

Building Better Schools:
A New Model For Autism Inclusion in Seattle
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A thesis submitted in partial fulfillment of the
requirements for the degree of
Master of Architecture

University of Washington
2016

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Program Authorized to Offer Degree:
Architecture

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Abstract

Building Better Schools: A New Model for Autism Inclusion in Seattle

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A growing number of children in the United States are diagnosed with autism spectrum disorder (ASD) and receive education within mainstream public schools. While research indicates that most special education classrooms meet the spatial and sensory needs of autistic students, generally the rest of the educational environment does not. Furthermore, studies indicate that environments that benefit autistic students similarly benefit all students. This thesis proposes that by addressing the sensory and spatial needs of autistic learners the educational environment can better serve the diverse needs of all students. This proposition is tested through the design of an elementary-level inclusion school in the Atlantic Neighborhood of Seattle. The methodology for investigating this topic spans architectural and educational resources, including a review of literature related to education design and the spatial needs of students with ASD.

Building Better Schools

A New Model for Autism Inclusion in Seattle

By Michelle Yates



Figure 01. Atlantic Elementary Courtyard

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Figure 02. *Introduction*

Chapter 1 : Introduction

According to the Centers for Disease Control and Prevention (CDC), in 2014 over 1% of the American population was diagnosed with Autism Spectrum Disorder (ASD) and the numbers continue to grow¹. Research indicates that our standard mainstream education design models frequently fail to meet the spatial and sensory needs of children with ASD and other cognitive differences. Special education classrooms tend to meet these needs, however the remaining general educational environment

does not. Rather than serving as a neutral backdrop architecture has an active role in the learning process. The size, proportion and legibility of space can help to soothe and relax a student or conversely it can cause stress and anxiety. Similarly architecture can fine tune sensory information to reduce or introduce distraction. While it does not necessarily provide learning content for students it does provide a learning context that can either support or detract from one's ability to learn.

1. "Autism Spectrum Disorder (ASD)," Centers for Disease Control and Prevention, 31 March 2016. <http://www.cdc.gov/ncbddd/autism/data.html>.

By closely investigating the relationship between the action of learning and the spatial learning environment, this thesis proposes that schools can better serve the diverse needs of all students with a range of abilities and needs. The methodology for investigating this topic includes a literature review informing principles to be tested by the design of a Seattle elementary school. The literature review explores the specific spatial and sensory needs associated with autism, existing education design theories, analysis of current autism learning centers, and analysis of daylighting strategies that facilitate diffused and calming lighting conditions. This literature review informs the principles of inclusive educational design, which are tested in this proposal for a Seattle elementary school serving both autistic and mainstream learners. The proposal includes a schematic overview of the entire site and school with more developed nodes within high and low sensory zones.



Figure 03. Reed Academy, Oakland, NJ

Chapter 2 : Autism and the Learning Environment

This thesis defines learning as the act of acquiring knowledge and skills through study and experience. This activity occurs everywhere whether walking in the street, socializing at home, and in its most structured form within the confines of a school. Research on the science of learning supports the claim that individuals learn best through different means and in different learning environments. In their book, *Teaching and the Human Brain*, Renate Nummela Caine and Geoffrey Caine look to neuroscience as a guide for understanding the mechanics

of learning. They make the case that students do not separate the learning content from the context, and are strongly influenced by their immediate experience of the space around them². The authors suggest that students are better equipped to learn if their spatial context supports a state of “relaxed alertness”. This state is achieved when an individual feels motivated while experiencing a sense of safety and security³. Architects play an important role in shaping the physical spaces that make it possible for students with a range of needs to learn.

2. Renate Nummela Caine and Geoffrey Caine, *Making Connections: Teaching and the Human Brain*. (Menlo Park, California: Addison-Wesley Pub, 1994), 133

3. Cain and Caine, *Making Connections*, 142.

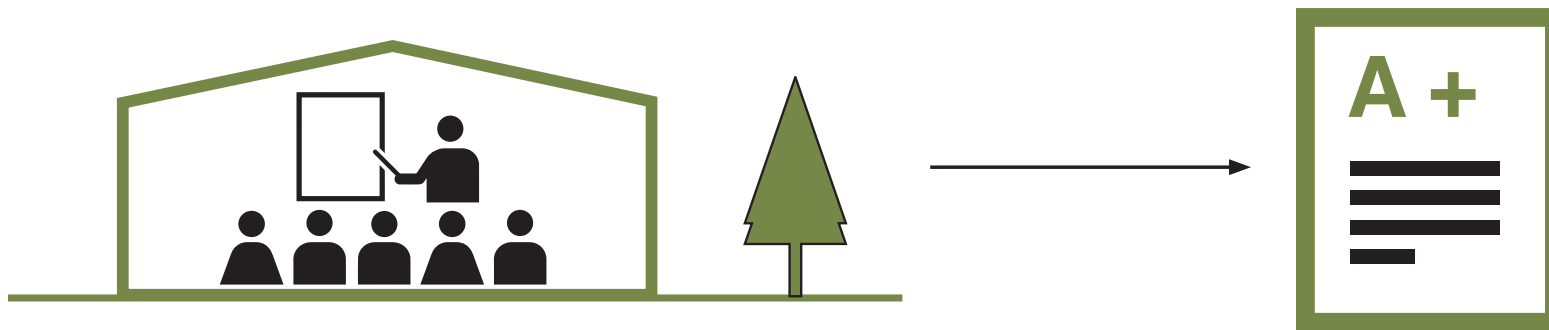


Figure 04. Relationship between context and performance

The physical spaces where students learn have an active role in shaping their experience and state of mind. Anne Taylor describes this as the, “silent curriculum⁴.” Taylor rejects the commonly held notion that a good teacher can teach anywhere and a motivated student learns anywhere regardless of the spatial context. She argues that the learning environment is, therefore, a “silent curriculum” as it can influence, either a positive or negative, educational outcome (See *Figure 04*). She maintains that architects

and educators need to view the learning environment as an active player in the learning process that must respond to the specific needs of the users⁵. While all students have individual needs with regard to their learning environment, those with autism spectrum disorder have spatial and sensory needs that are often left un-addressed within learning spaces.

4. Anne Taylor and Katherine Enggass. *Linking Architecture and Education: Sustainable Design for Learning Environments*. (Albuquerque: University of New Mexico Press 2009), 25.

5. Ibid.

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is a developmental disability causing social, communication and behavioral challenges⁶. As a result these individuals often communicate, interact and learn differently from their peers. ASD is a spectrum disorder meaning that individuals may have a range of deficits and behaviors from mild to severe. In 2014 the Centers for Disease Control reported 1 in 68 children were diagnosed with ASD, with males outnumber females 4 to 1 (See Figure 05). To date, there is no known

cause for the condition⁷. In 1997 50 students were reported to have ASD in the Seattle Public School District and that number grew to 350 students in 2007⁸. This increase in diagnosis is consistent with national trends, perhaps due to increased awareness, a shift in ASD definition, differences in study methodology and/or a true increase in individuals affected⁹.

6. American Psychiatric Association. "Diagnostic and Statistical Manual of Mental Disorders : DSM-5. Fifth ed." (Arlington: American Psychiatric Association, 2013)

7. "Autism Spectrum Disorder (ASD)," (Centers for Disease Control and Prevention, 31 March 2016. Web. 14 Apr. 2016

8. Riley Oct 2007, pg 6

9. American Psychiatric Association. "DSM-5"



Figure 05. Autism Rate
 1 in 68 children were diagnosed
 with ASD in 2014 as reported by
 the CDC

An individual with ASD confronts a range of challenges in the learning process. She or he may have trouble deviating from strict routines and engage in ritualized patterns of behavior. Students may demonstrate extremely fixated interests with abnormal intensity. Furthermore, they may demonstrate either hyper or hypo-reactivity to sensory input from the environment. This may include fascination with lights or movement, sensitivity to bright light, and/

or an adverse response to certain textures or sounds¹⁰. Therefore, architecture plays a major role in calibrating sensory information to decrease distractions and reduce stressful stimuli that hinder the learning process (See *Figure 06*). The education design plays a critical role in how students with special needs learn, affecting how they occupy and experience their spatial environment.

10. American Psychiatric Association. "DSM-5"

Figure 06. Autism Spectrum Disorder Symptoms & Considerations

Communication/Interaction

Upset with new/ overly stimulating environment

Overly focused interests

Impaired social interactions

Impaired verbal communication

Impaired non-verbal communication

Sensitivities

Light



Temperature



Noise



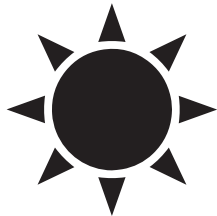
Clothing



Proxemics



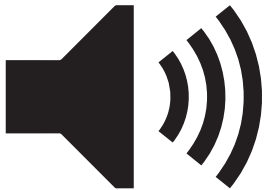
architectural considerations



Daylight control



Wayfinding



Acoustics



Sequencing

Figure 07.1. Issues of Perception: Hypersensitivity



neuro-typical

Often individuals with ASD perceive space differently than individuals without autism who have a neuro-typical, or “normal”, perception of the world. Someone with autism may be exposed to the same sensory information but interpret the raw material differently, which therefore changes their experience. There is not a standard way of processing sensory information but rather a range of ways someone with autism may perceive space.



hypersensitivity

Many individuals with ASD experience **hypersensitivity** to their environments. This essentially means that too much information is processed by the brain causing the individual to be acutely aware of information that others simply miss. This can result in very overwhelming feelings and can cause stress or pain in environments where others are comfortable¹¹.

11. Wendy Lawson and Olga Bogdashina. *Sensory and Perceptual Issues in Autism and Asperger Syndrome*. (London: Jessica Kingsley Publishers, 2003), 55.

Figure 07.2. Issues of Perception: Hyposensitivity



neuro-typical

Alternatively, individuals with ASD can experience **hyposensitivity** to sensory stimuli, meaning they process less information than what is typical. Visually, this can mean that specific elements within a space may be interpreted as only outlines. As a response these individuals may enjoy movement or rock back and forth to experience more sensation¹².

12. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sperger Syndrome*, 56.



hyposensitivity

Similarly, individuals who experience hypo-hearing may be attracted to crowds or sirens and those who experience hypo-taste or smell may attempt to chew or taste everything¹³.

13. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sperger Syndrome*, 56.

Figure 07.4. Issues of Perception: Gestalt Perception



neuro-typical

Some autistic individuals find it difficult to distinguish between foreground and background information, known as gestalt perception¹⁴. Everything in a scene is interpreted without discrimination making it difficult to separate a specific detail. Those who perceive space in this way may process more information than those with neuro-typical

14. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sperger Syndrome*, 45.



gestalt perception

perception, however, this can lead to becoming easily overwhelmed¹⁵. The same can be true with acoustics. In a classroom, for example, it may be difficult for a student to focus on a teacher's lecture if there are other noises, even those as seemingly unnoticeable as moving air¹⁶.

15. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sperger Syndrome*, 48.

16. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sperger Syndrome*, 50.

Figure 07.4. Issues of Perception: Fragmented Perception



neuro-typical

Unlike gestalt perception, some individuals perceive the world in fragmented parts rather than a unified whole. If someone is used to identifying a specific place, a classroom for example, by a specific chair and that chair is moved the classroom may become unrecognizable¹⁷.

17. Lawson and Bogdashina, *Sensory and Perceptual Issues in Autism and Sparger Syndrome*, 70.



fragmented perception

While those with ASD may perceive space in a range of different ways literature suggests it's best to design calming, low-sensory environments. It is easier to selectively add sensory information for those who require it than to remove stimuli from a space¹⁸.

18. Mostafa, "Architecture for Autism," 205

Theories on Designing for Autism

Experts in the area of autism design developed detailed guidelines for the layout, form and materiality of learning spaces. Architecture professor, Magda Mostafa developed guidelines based on her pioneering studies on autism classroom design. She identifies criteria that contribute to a positive learning experience for autistic students (*See Figure 08*). Sequencing, a primary design recommendation, describes a continuum of controlled spaces organized in a specific order. This approach allows for controlled circulation and varying levels of sensory input including light, sound, and textures¹⁹. Mostafa recommends physical “escape space” in each classroom allowing students to remove themselves from group activity with they become over stimulated²⁰. Furthermore, the guidelines advocate for sensory zoning, meaning that

high-sensory activities are grouped together separate from low-sensory ones. Examples of high-stimulus programs include activities such as art, music, athletics and building services. Low-stimulus activities, such as classroom time, require a high degree of focus and attention from the student²¹. She also points out the importance of transition zones as a means of easing the movement from high sensory to low sensory areas. Lastly, she emphasizes the use of visual cues, including distinctive landmarks, to facilitate predictable wayfinding²².

19. Magda Mostafa. “An Architecture for Autism: Concepts of Design Intervention for the Autistic User.” IJAR, International Journal of Architectural Research 2.1 (2008): 204. Archnet. Web. 21 Apr. 2016

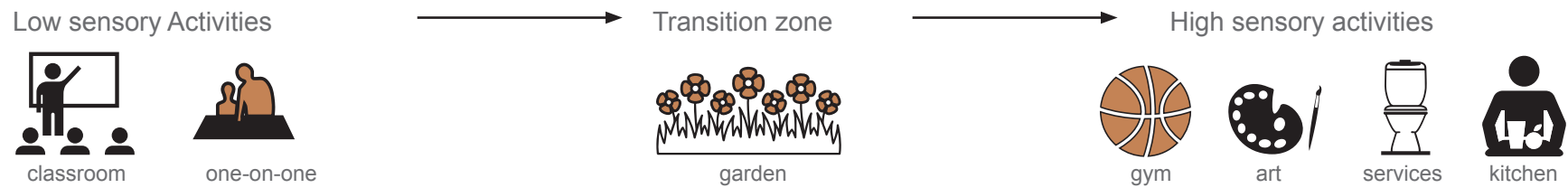
20. Idib.

21. Mostafa, “Architecture for Autism,” 205

22. Idib.

Figure 08. Designing for Autism

Sequencing and sensory zoning

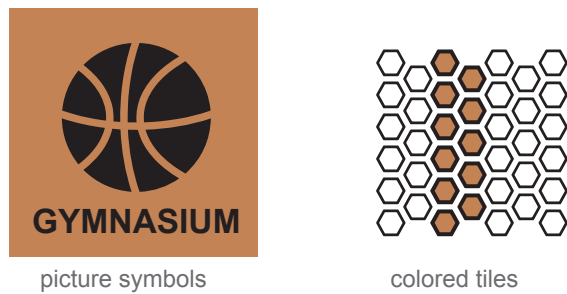


Wayfinding strategies

Landmarks



Signage



Research by Rachna Khare and Abir Mullick on existing educational facilities indicates a strong correlation between student performance and their environment²³. The subjects of this study included both general education students and autistic students in specialized and inclusion programs. Their findings suggest that design supporting autistic students similarly supports non-autistic students²⁴. Khare published guidelines for designing inclusive educational spaces based on her research (See *Figure 09*). These guidelines are generally consistent with those established by Mostafa. When determining a site for a school she highlights the need for distinct physical features and landmarks such as trees or contours. Furthermore, she emphasizes the importance of siting the school near existing community resources to foster a mutually beneficial relationship with the community²⁵. To support

focused environment she recommends screening off distracting areas such as parking lots or playgrounds from classrooms. Like Mostafa, Khare stresses the importance of escape spaces or “withdrawal spaces” throughout the building and grounds. This space is especially important in socially demanding areas such as cafeterias or classrooms²⁶.

Simon Humphreys, a British architect, outlined a similar set of principles for designing safe and supportive environments for autistic users. Like Mostafa, he stresses the importance of order in layout and proportion of the space. He introduces the term proxemics, which refers to the amount of personal space an individual requires. An individual with ASD can feel very protective over this space and feel threatened unless sufficient space is provided. He also notes that attention needs to be given not only to the quantity but quality of light and sound²⁷.

23. Rachna Khare, *Designing Educational Spaces for Autism*. (Boston: Institute for Human Centered Design, 2010), 159

24. 16. Rachna Khare and Abir Mullick, “Designing Inclusive Educational Spaces with Reference to Autism.” *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 53.8 (2009), 518

25. Rachna Khare, *Designing Educational Spaces for Autism*. (Boston: Institute for Human Centered Design, 2010), 159

26. Khare, *Designing Educational Spaces for Autism*, 166

27. Simon Humphreys. “Autism and Architecture.” *Autism London*. (Feb. - Mar. 2005)

Figure 09. *Guidelines for Inclusive Educational Spaces*

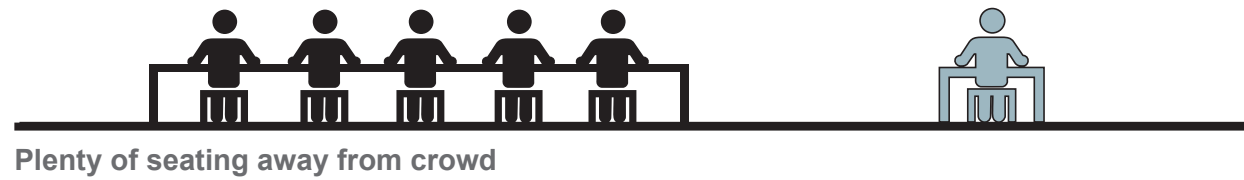
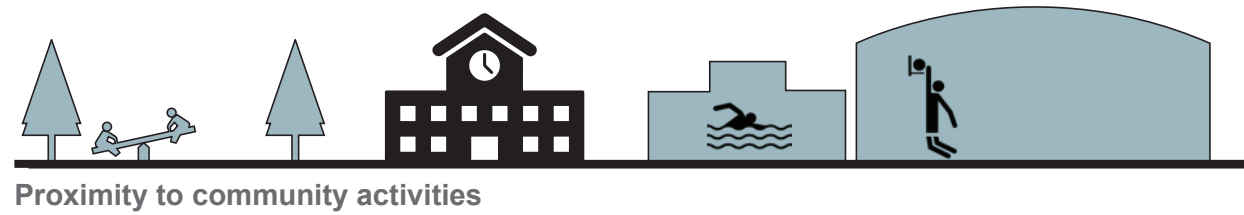
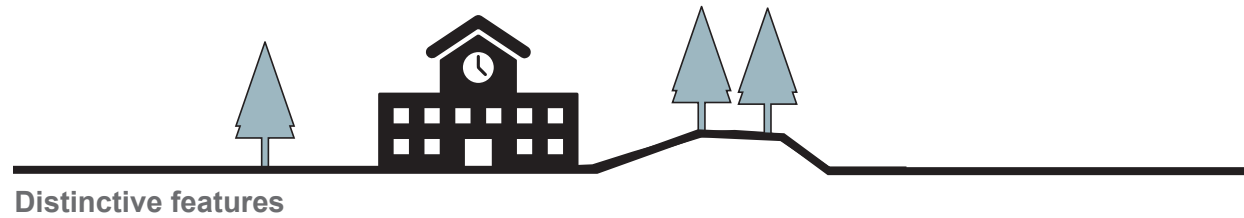




Figure 10. The Eden Institute

Case studies: Schools for ASD Learners

Review of theories on designing for students with ASD supports the critical role that physical space plays in the quality of learning. Scholars argue that special attention should be given to the way spaces are organized and how

they are experienced through the senses. The following case studies examine how existing learning spaces for special needs students realize the relationship between interior and exterior space, circulation, and sensory zoning.

Eden Institute

Princeton, NJ, KSS Architects, 2011



Figure 11. *The Eden Institute
First Floor Plan*

Designed by KSS architects, the Eden Institute attempts to strike a balance between providing a secure learning space for students with ASD while engaging with the immediate context. The education and outreach center is located in a mixed-use complex that includes retail, offices, and restaurants, enabling students to feel included within a broader community. Students are able to make use of the complex's facilities such as the swimming pool

at the health club. Additionally, a convenience store, open part-time to the public, is located within the building and is staffed by supervised students. According to the architects, the intent is to foster connections between students and the public in a “real world” context²⁸ (See Figure 11).

