instill a sense of discovery, agency, and inquiry in children. In order to make the natural spaces comply with universal design concepts, pathways must be made to encourage exploration and provide better access for different types of users. Gardens are excellent opportunities for teaching children multiple lessons, such as responsibility and the different types of native plants and vegetables. Using raised planters allows for universal use. Informal seating and gathering spaces on the site encourage outdoor classrooms and playing in nature. In addition, to artificial seating places in nature, boulders and logs strategically placed



- | | | |
|---|--|--|
| = Transition | = Typical Class Court- | = Freeform Nature |
| = Music Room Court- | = Playground | = Sensory learning Zone |
| = Drama Room Court- | = Garden | = Quiet Zone |

Figure 77 | Exterior Third Site Zoning Diagram

Potential Exterior Third Spaces

also offer climbing and seating opportunities. Trees and other plants allow for interaction with wildlife and offer shade.

Colour must also be taken into account when designing. Using colour badly can harm students with colour-blindness or vision loss. Not using contrasting colours on borders and edges of zones and equipment can be hazardous as it is needed as a warning.

There must also be opportunities for solitary activity. As well as areas for single play with the option of observing how other children play and interact for children to learn from example. Sightlines must be accounted for so that teachers, caregivers, and other staff can observe the children and ensure their safety.

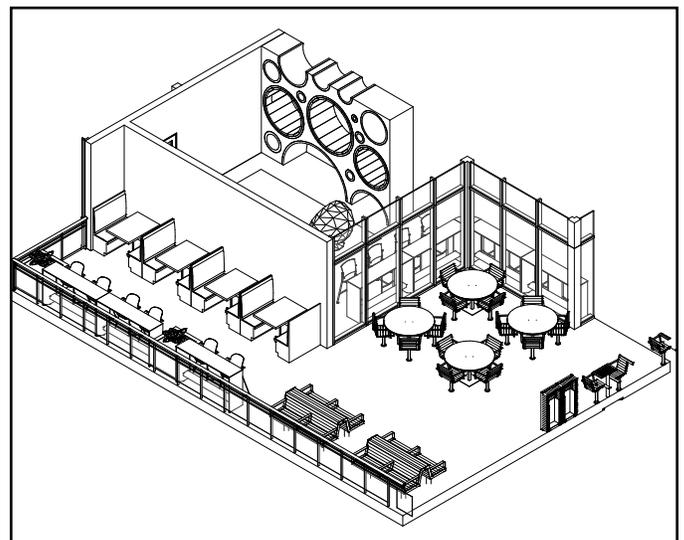
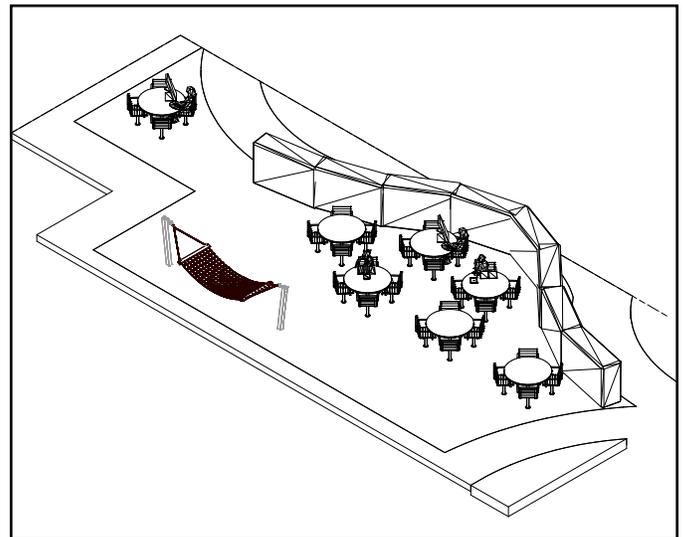
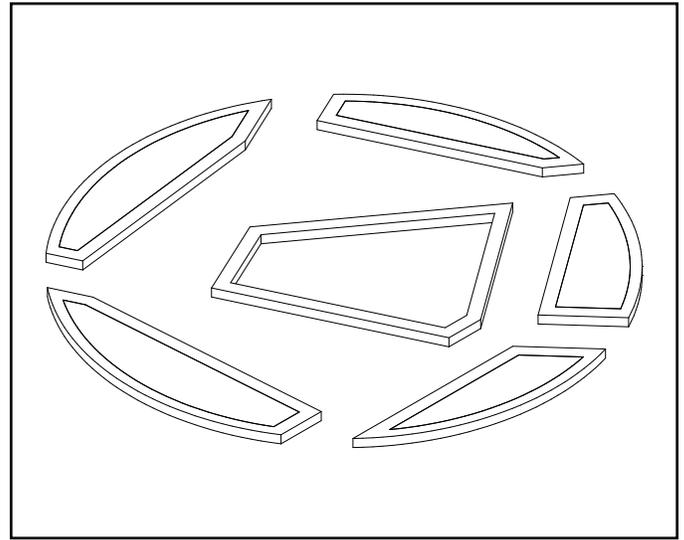
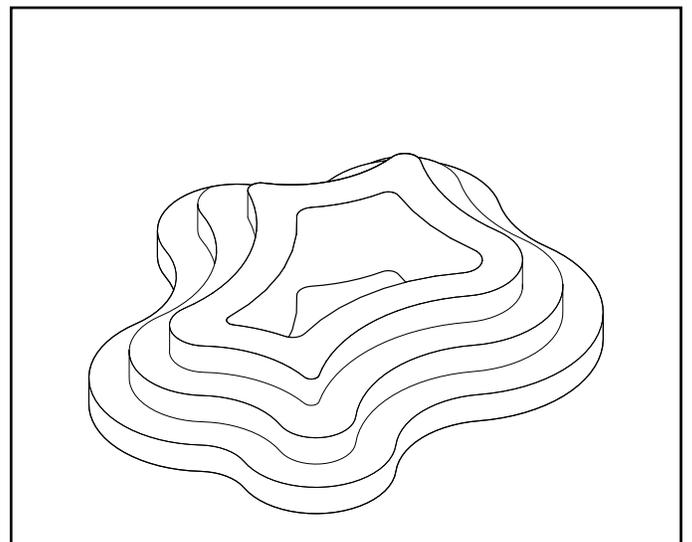
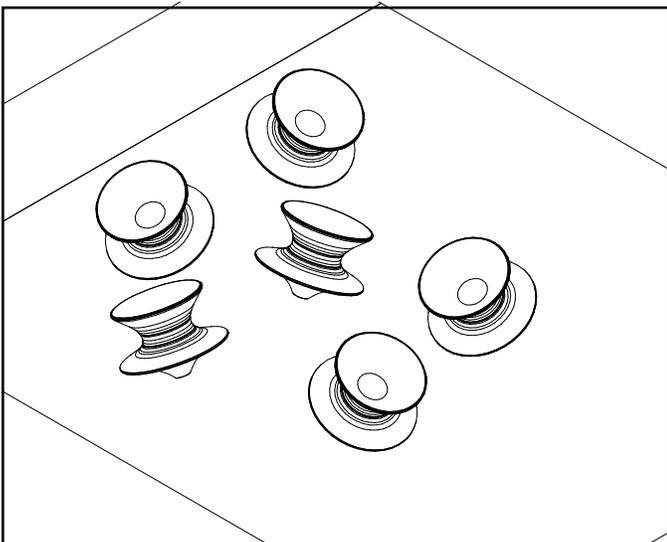
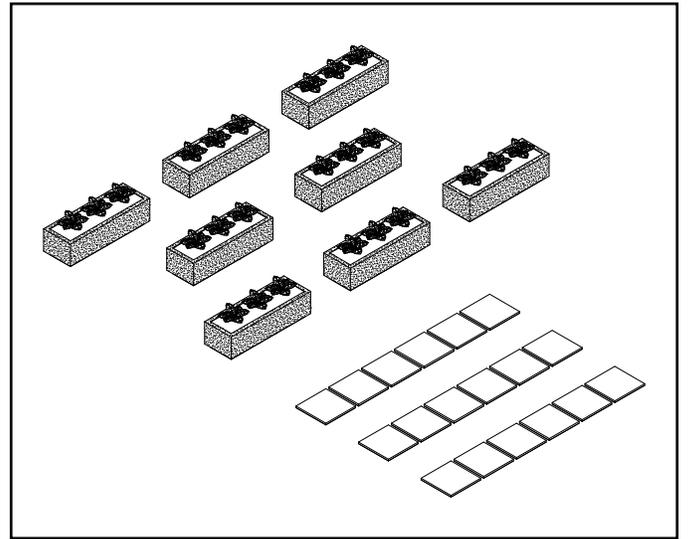
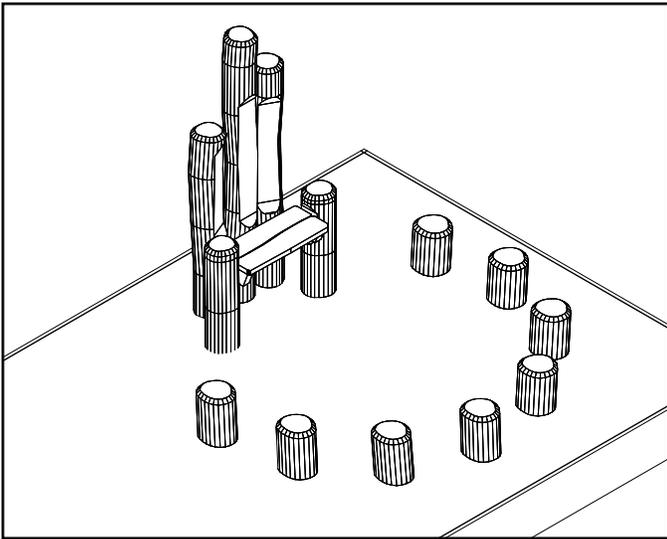
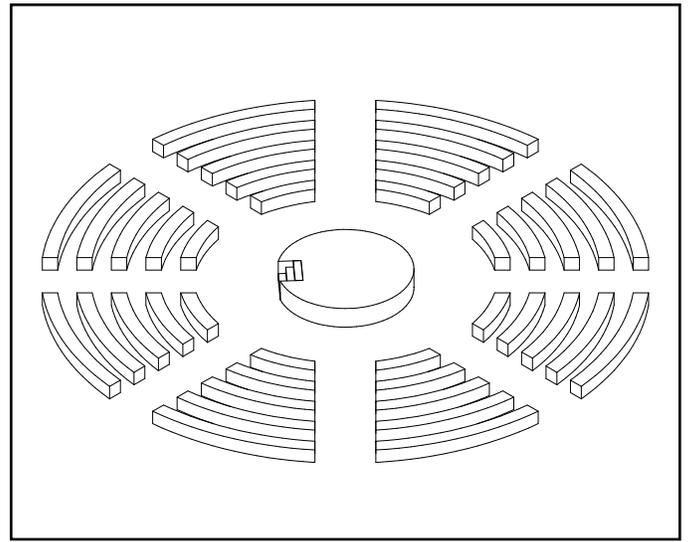
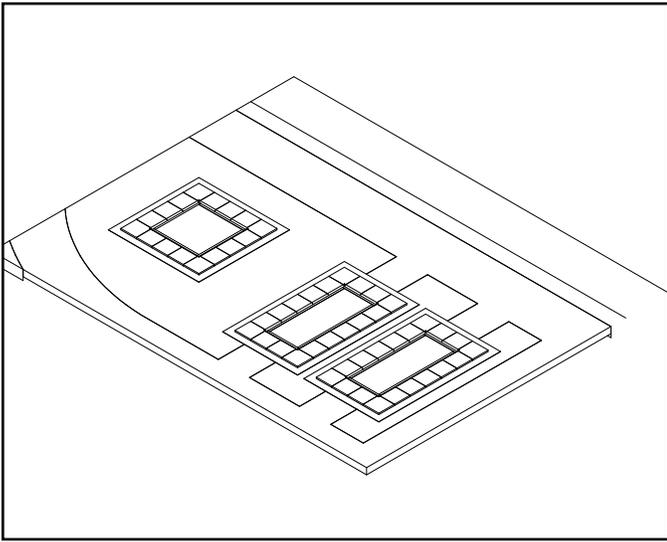