²⁸. Sarah Amelar, “Handled with Care.” *Architectural Record* 201. 1 (2013): Web. 28 Mar 2016

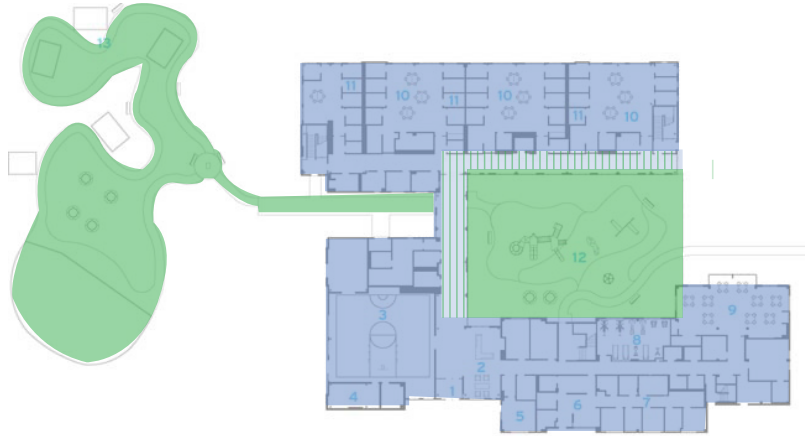


Figure 12. *Courtyard at Eden*

The main building is organized around a large courtyard, with clear circulation running the length of the U-shaped plan (See *Figure 12*). The institute connects to a large park by a curving walking path, creating a series of interlocking exterior and interior spaces. Several corridors are lined with floor-to-ceiling glazing strengthening the connection to the outdoor courtyard (See *Figure 13.1*). Colored tiles mark classroom entrances to support wayfinding.

Classrooms are located along a single corridor to the northwest, each connected to a series of individual therapy rooms. This sequence allows for a gradual transition from higher to lower sensory spaces and from group spaces into progressively more individualized spaces. (See *Figure 13.3*). The architects took steps to further eliminate distractions by using indirect natural light, acoustical separations and neutral colors²⁹.

²⁹. Sarah Amelar, "Handled with Care." *Architectural Record* 201. 1 (2013): Web. 28 Mar 2016



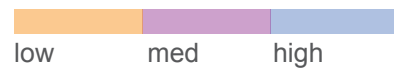
Interior/Exterior



Circulation



Stimulus Level Organization



Figures

13.1. Eden Circulation (Top right)

13.2. Eden Interior/Exterior Relationship (Top left)

13.3. Eden Sensory Zoning (Lower left)



Figure 14. Reed Classrooms

Reed Academy

Oakland, NJ, WXY Architecture and Urban Design, **2011**

Reed Academy, located in Oakland, NJ, takes a more neuro-typical approach to sensory design. Rather than intentionally taking measures to reduce stimuli, the architects instead introduce select stimuli in a controlled manner to encourage students to generalize learned skills in “real world” conditions³⁰. Elements such as varied lighting and bathroom fixtures, a diverse color pallet and a range of finishes attempt to present conditions of the outside world³¹(See *Figure 14*). Furthermore, transitions between higher stimulus and focus spaces are intentionally more ambiguous (See *Figure 17.2*).

30. Amelar, “Handled with Care,” 2013

31. Ibid.

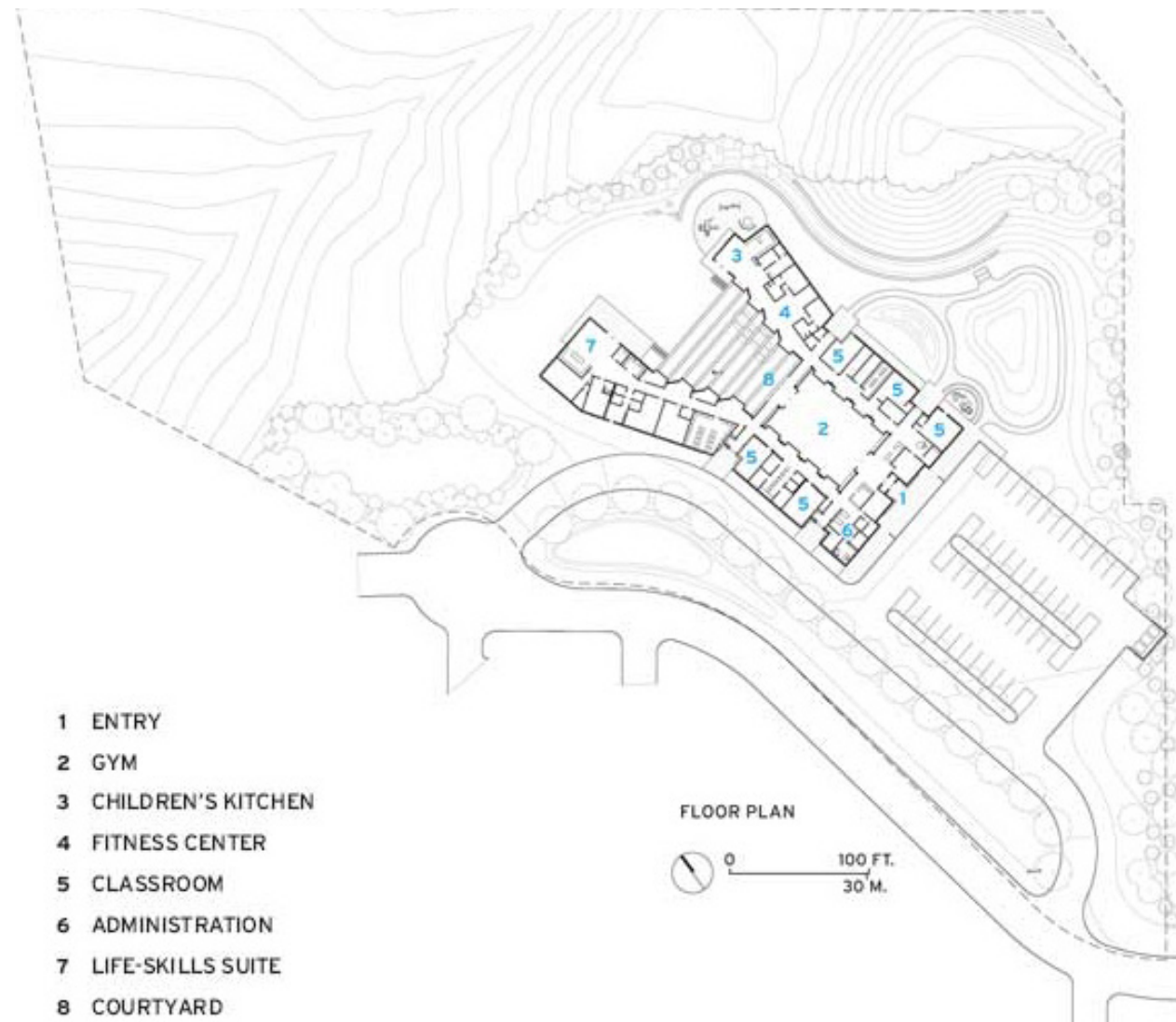
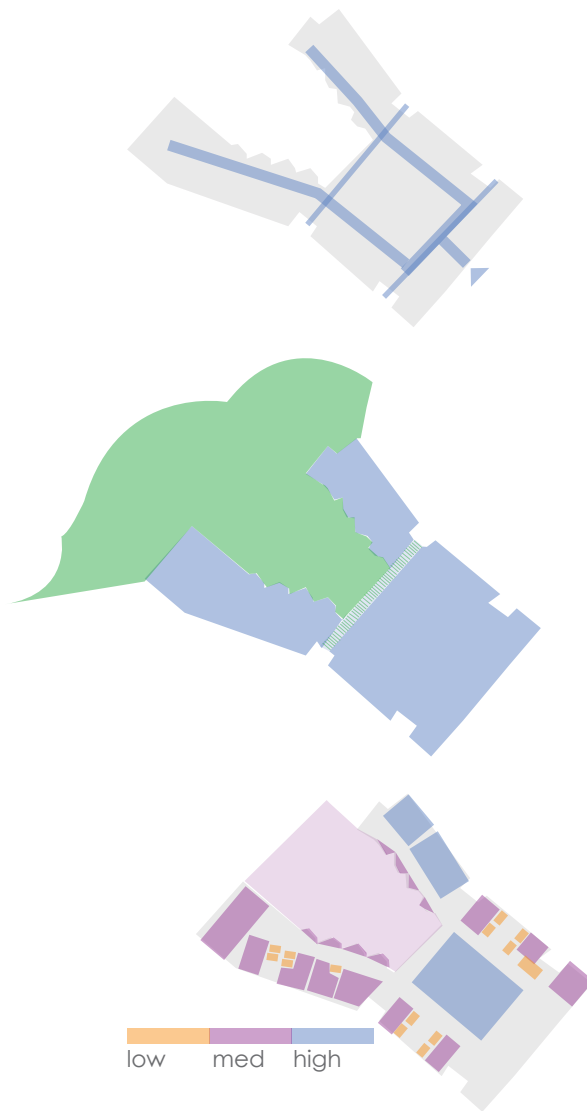


Figure 15. Floor plan of Reed Academy



Figure 16. Courtyard at Reed Academy



Figures

17.1. Reed Circulation (Top)

17.2. Reed Interior/Exterior Relationship (Middle)

17.3. Reed Sensory Zoning (Lower)

The circulation within the school is designed to promote independence and social interaction (See *Figure 17.1*). The corridors take on an intentionally meandering route and are lined with smaller scale nooks that flank the courtyard. These nooks are intended for informal socializing and alternative teaching spaces. Sight-lines of views and transparencies of surfaces are considered in order to encourage independence while maintaining security and oversight³².

Based on the analysis of the case studies and theories concerning autism design, the driving design principles for the proposed learning center focus on integration, predictability, and control over sensory information.

³². Sarah Amelar, "Handled with Care." *Architectural Record* 201. 1 (2013): Web. 28 Mar 2016

Case Studies: Daylighting Strategies for Schools

The theories surrounding architecture and autism reviewed earlier in the chapter address the importance of natural daylight within learning spaces. The three primary goals for daylighting classrooms include controlling direct sunlight when the building is occupied, balancing the luminance on interior surfaces, and providing adequate illuminance for visual tasks³³. Providing balanced illumination to

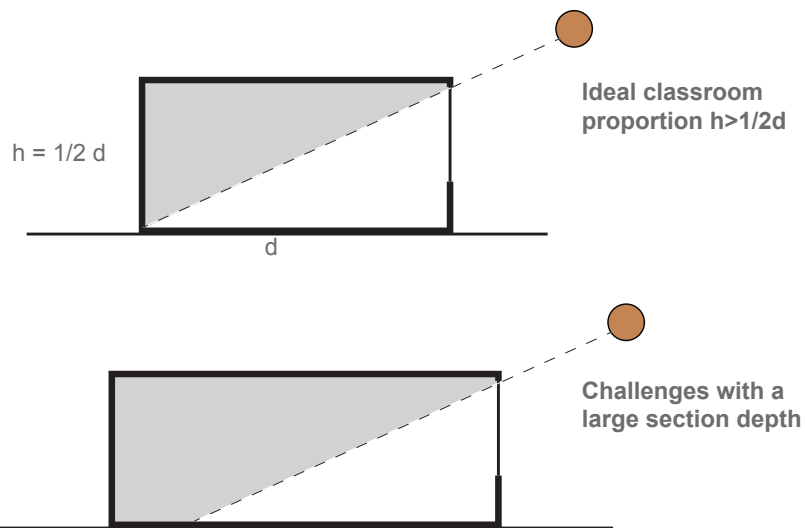


Figure 18. Section Depth and Daylighting

33. "Pattern 16: Daylight from Top and Side." Daylighting Pattern Guide. 2016 <<http://patternguide.advancedbuildings.net/patterns/pattern-16-daylight-from-top-and-side-classroom>>.

the back of classrooms can be challenging. Dramatic differences in lumination among different surfaces within the classroom can cause glare, which can be both visually distracting and stressful³⁴. Traditionally balanced illumination and lumination of surfaces within a classroom were accomplished by a section depth less than 24' - 0" and tall ceilings, typically greater than 12' - 0". With the larger section depth of modern classrooms and lower ceilings often classroom spaces experience glare and require additional electric lighting to accomplish adequate illumination levels³⁵. The following classroom case studies illustrate strategies for accomplishing adequate daylighting in spaces with a deep section.

34. Ibid.

35. Ibid.



Figure 19. Chartwell School Gym

Chartwell School

Seaside, CA, EHDD Architecture, 2006

Located in Seaside, California, the Chartwell School serves students with a range of learning differences. The school is organized around two courtyards and most circulation occurs outdoors. This increases the amount of exterior envelope and in turn allows for greater opportunities for apertures to the outside. The architects, EHDD, emphasize the importance of intuitive wayfinding and fully day-lit classrooms³⁶.

36.“Chartwell School,” EHDD, 2012. <<http://www.ehdd.com/work/chartwell-school>>

Classrooms in Chartwell School employ a daylighting strategy that includes perimeter windows combined with top lighting. The perimeter windows provide visual connection to the outdoors and the primary source of illumination but the depth of each classroom requires an additional source of light. Skylights provide illumination to the back of the room and help to balance the light levels within the space, preventing glare. The translucency in the skylights prevents direct-beam sunlight to enter the space, which can be both distracting and contribute to heat-gain. Furthermore, the light-colored interior finishes help to reflect the daylight within the space rather than absorb it³⁷.

37.“Pattern 16: Daylight from Top and Side.” Daylighting Pattern Guide. 2016

Top lighting helps to balance the illumination and prevent dramatic contrast throughout the space. The skylight is placed closer to the back wall rather than in the center of the space to wash the back wall with light, which reduces contrast.

Side lighting provides the primary source of illumination but given the large section depth of the space, additional sources of illumination are required.



The light colored materials help to reflect the light rather than absorb the daylight within the space.

Figure 20. Top and Side lighting

Mount Angel Theological Studies

St. Benedict, OR, SRG Partnership, 2006

Located on a hill looking down on Mount Angel, Oregon, the Mount Angel Center for Theological Studies is a place for the Benedictine study of God. The daylighting goal for the 21,000 square foot building was to provide an even distribution of daylight during normal occupancy hours at least 95% of the time. To achieve this goal, the architects emphasized top-lighting. Classrooms are lit by a single large skylight to draw in daylight from the top. The sloping ceiling combined with a reflector made of aluminum tubes redirects the light out to the edges of the room. Classrooms on the southern side of the building include sunshades and light-shelves to reduce glare entering the space from perimeter windows³⁸.

38. "Pattern 11: "Toplighting: Classroom Toplighting Design" *Daylighting Pattern Guide*. 2016.<<http://patternguide.advancedbuildings.net/patterns/pattern-11-toplighting-classroom>>.

Top lighting allows for greater uniformity throughout the year

The sloping ceiling combined with a reflector made of aluminum tubes redirects the light out to the edges of the room.

Light colored finishes help to reflect daylight



Figure 21. *Top Lighting*



Figure 22. TOPS Elementary, Seattle

Chapter 3: Seattle Public School and Special Learners

Seattle Public Schools (SPS) is among the largest school districts in the United States, serving a diverse population with different social backgrounds and needs. Currently, 13% of students within the district receive special education³⁹.

The Seattle Public School District adopted the Least Restrictive Environment Policy (LRE) for its students with special needs, which is consistent with national standards. This means that these students should be able to attend

the same school as general education students and thus should be able to learn in a regular classroom to the greatest extent possible⁴⁰. Additionally, if a school does not have a specific program a student needs, such as autism support, a placement should be available in a building reasonably close to the child's home⁴¹. The school district is essentially advocating for an inclusive education rather than creating specialty schools. The policy acknowledges, however, that some students have disabilities so severe that they require a separate learning program in order to thrive.

³⁹ "Overview of Special Education Services." *Seattle Public Schools*. 19 Sept. 2016.

⁴⁰ "Superintendent Procedure 2161SP," (Seattle, Seattle Public Schools, 2013)

⁴¹. Ibid.

In 2007, the chief academic office commissioned an independent research team to evaluate the delivery of special education in Seattle Public Schools. The Urban Special Education Collaborative (otherwise known as ‘the Collaborative’), collected data on the district and interviewed students, staff and families⁴² (Riley et al 3). The report found that at the middle school and high school levels most special education students in Seattle were able to attend their local school⁴³, but at the elementary level students with special needs were often obliged to attend a school far from where they live. The authors found that this puts stress on the family, removes a child from her or his immediate community, and often separates siblings. Furthermore, students were often forced to switch schools due to lack of consistency in the availability of special education programs⁴⁴.

42. David P. Riley, “Special Education: Organizational, Program, and Service Delivery Review – Seattle Public Schools: A Report of the External Core Team.” (*Urban Special Education Leadership Collaborative Education Development Center*, 2007) 3

43. David P. Riley, “Special Education: Organizational, Program, and Service Delivery Review”, 9

44. Ibid.

Following the report, Seattle Public Schools introduced a new system called Integrated Comprehensive Services (ICS). The idea was to promote collaboration between that general and special education teachers so more special needs students could attend their neighborhood schools⁴⁵. During the 2013-2014 school year ten elementary and K-8 schools included autism inclusion programs and four schools supported self-contained programs⁴⁶. John Hay Elementary, located in Queen Anne, is a rare example that supports both programs, illustrating that the autism inclusion programs can benefit all learners⁴⁷.

45. David Rosenthal. “Not-so-special treatment in Seattle of Special Education,” *The Seattle Times*. 21 Oct. 2012
< <http://www.seattletimes.com/seattle-news/not-so-special-treatment-in-seattle-of-special-education/>>

46. Location of Services: Special Education (2013-14). Seattle: Seattle Public Schools, 28 Aug 2013. PDF

47. “Autism Inclusion.” *John Hay Elementary School*, 19 Sept. 2016. <http://hayes.seattleschools.org/services/autism_inclusion>



Figure 23. John Hay Elementary, Seattle



Figure 24. John Hay Elementary Move-A-Ton, 2013

The school district continues to support the idea of inclusion but has been hindered by a lack of funds and facilities. The result is that special programs are frequently in flux and continue to cause special needs students to switch schools during their time in elementary school. In 2012 Seattle Times reported that complaints by special education families had doubled from those in 2010⁴⁸.

The Continuum Approach

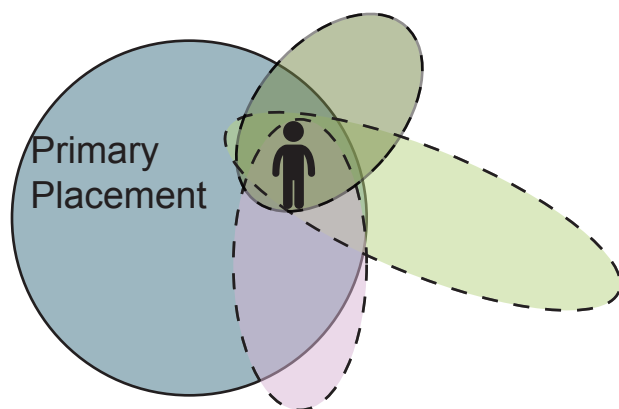
Starting in the 2016-2017 school year the district announced the launch of the Continuum Approach to special education. This approach assigns programs to one of five specialized designations. The concept of this new approach is that services can remain specialized, while clustered together such that students can benefit from shared skills, opportunities and resources. In theory this will lead to a more individualized approach to a student's specific educational needs. A student could span

multiple placements in specialized programs in addition to their primary placement. At the elementary level different schools will be clustered together to collectively provide the full continuum of services. Schools are either designated as a "continuum" school or a "satellite" school. Continuum schools provide most of the five special education specialties, while satellite schools provide less and in turn maintain a strong relationship with a continuum school⁴⁹.