Figure 78 | Exterior Third Space Diagrams



6 – The New Pierre Laporte Middle School

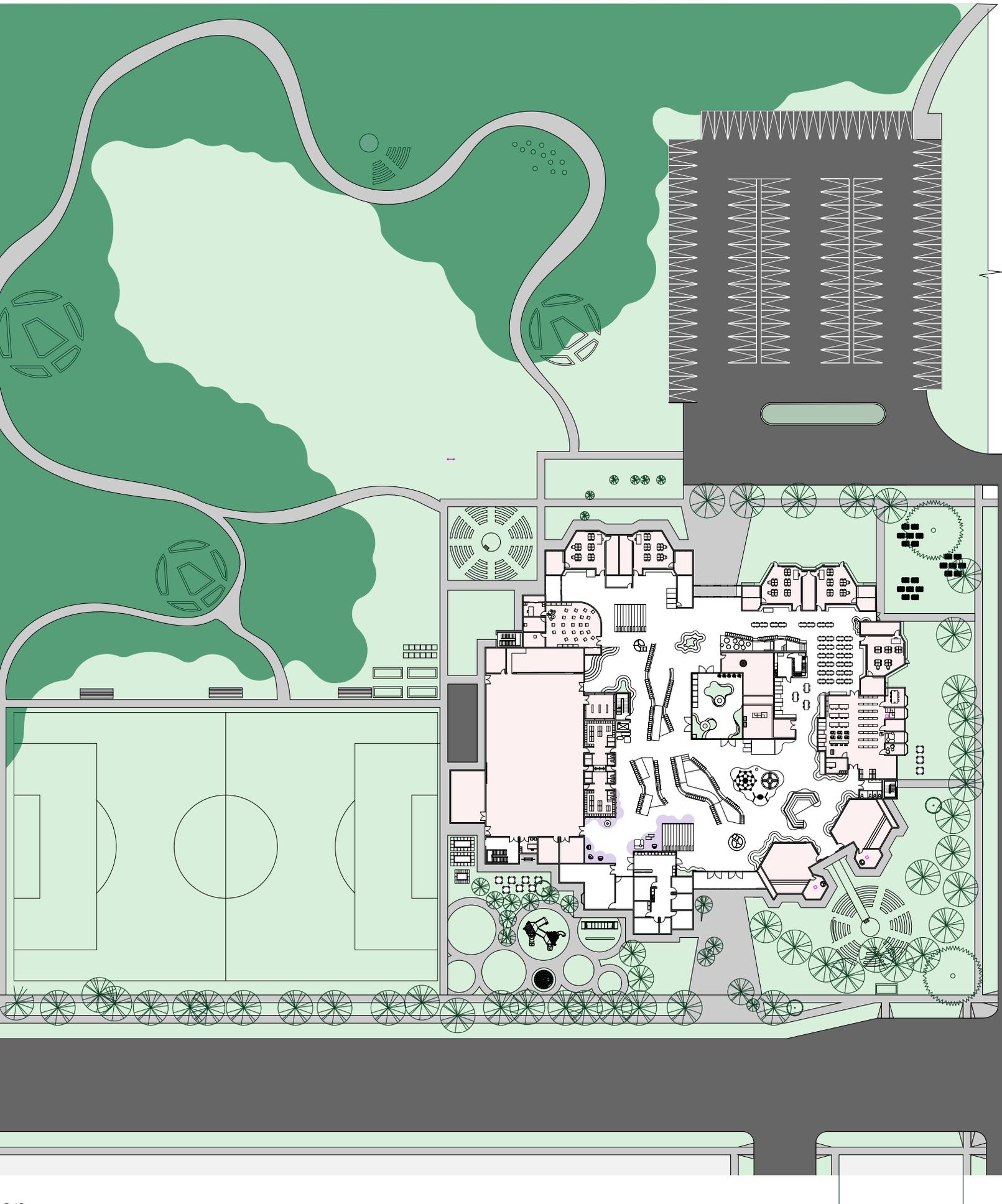
The New School



Figure 79 | Front Entrance Render



6.1 School Plan



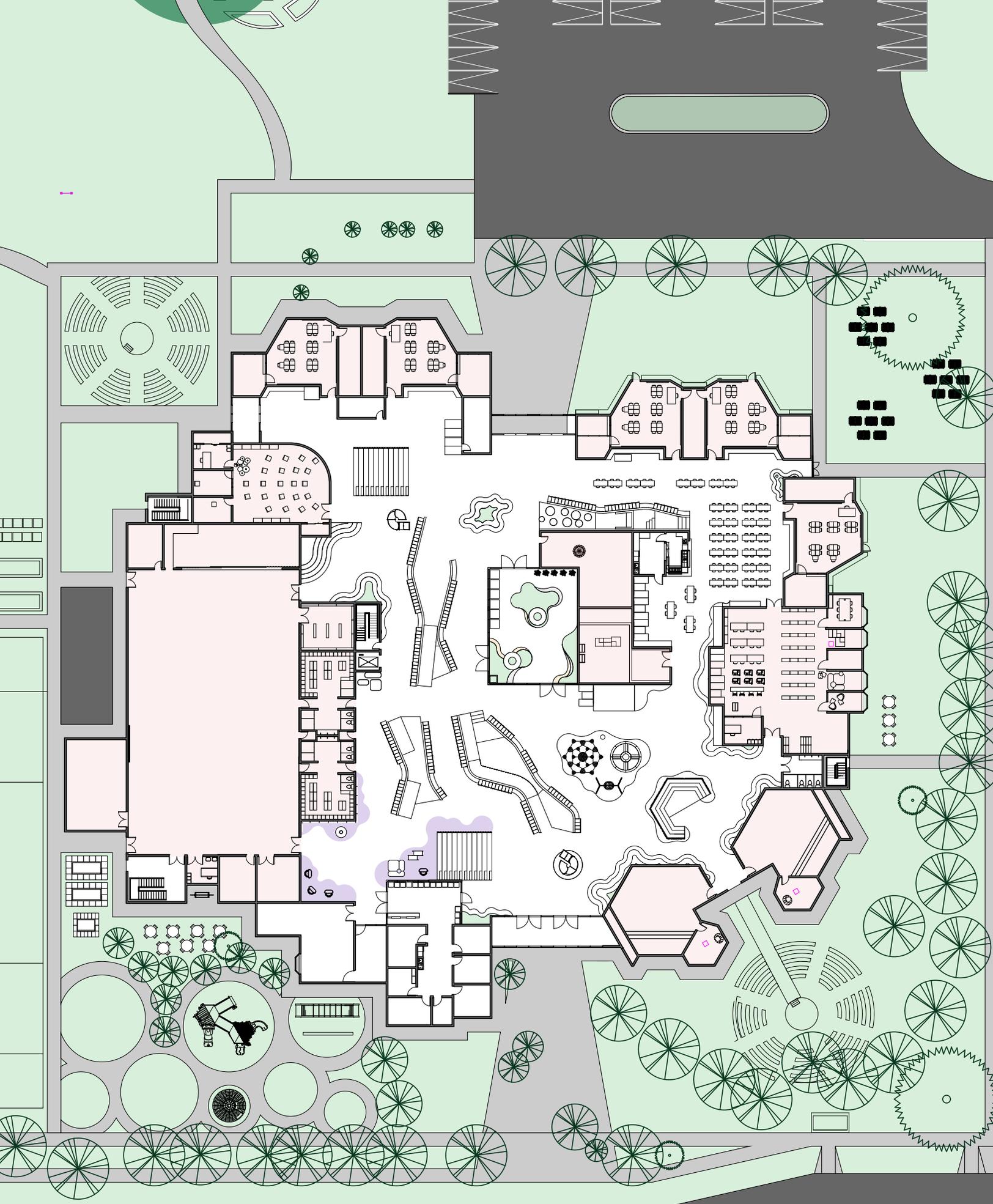


Figure 81 | Level 1 Plan

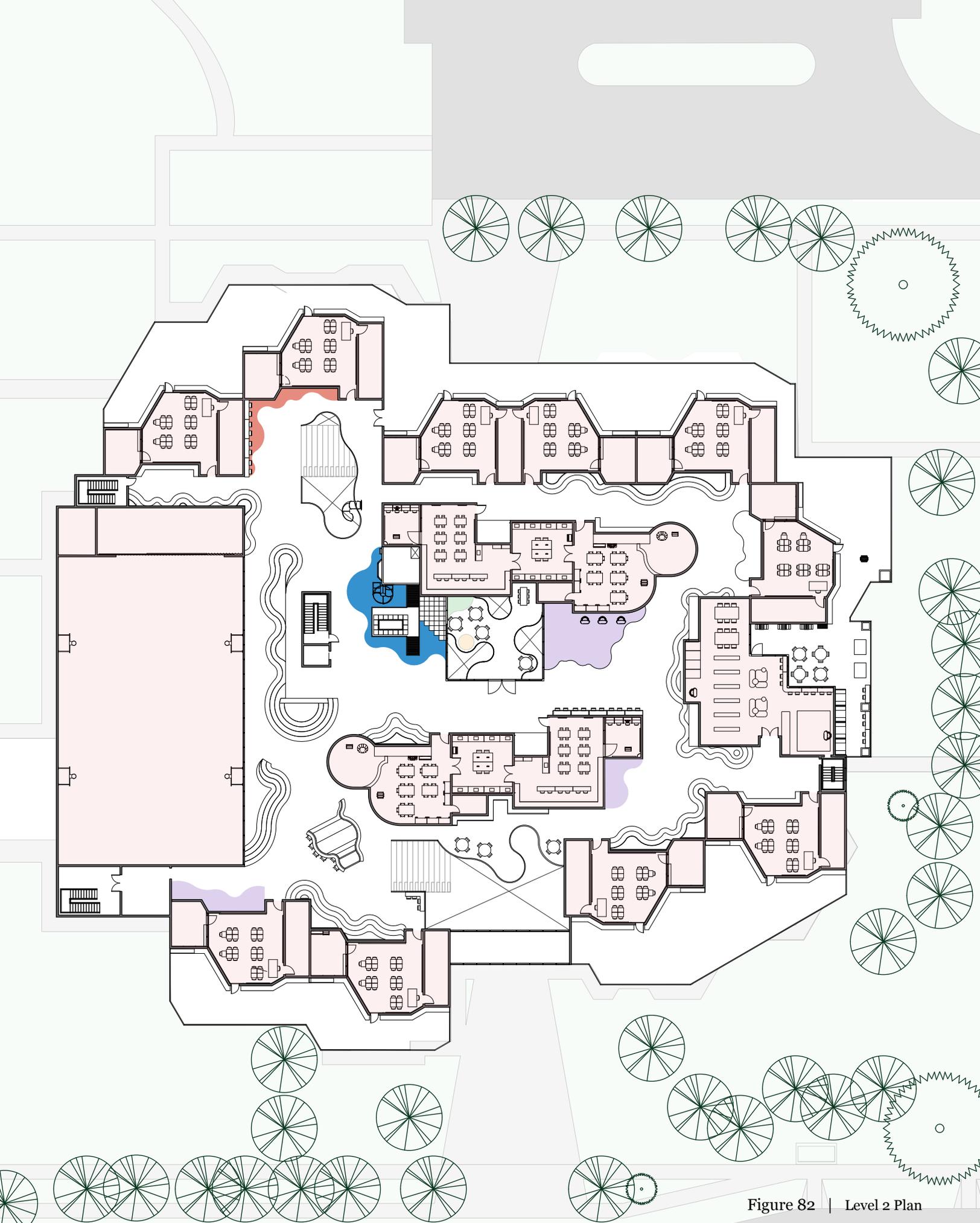


Figure 82 | Level 2 Plan

6.2 Classroom Design - Typical Classroom

The typical classroom layout is a variation of the 'L' shaped class. This layout was the most effective way to create sensory zoning, transitional spaces, and a support space while also creating room for a range of educational activities. The additional storage space means plenty of room for different educational equipment and tools and alternative seating and desk