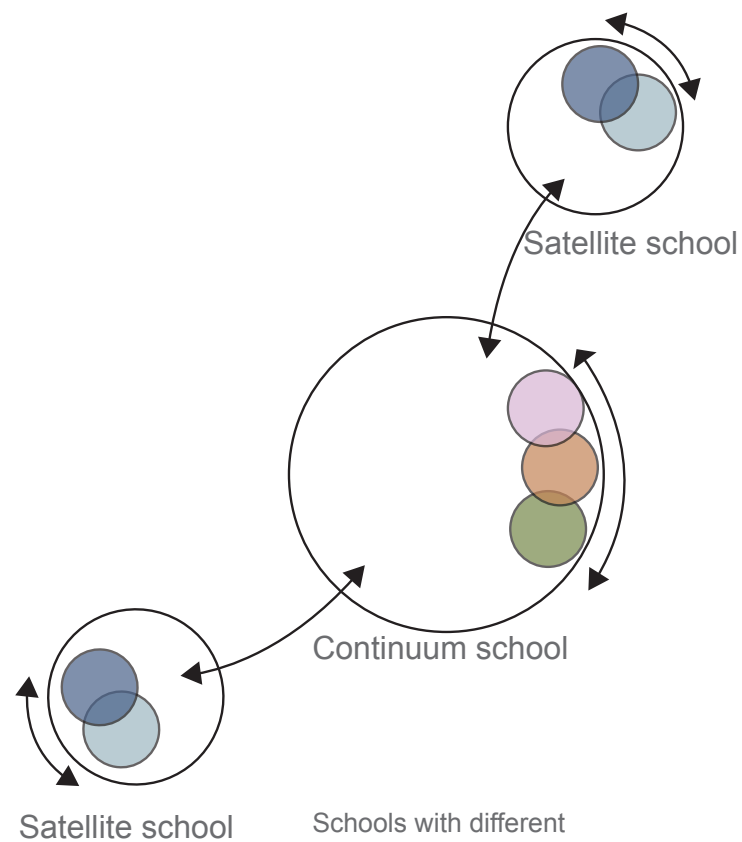
In conclusion, the current lack of programs serving special education students in Seattle is exacerbated by a lack of physical facilities. Architecture can play a role in realizing the inclusive agenda for the public school system. This thesis proposes that the design of an inclusion school can provide a spectrum of spaces that serves the needs of all students in an under-served neighborhood in Seattle.

48. David Rosenthal. "Not-so-special treatment in Seattle of Special Education," Oct 2012

49. "K-12 Continuum Placements." *Seattle Public Schools*. 2016. PDF



Specialized services are grouped together allowing shared resources to meet the specific needs of the individual student.



Schools with different specialized services are clustered together to support the full continuum of need.

Figure 25. *The Continuum Approach*



Figure 26. The entry to Eden Institute, Princeton, NJ

Chapter 4: Program and Design Guidelines

The elementary school serves between 250 - 300 students from kindergarten through fifth grade. All abilities are served with and an emphasis on autism inclusion. The school will include 12 classrooms and therapy rooms while addressing physical education, the arts, and music. The approximate program and square footage is based on the 2012 revised Seattle Public Schools Facilities Master Plan. This document is used as a guide rather than a prescriptive list. The program is allowed to shift and flux to reflect the needs and enrollment of this specific school model.

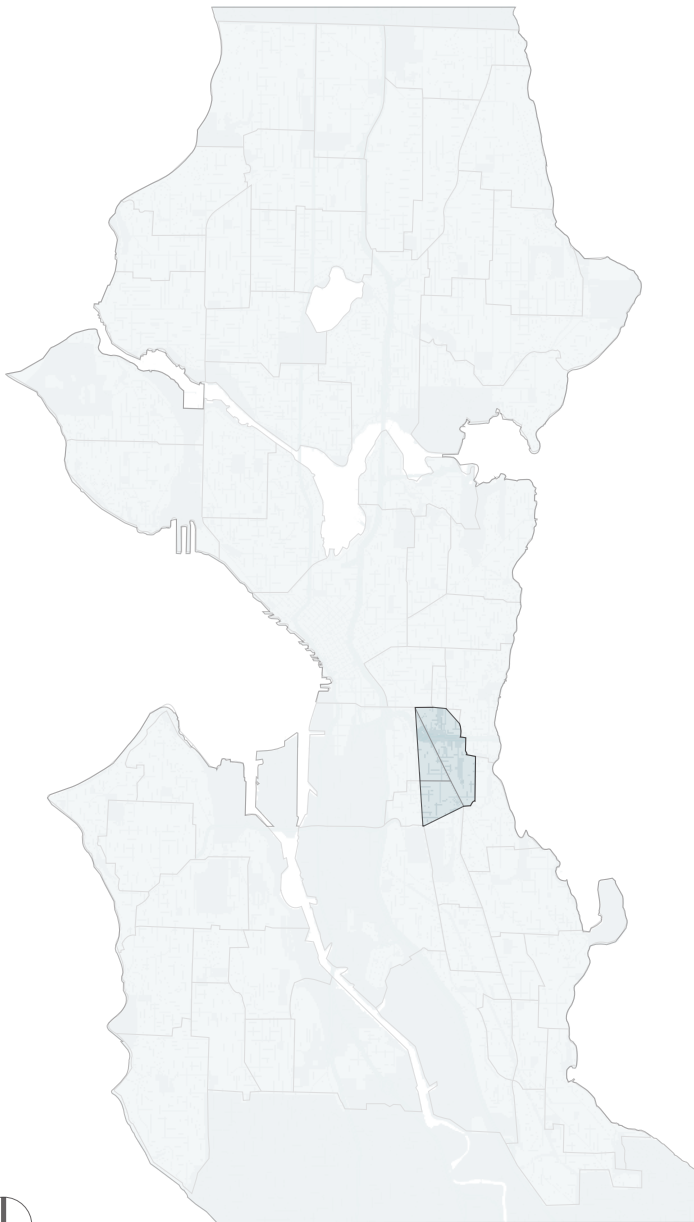


Figure 27. Attendance Area

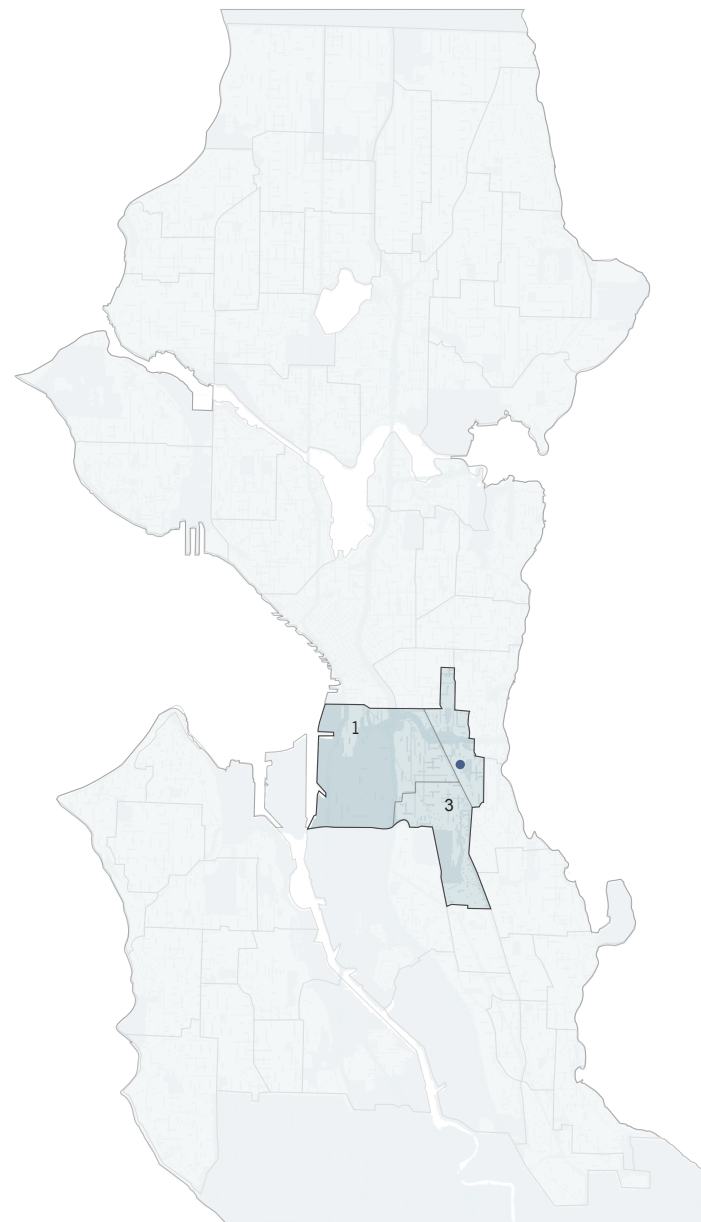


Figure 28. Continuum Area



Figure 29. Continuum Area Urban Fabric

This school is intended as a neighborhood elementary rather than a magnet or option school. Figure 27 suggests a proposed attendance area for the school based on the current designations. The majority of enrollment is expected to come from this area. As discussed in chapter 3, given the low enrollment of elementary programs, schools are expected to share specialties. This means

that students with ASD could be coming from the further attendance areas of Beacon Hill International, Thurgood Marshall, and Kimball Elementary (See Figure 28). The projected enrollment for 2020 anticipates 1421 students served in this combined area⁵⁰. Applying the national 1.5 % national average of autism prevalence to this number the school can expect about 20 - 25 students in need of

⁵⁰. "5-Year Projections (2015-2020)." *Seattle Public Schools*. 2016. PDF

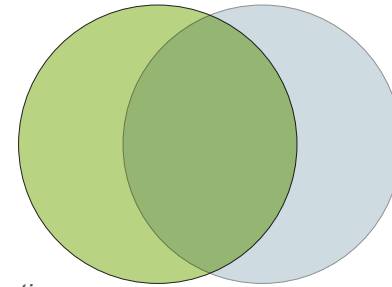


Figure 30. *Integration*

Design Guidelines

Based on the analysis of the case studies and theories concerning autism design, the driving design principles for the proposed learning center focus on integration, predictability, and control over sensory information.

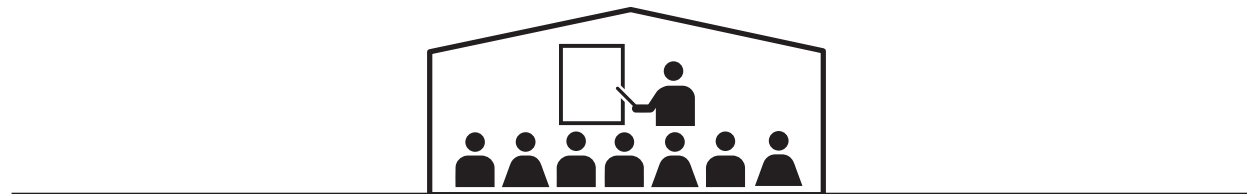
Integration as a core principle of the building's design begins at how the building sits in its site and engages the immediate community. The building will connect with existing community resources. Furthermore, this idea of integration includes a strong relationship between interior and exterior spaces. Finally, programmatically, the learning center is consistent with the Seattle Public School position on an inclusive education meaning that all students, regardless of their cognitive ability, shall have primary assignments within a general education classroom.