choices. Clerestory windows offer plenty of natural lighting while limiting potential distractions. The shape of the class also creates a link to the outside while creating a zone for each class to have a courtyard of their own.

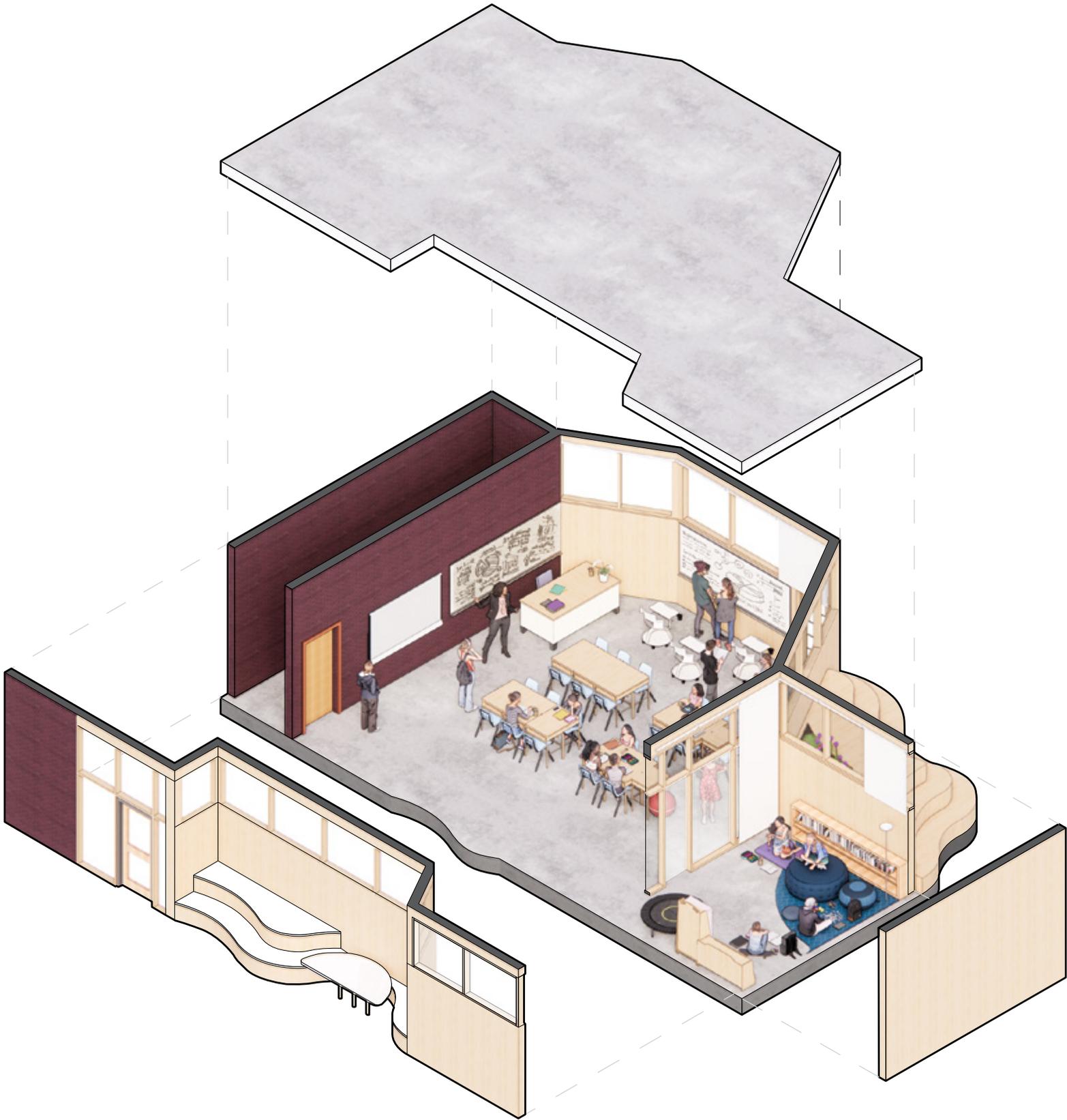


Figure 83 | Typical Classroom Axonometric

Drama Room

The style of teaching methods informed the shape of the drama class. Drama is more freeform with less structured lecture-style learning. This means that the furniture is more dependent on what the children are learning, and there is no need for desks. Mirrors are added to two of the walls with curtains for the option of covering them, which is a requirement per the TSDB. A small stage was added to the room for students to practice.

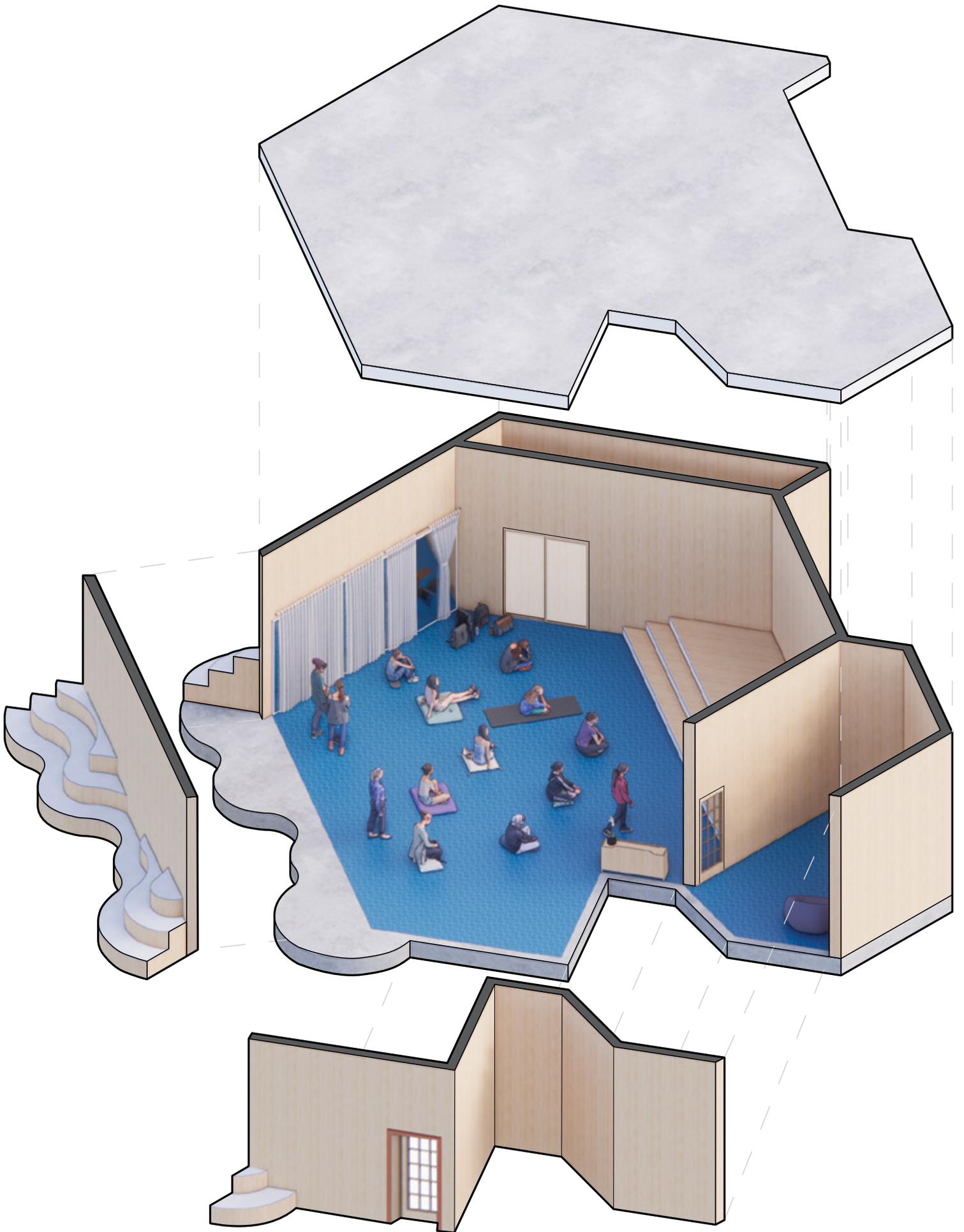


Figure 84 | Drama Classroom Axonometric

Music Class

Similar to the drama room, the music classroom is also different in that it is a more participatory and group-style learning environment. The circular layout of the class promotes this. One thing unique to the music classroom is the addition of a soundproof room that is needed for multiple reasons, such as individual music tests or practicing an instrument. The music classroom is near the gym's stage for easy access during performance times.

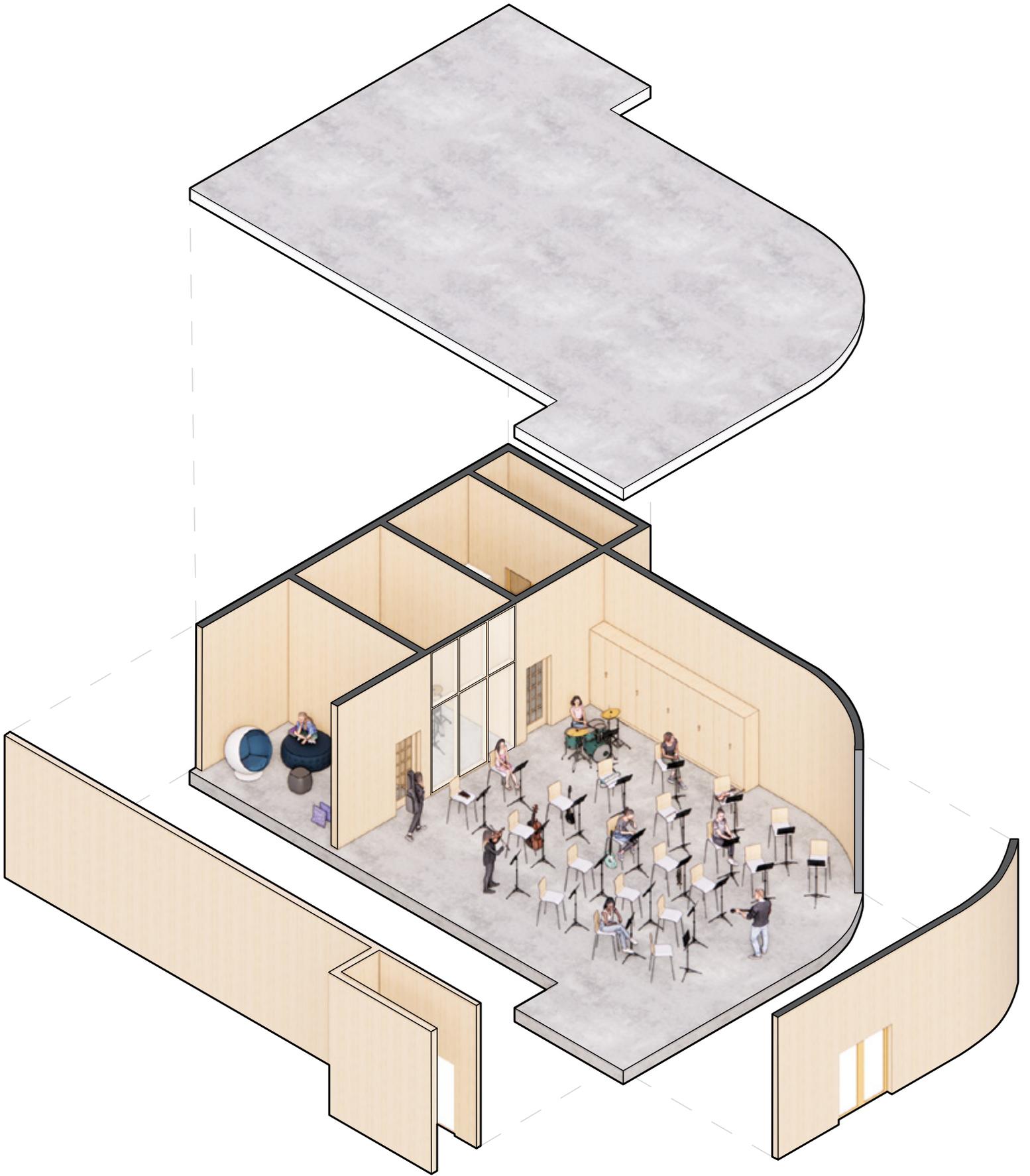
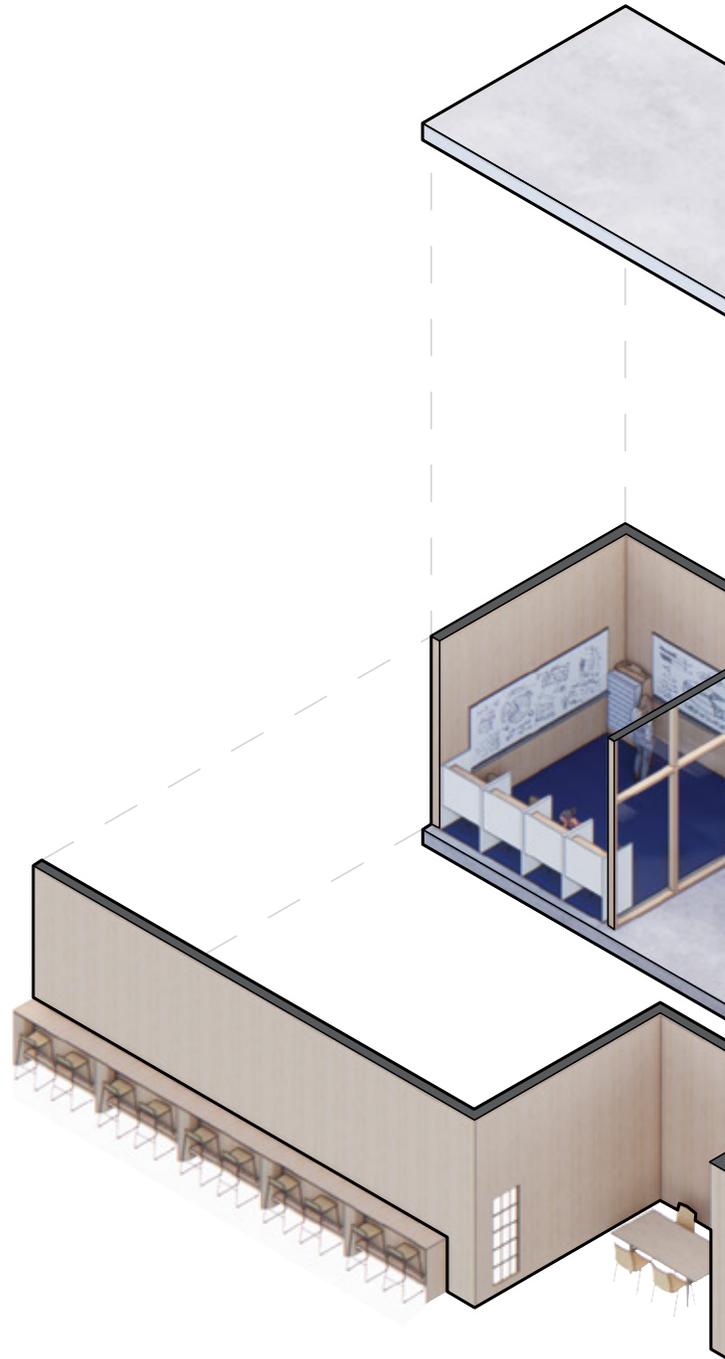


Figure 85 | Music Classroom Axonometric

Art + Science Classrooms

The art and science classrooms are connected through a technology workshop per TDSB rules. A bookcase and a floor elevation separate the art room's separate room.