Strong relationship with community amenities



Indoor/Outdoor connection



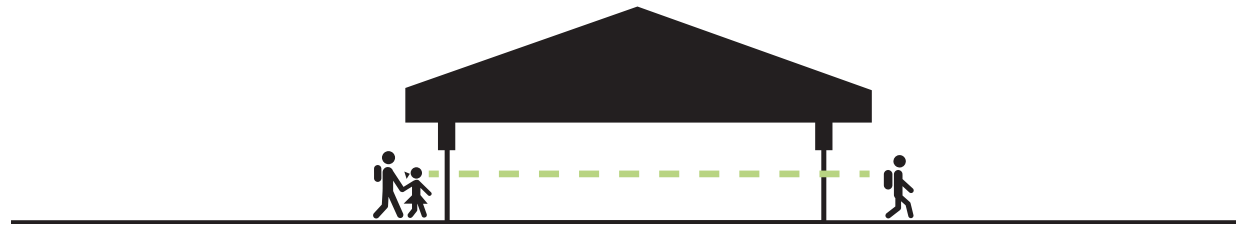
Inclusive of a range of spatial preferences

Figure 31. *Points of Integration*

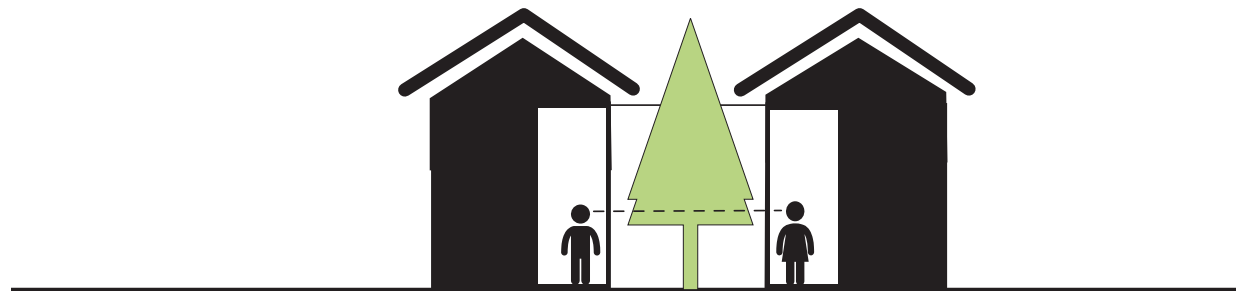


Figure 32. *Predictability*

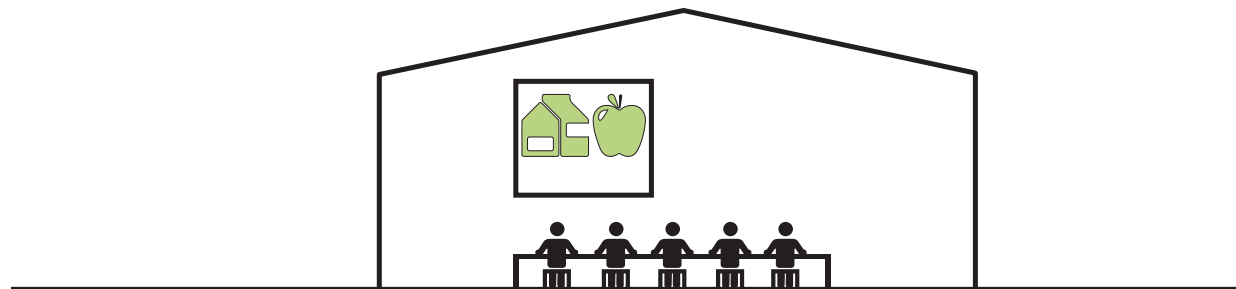
Predictability as a guiding principle emphasizes straightforward circulation, the use of landmark to assist in wayfinding and picture symbols in all signage.



Straightforward circulation



Landmarks



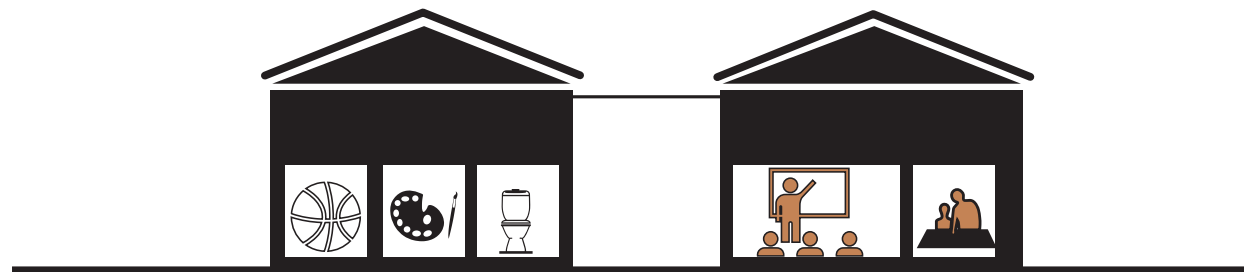
Clear signage

Figure 33. *Points of Integration*

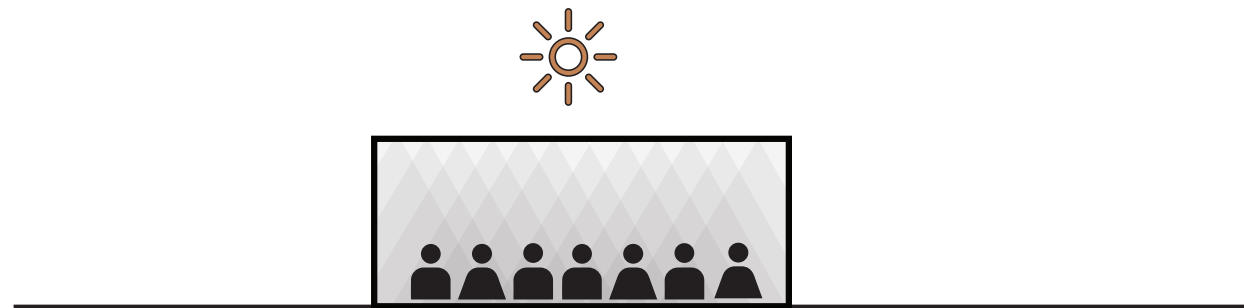


Figure 34. *Sensory Information Control*

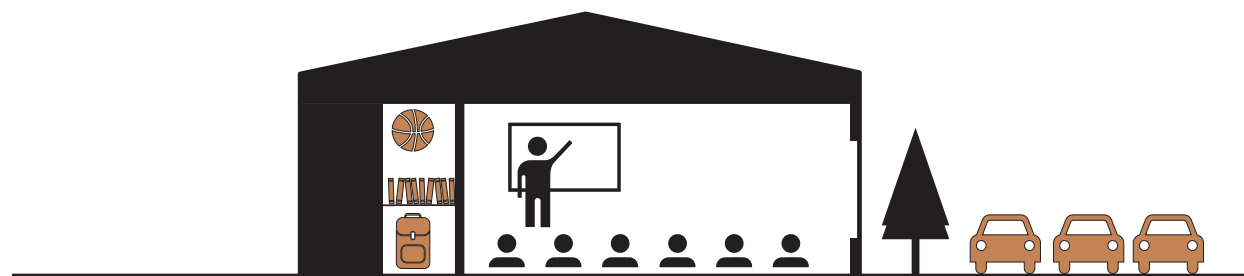
As previously discussed, individuals with ASD can have a heightened sensitivity to sensory information. This design will focus on control of sensory information through the use of sensory zoning, a diffused daylighting strategy in most spaces, and an emphasis on reducing visual and acoustic distractions both inside and outside the building.