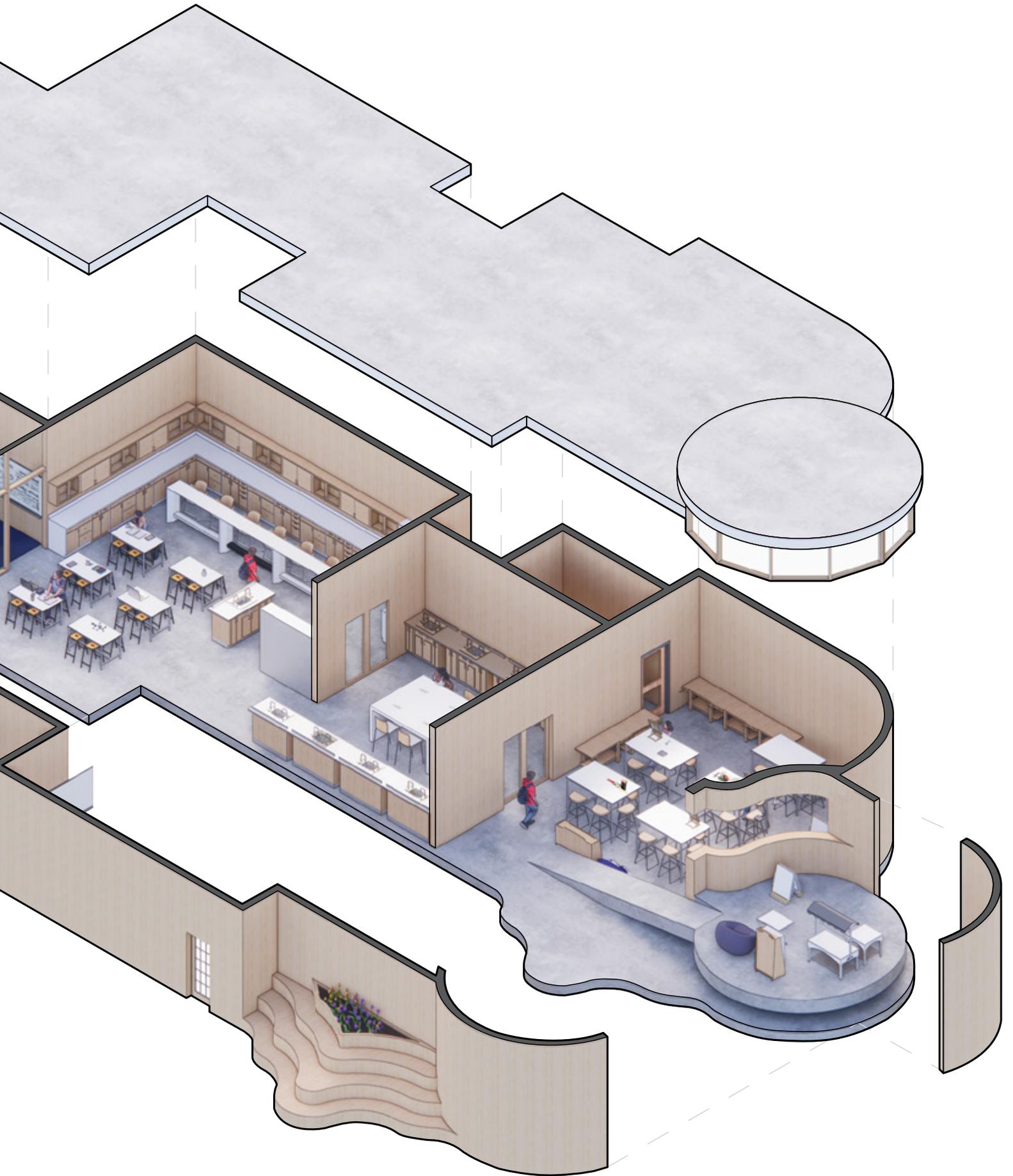


Figure 86 | Art and Science Classroom Axonometric

Sensory Room

A sensory room is an umbrella term to describe a therapeutic room that serves as a safe space for students to grow and develop their sensory skills and a place where they can go if they feel overwhelmed. The equipment and layout of sensory rooms vary greatly depending on the room and the desired result. The layout of the sensory room design is an “L” shape; this allows for the creation of different levels of stimulation in a different area in the room, which aids in its goal. A clear transition zone is created through the placement of the door. The room is located in the first-floor center and near the resource center and accessibility services offices. It is also beside the greenhouse, allowing them to choose what sensory environment they want and what would help them the best. Lastly, it is located near the cafeteria, so they can grab some food and water before going into their safe space. While the room’s shape is similar to the classroom, the design is very different. The main difference is the windows, lighting choice, and the type of material. The room does not have any windows as this type of room needs to control its lighting completely. In terms of furniture, there

are no desks, and the chairs are chosen for their sensorial qualities and how comfortable they are.

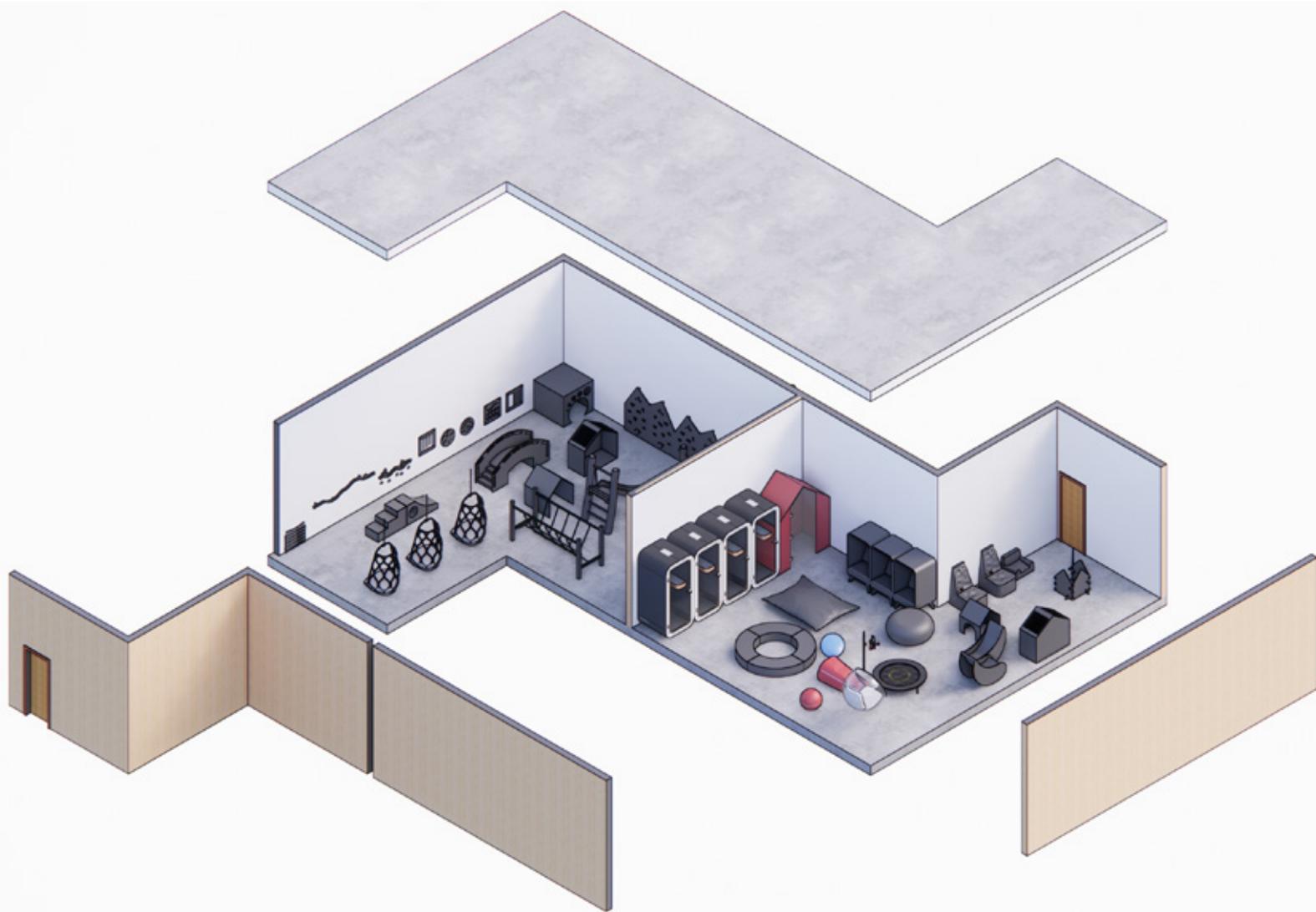
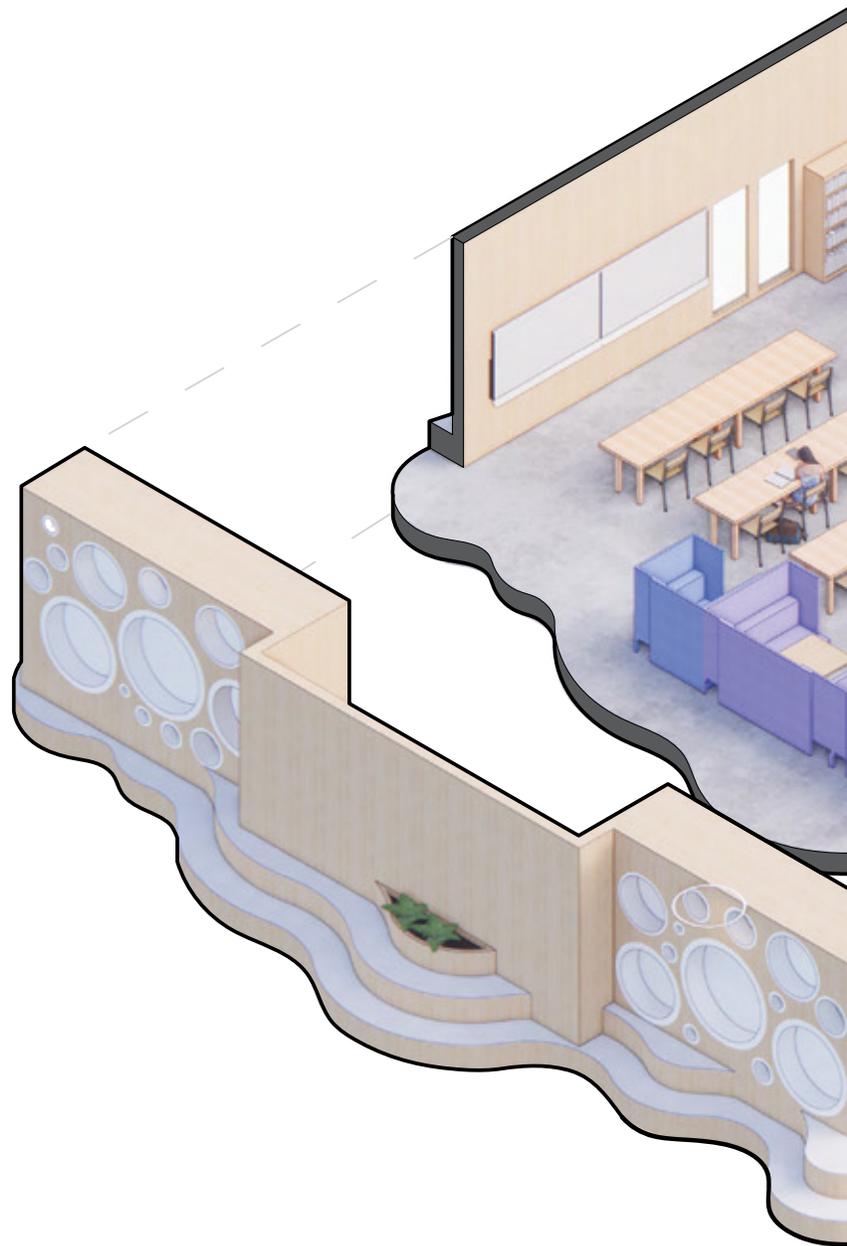


Figure 87 | Sensory Room Axonometric

Library

It is essential to create a different environment within the library. There are areas for independent research, group research and projects, and group lectures. In addition to the different spaces within the library, there are also learning environments outside the library. There are some in-built circles outside the library to lounge and read in. The library is also connected to its courtyard and a balcony on the second floor.



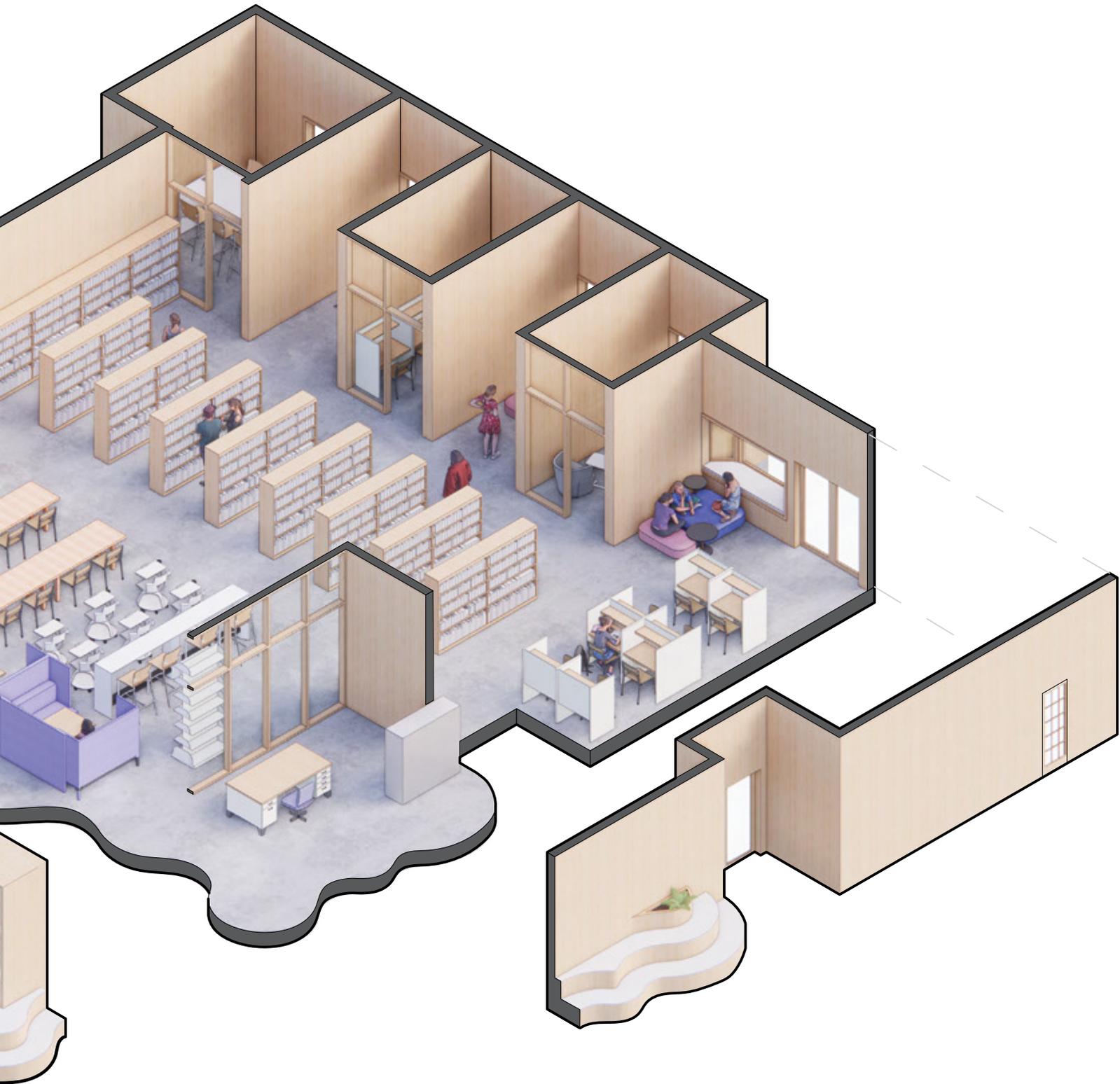
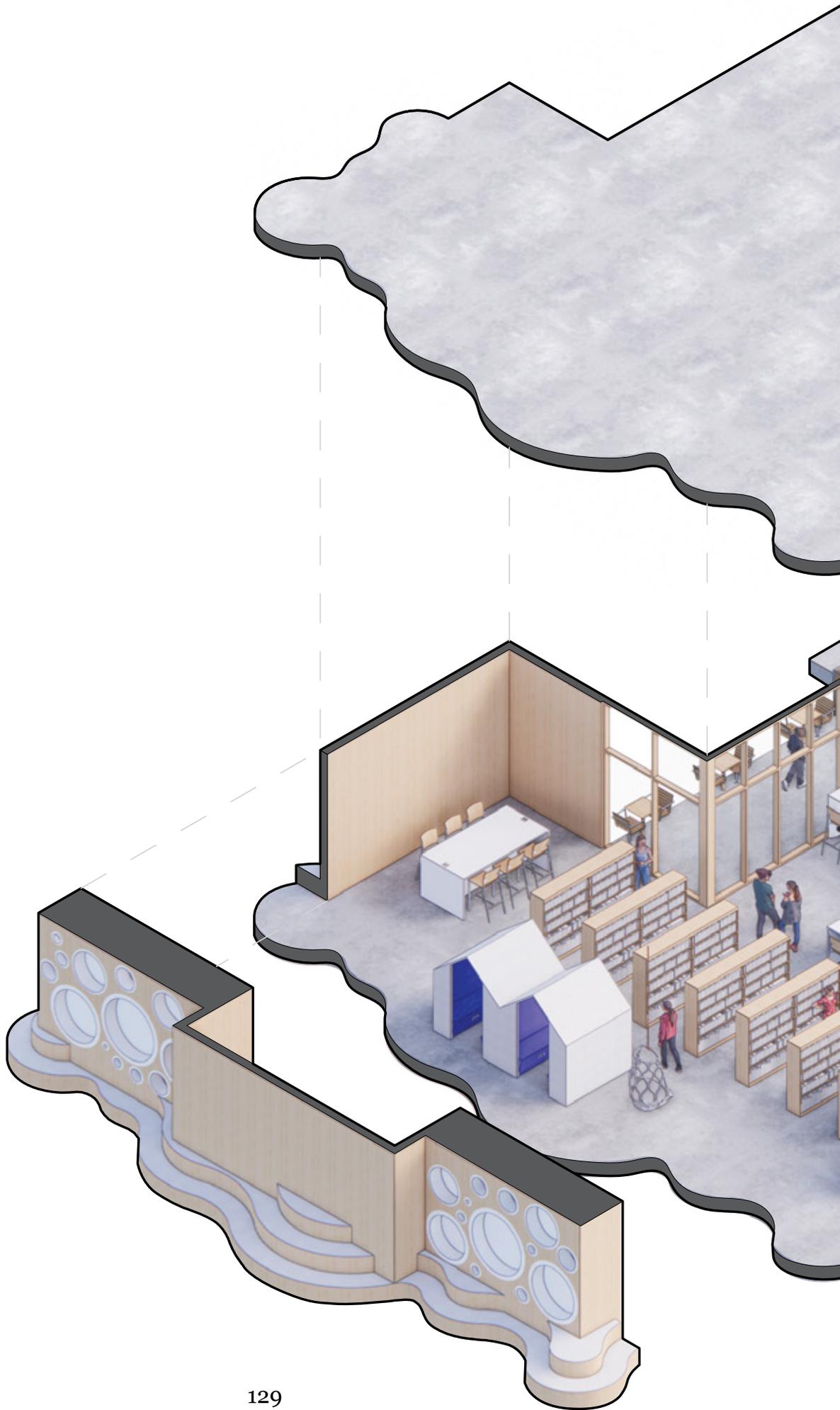