Sensory zoning



Diffuse daylighting strategy



Minimize views to distractions

Figure 35. *Points of Sensory Information Control*



Figure 36. Proposed site for Atlantic Elementary

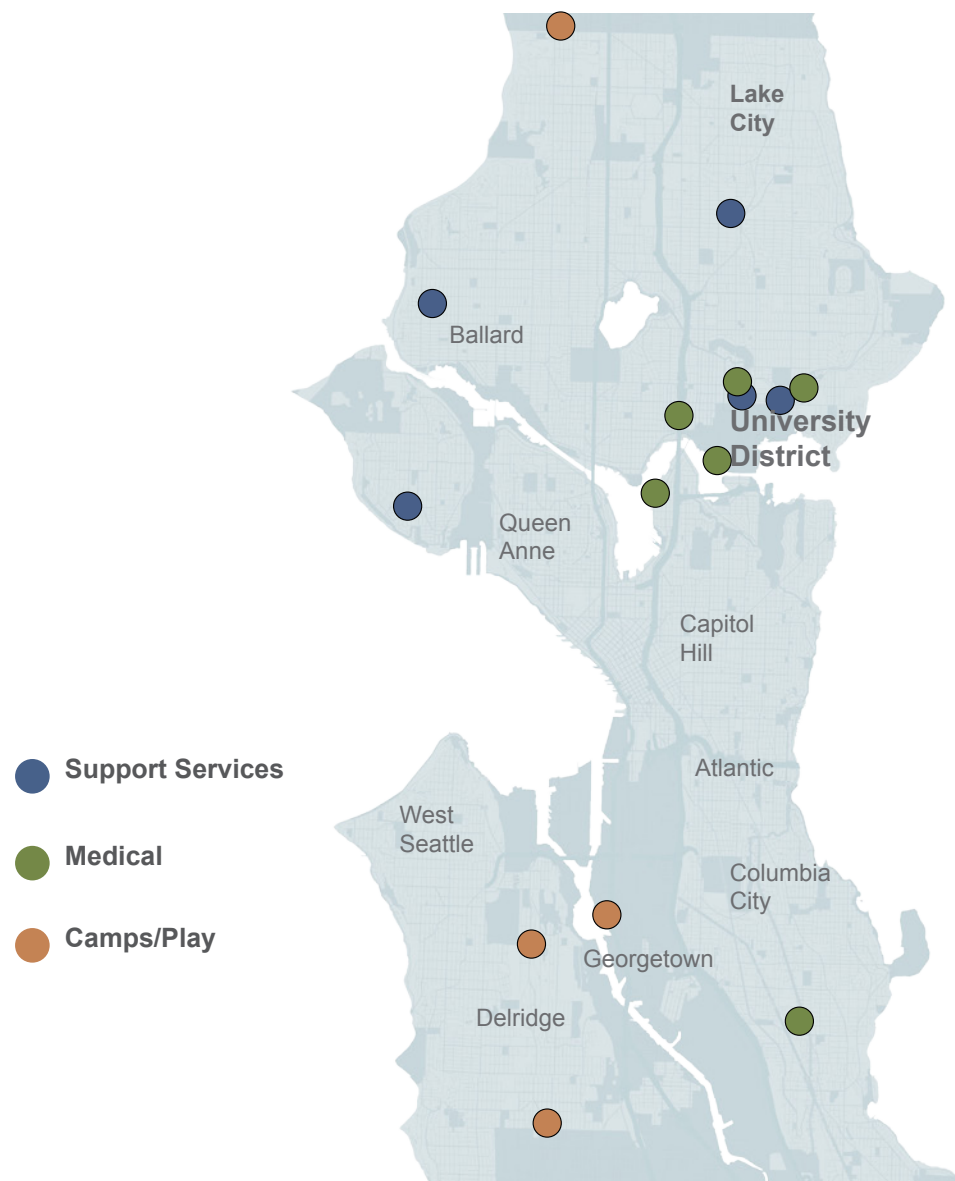
Chapter 5: Site Selection



Figure 37. Site Selection Criteria

Analysis of the current Seattle Public Schools network, as well as autism design theory, leads to four driving selection guidelines for determining an appropriate site for a Seattle elementary school. These criteria consider current educational and community resources, projected neighborhood growth, and elementary schools in need of greater capacity. Preferred sites are vacant or underdeveloped to avoid displacing existing occupants or assets to the community.

As seen in Figure 38, existing resources supporting children with ASD in Seattle are concentrated around the University District. Many of these services are directly linked to the University of Washington Autism Center and Children's Hospital. While a few special needs camps and medical services are located to the south, much of Seattle remains under-served.



 **Figure 38. ASD Resources in Seattle**

Seattle's comprehensive plan for managing its unprecedented growth includes densifying urban centers and villages⁵¹ (See *Figure 39*). The site for the proposed elementary school acknowledges the areas planned for greater growth in order to serve a larger population and partner with existing neighborhood services. Currently, the largest elementary autism inclusion program is offered at John Hay Elementary on Queen Anne, a significant distance away from students seeking services from west and south Seattle.

51. "Seattle's Draft Comprehensive Plan," Seattle 2035. City of Seattle, May 2016

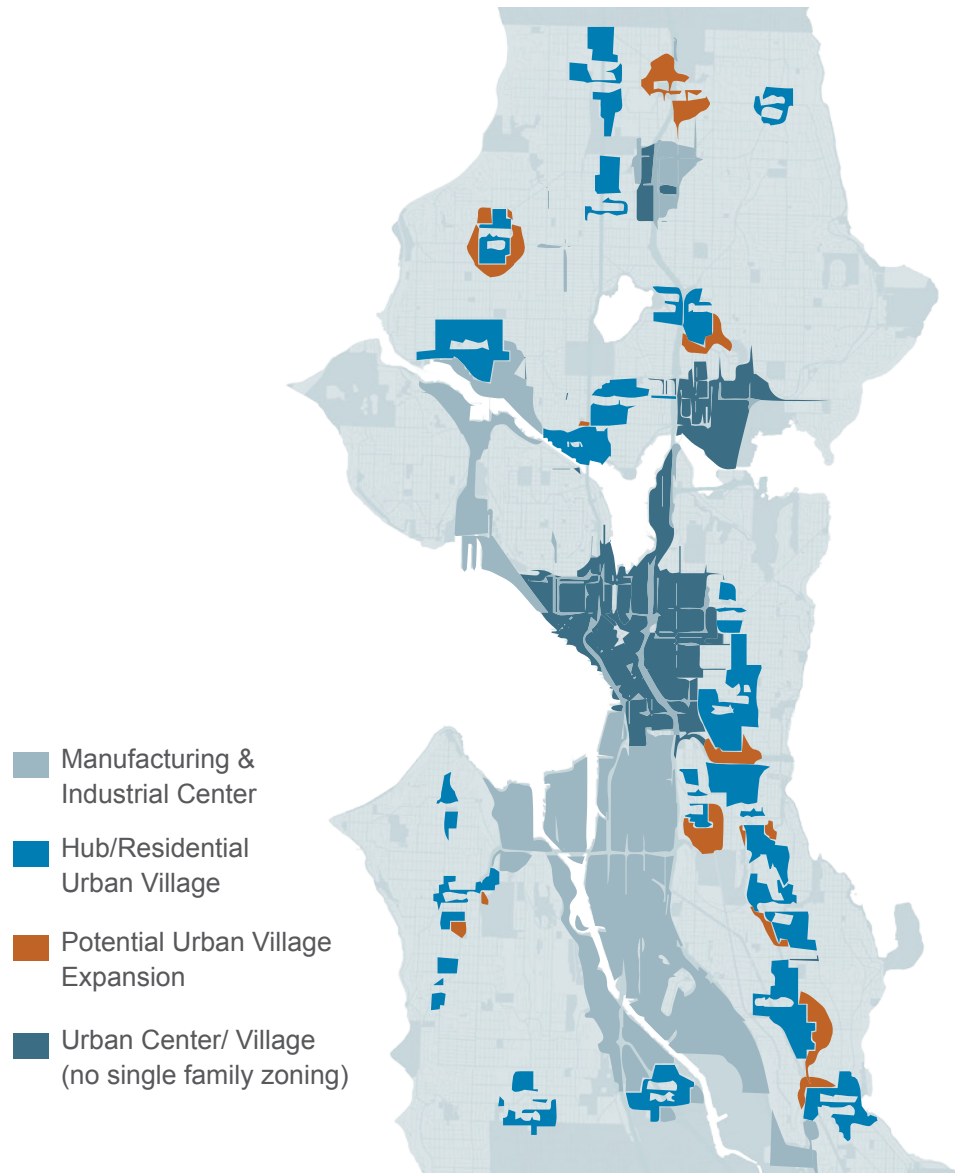


Figure 39. Urban Village Plan 2035

The 2035 Urban Villages Map designates the North Rainier/ Atlantic area as an urban hub/residential urban village with the potential for expansion⁵². With more growth planned for this neighborhood the need to serve more students will also increase. The existing local elementary schools are already close to capacity as is the distribution of portable classrooms. Data from 2006 indicates that six out of the nine elementary schools in the area have four or more portables⁵³ (See Figure 40).

The Facilities Data Matrix, updated in 2010, indicates that sites for Seattle elementary schools range from 1.4 acres to 10.3 acres⁵⁴. Enrollment capacity without portables ranges from about 200 to 400 students⁵⁵. The proposed elementary school will serve approximately 250 – 300 full time students and the acreage for the site will be consistent with those of other Seattle elementary schools ranging from 1.5 to 10 acres.

52. Appendix C: Facilities Data Matrix. Seattle: Seattle Public Schools, 2010. PDF.

53. Ibid.

54. Ibid.

55. Ibid.

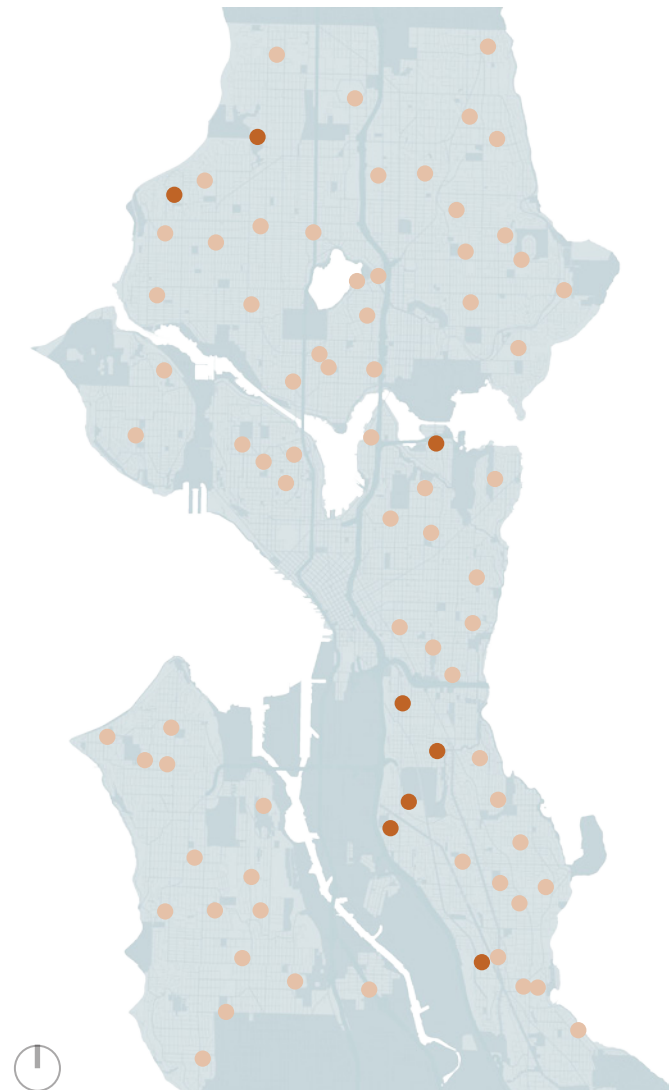


Figure 40. Portables at Seattle Elementary Schools

● Seattle elementary schools with portables

● Seattle elementary schools with four or more portables

Atlantic Neighborhood Site



Taking these factors into account, the proposed elementary school is located in the Atlantic neighborhood just south of Interstate 90 (See *Figure 41*). The neighborhood gives the school its name, Atlantic Elementary. The combined two-block site flanked by Plum Street and Hill Street off of Rainier Avenue addresses the need for greater school capacity in the neighborhood and integration with an under-served community.