Figure 88 | First Floor Library Axonometric



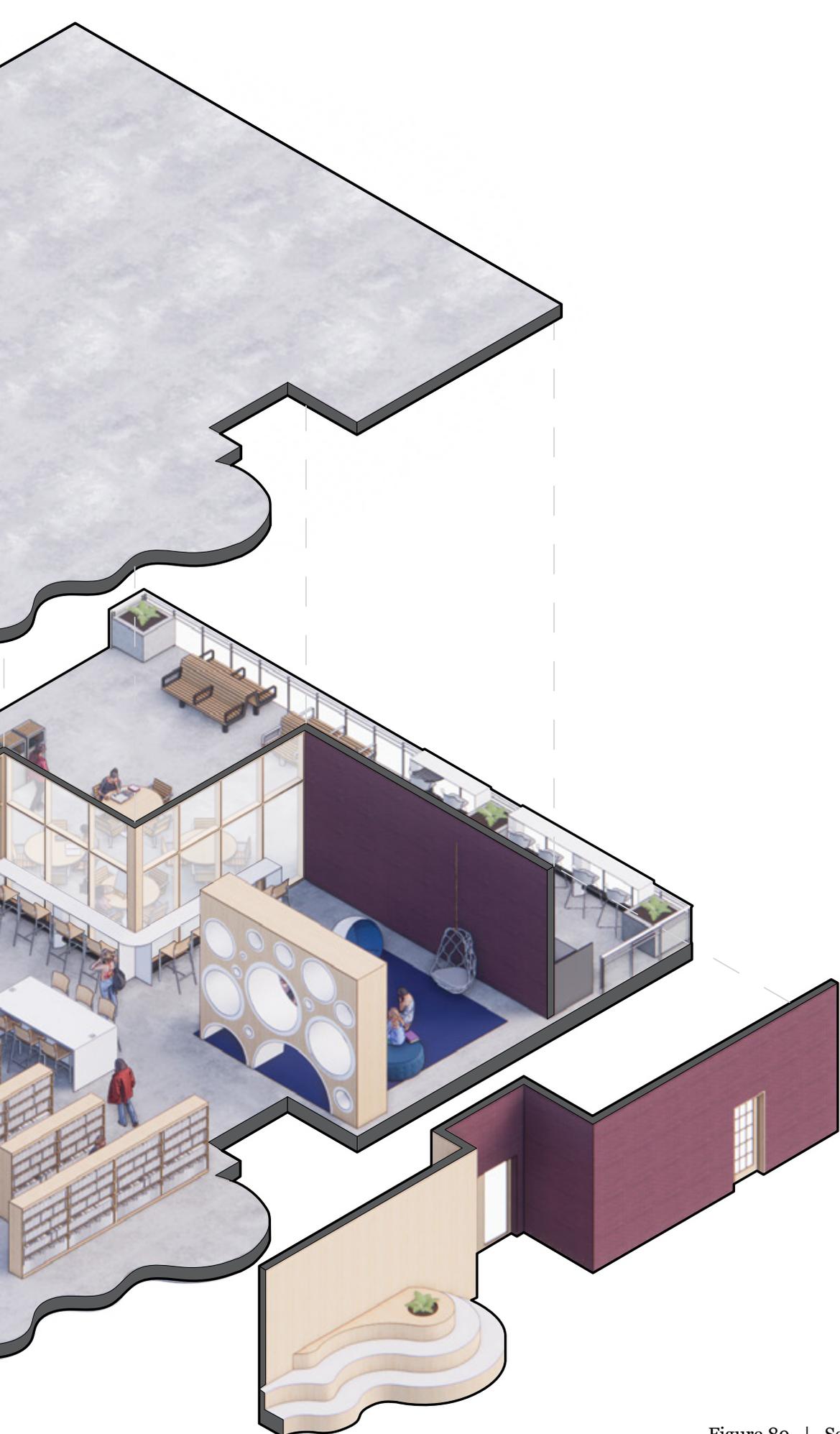


Figure 89 | Second Floor Library Axonometric

6.3 Third Spaces

No longer is the hallway just a tool to get someone from one class to another. This was inspired by the concept of the third space and by the case studies for the open-plan, Montessori, and Reggio Emilia schools. “By creating an open, flexible environment where the two can merge. Third spaces are not limited to learning, as play can be important in solidifying conceptual understanding.” The idea of a third space is to create a learning environment for diverse learners outside of the classroom. Moreover, this is extended to the exterior of the building, where learning environments are extended outside of the classroom.



Figure 90 | Front Entrance Render
Figure 91 | Back Entrance Render



Active Zone



Figure 92 | Interior Playground
Figure 93 | Interior Playground and Courtyard



Social Zone

The traditional cafeteria is not very welcoming to neurodivergent students, and it is very noisy, has much visual input, and has an ample open space that can be anxiety-inducing. This school's cafeteria is spread out, with many different areas to eat outside of the main cafeteria area.



Figure 94 | Main Cafeteria Render
Figure 95 | Second Floor Stands Render



Relaxing Zone

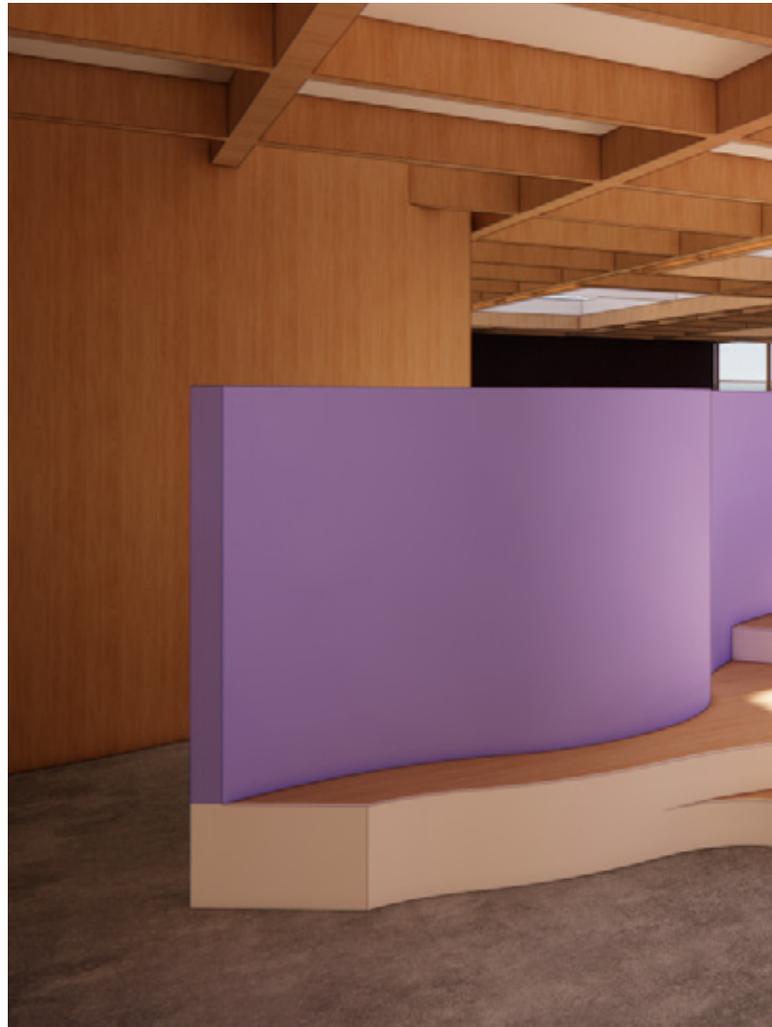
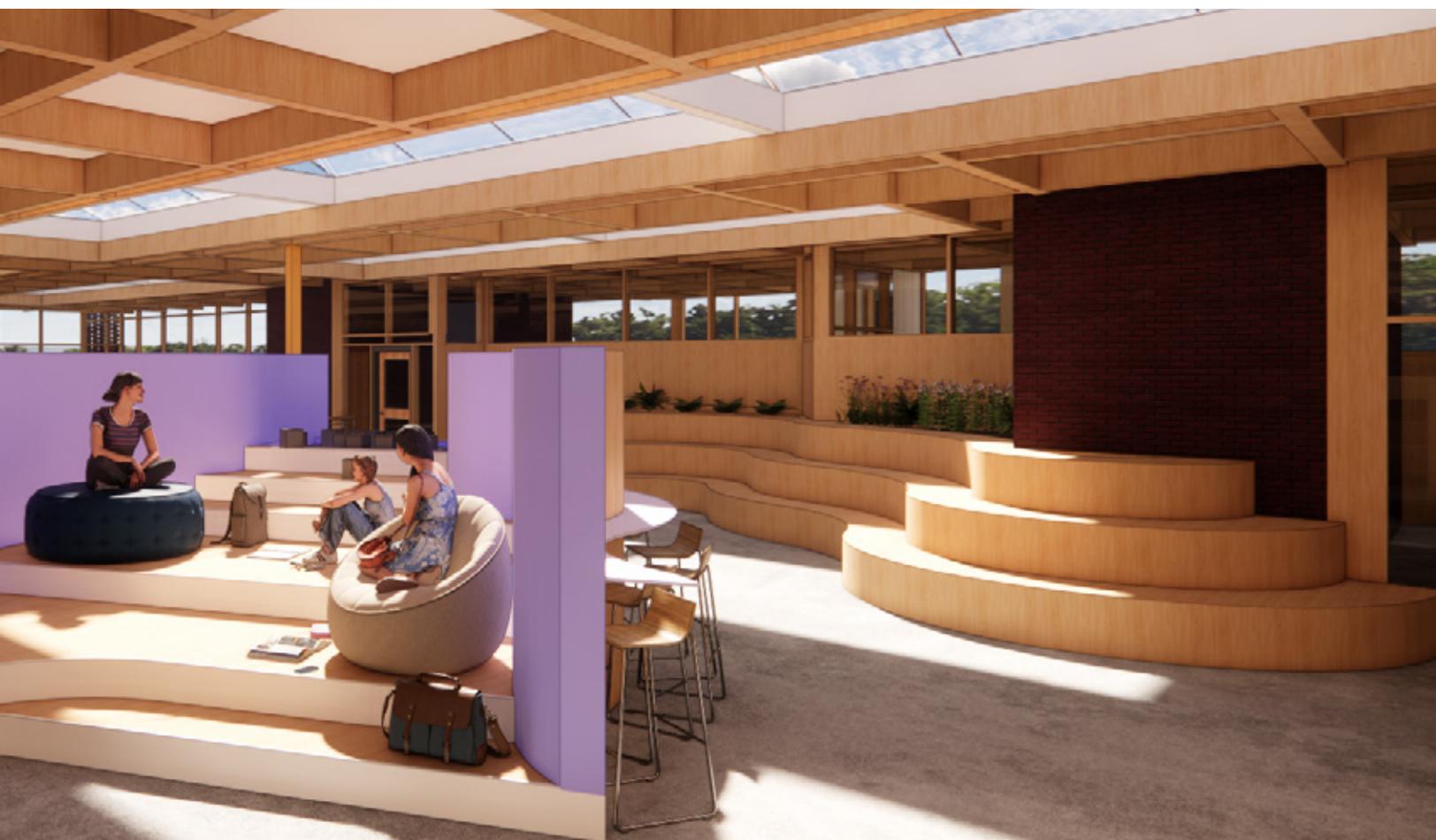


Figure 96 | First Floor Relaxation Area
Figure 97 | Second Floor Relaxing Podium



Exterior Third Spaces - Site

Each typical classroom has its own exterior garden. This space is mainly informally designed so that the space can become whatever the teacher needs to create different learning opportunities. Therefore, the primary interventions done in these gardens are the addition of seating, some paved zones, and trees to create a sense of privacy and separation from the rest of the school. Except for the art and science classes, the other types of classrooms also have their own exterior space. An auditorium was created for the drama and the music classes to serve as an informal stage and place for outdoor lectures. The library has been expanded to the outside by creating both informal and formal seating options and an exterior balcony on the library's second storey.

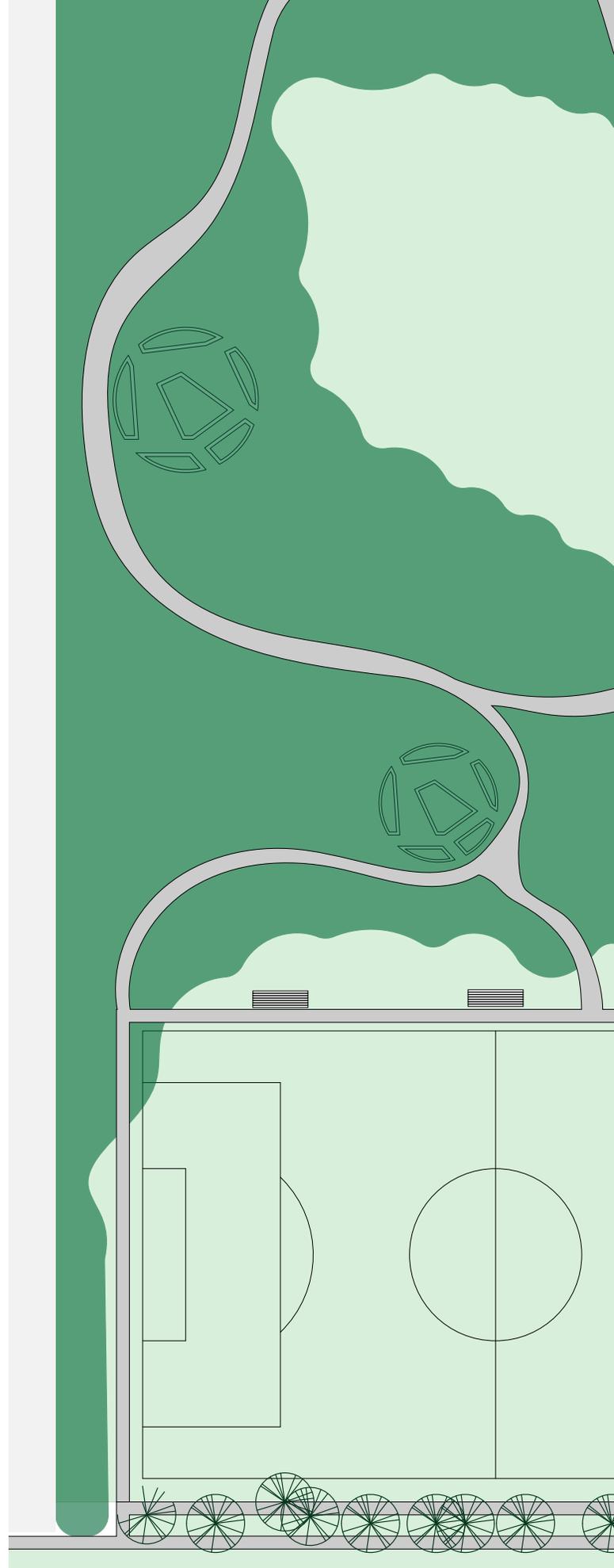
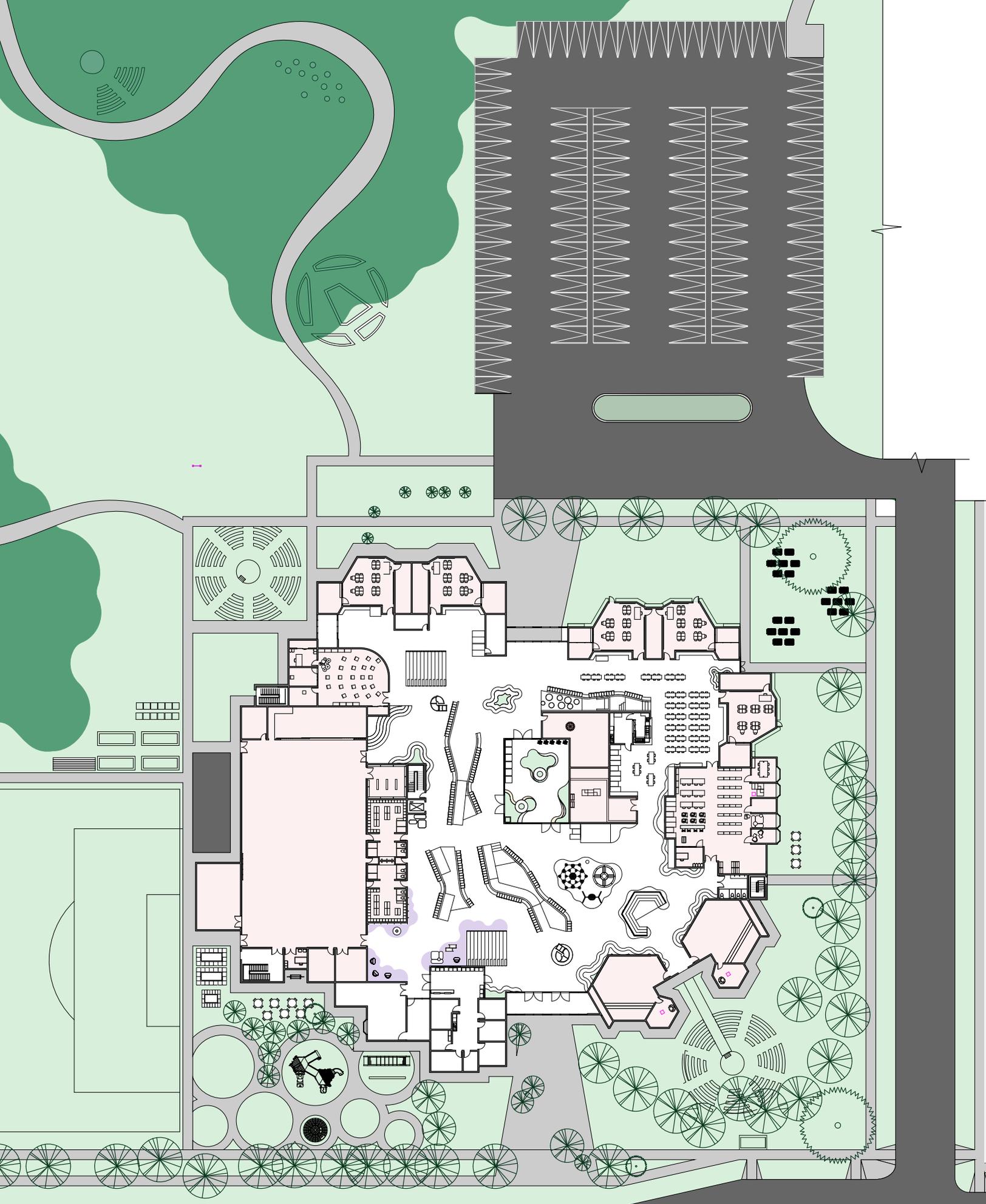


Figure 98 | Site Plan



An aerial architectural rendering of a modern playground. The scene is dominated by a large, light-colored wooden building with several open-plan rooms. In the foreground, there's a green lawn with a grey paved path. To the left, three rectangular sand pits are outlined in yellow, with a person in a wheelchair in the first one. In the center, a circular area with brown mulch contains a swing set. To the right, another circular area with brown mulch has a person walking. Further right, a circular area with a yellow background contains two grey, cat-like play structures. In the middle ground, a green lawn area is divided by a low green hedge, with several round tables and chairs arranged for seating. A person is standing near the tables. The overall design is clean, modern, and inclusive.

Main Playground



Figure 99 | Exterior Third Space Render

Outdoor Classrooms



Figure 100 | Library Balcony

Figure 101 | Drama Class Courtyard







Figure 102 | Front Elevation



Figure 103 | Section A



Figure 104 | Section B

6.4 Conclusion

Our contemporary public schools are ill-equipped to accommodate and aid all their students. Our understanding of neurodivergent people, especially ADHD, has changed significantly, and this new understanding is not being applied to the way we approach designing our schools and classrooms. This thesis explored how we can use architecture to create a more inclusive classroom. Through a comparative analysis of the evolution of the classroom environment, we were able to showcase how societal, philosophical and legislative changes in our society have changed the architecture of schools.

Education can impact every aspect of a student's life and future. It is a right to have access to education, and our current schools are struggling to accommodate students in schools not designed with neurodivergent people considered. As a society, we have been failing our students, which is why this thesis project is essential. Through this design project, this thesis attempted to create a flexible and adaptable school that addresses the needs of neurodivergent students. We can proactively

design for these students before their issues become overwhelming and detrimental to their lives and education. By designing a learning environment that accommodates and works with diverse needs, we can create a school with a variety of spaces for diverse needs.

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