Figure 41. Proposed Site



Figure 42. Immediate neighborhood

Currently these two underdeveloped blocks contain low-rise residential and commercial buildings and vacant lots. This project assumes that the city would allow for the closure of 24th Avenue South between Plum Street and

Hill Street since 25th and 23rd Avenue South both connect the two streets (See Figure 42). Furthermore, 24th Avenue currently terminates at Walker Street, two blocks to the south.



a. North end of site along Hill Street



b. Neighbor across Hill Street



c. Amy Yee Tennis Center



d. Low rise commercial on existing site



e. Empty lots on east end of site



f. 2100 Building

Figure 43. *Atlantic neighborhood and proposed site*

Multiple parks, as well as community and youth-oriented services, are located within a quarter-mile radius of the proposed learning center site (*See Figure 43*). This offers a potential for shared resources and collaboration with the school. Colman playground, located just two blocks north of the site, consists of 2.4 acres of play area. Additionally, Amy Yee Tennis Center located east and across Martin Luther King Avenue, includes indoor and outdoors courts with programming for all ages. Martin Luther King Jr Memorial, located just south of the tennis center across South Walker Street, includes a green space and central sculpture memorializing the civil rights leader. The school could use these spaces for break-out activities, neighborhood walks and picnicking (*See Figure 44*).



Figure 44. Martin Luther King Junior Memorial Park



Figure 45. Green Plate Special

The Atlantic neighborhood has already demonstrated its commitment to supporting learning with the 2100 Building, a community institution built in 2003(See *Figure 43*). The 2100 Building is directly south of the site and houses 12 non-profit groups supporting children in the community including the YMCA family and young adult services, Rainier Scholars and the Northwest Children’s Fund. The building additionally provides the community with four meeting rooms, a conference space and an art studio⁵⁶. Located next door, the Green Plate Special aims to foster youth empowerment through gardening, cooking, and eating. Programming includes after-school and summer programs focusing on cooking and gardening skills (See *Figure 45*). This organization already partners with Seattle Public Schools laying the foundation for future collaboration with the learning center⁵⁷.

56. “The 2100 Building,” The 2100 Building. 2016 <<http://2100building.com/>>

57. Laura Dewell, “About Green Plate Special,” *Green Plate Special*. 2016 <<http://greenplatespecial.org/>>



Figure 46. Atlantic Elementary West Courtyard

Chapter 6: Design Response

Programmatic Organization and Massing

The design of Atlantic Elementary demonstrates how designing to the spatial and sensory needs of autistic students results in better spaces for everyone. The design approach focuses on a schematic-level design of the entire school with greater detail focused on a classroom, interior courtyard, learning commons, and the dining hall. In this way, the design explores a representative low-sensory space, high-sensory space, collaborative zone and exterior space. The general layout of the school is organized around the notion of sensory zoning.

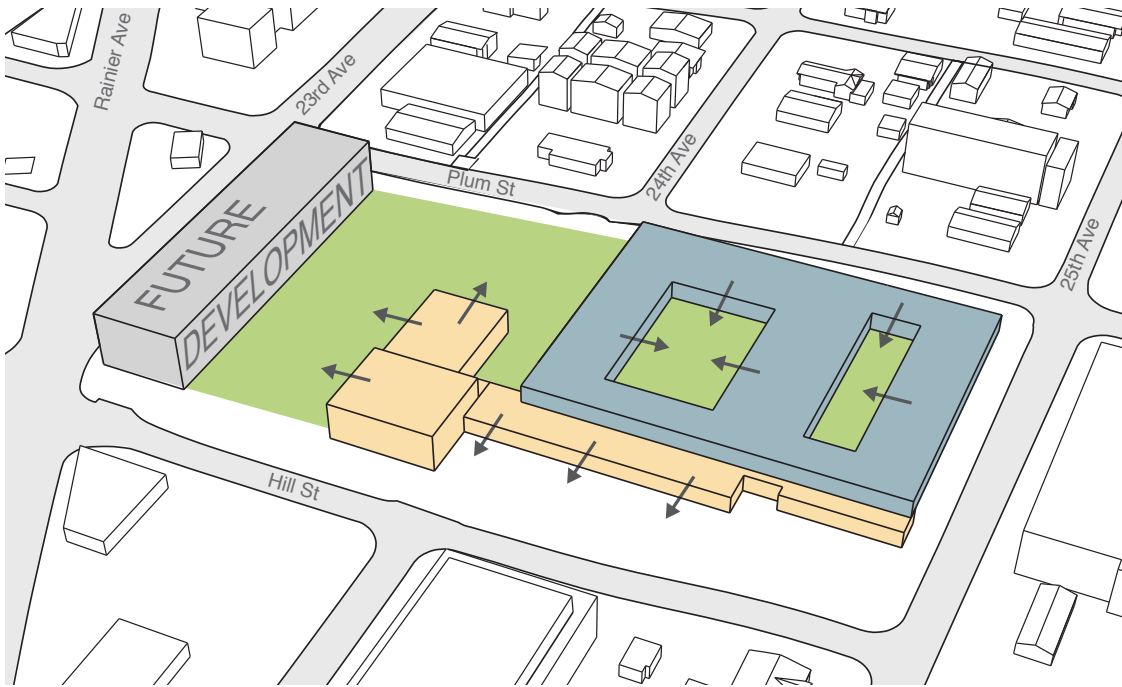


Figure 47. Massing

The school building is positioned against 25th Avenue taking advantage of the quietest edge of the site while the edge facing 23rd Avenue and Rainier Avenue is reserved for future development (See Figure 47). This future development serves as a buffer against the traffic and activity along Rainier Avenue and will house program that facilitates a mutually beneficial relationship with the school. Program may include additional education-oriented

non-profits, a daycare, or therapists focused on ASD and other developmental disorders. Within the building itself, the low-sensory, high-focus areas are raised above the entrance level and look inward towards interior courtyards. This leaves the higher sensory program, including gym, music, art, dining, and administrative functions to orient outward towards the street and playfield.



Figure 48. *First Floor & Site Plan*

Circulation

School buses drop students off on the south side of Atlantic Elementary adjacent to Hill Street. Students enter the building between bars of administrative offices. They then continue up ramping corridors along the classroom wings. The corridors' shift in plane emphasizes the transition from the school's entry up into the higher-focus learning zone. The lower grades are located closer to the entrance in the eastern half of the school while grades four and five are located in the western academic wing sitting a level above. A stair and elevator bring these older students down to the higher-sensory functions of the school.



Figure 49. Section looking east

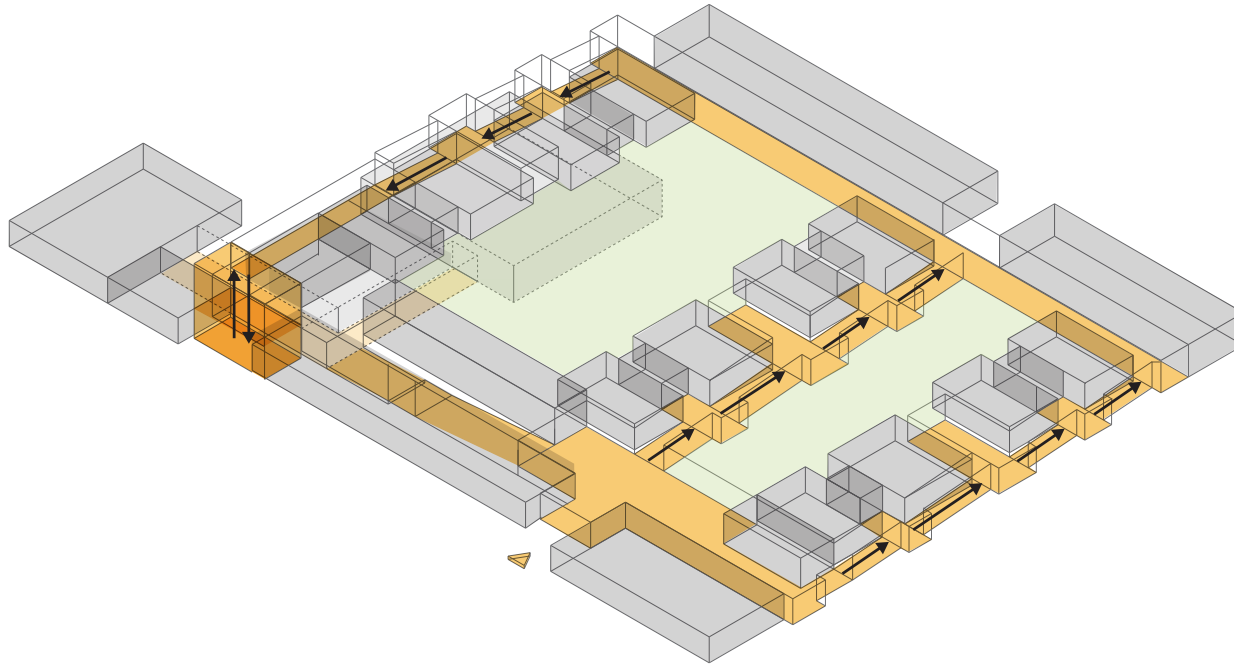


Figure 50. Building Circulation

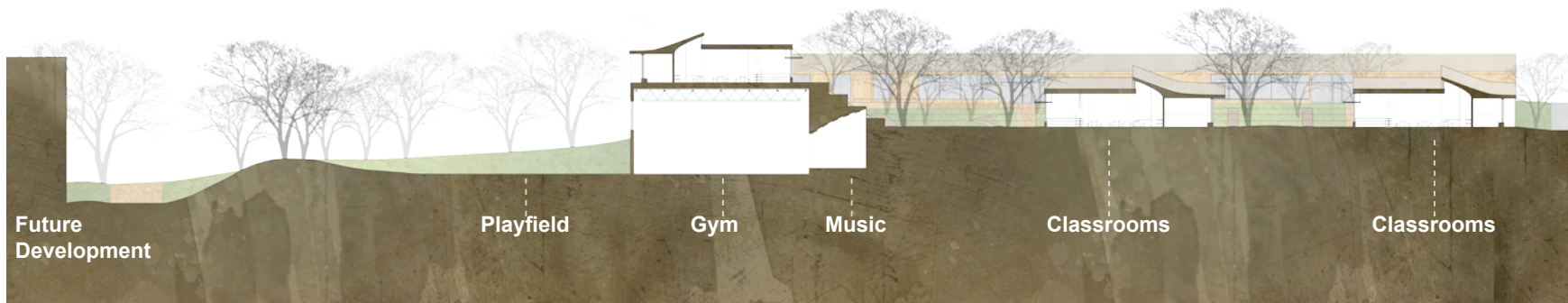


Figure 51. Section looking north

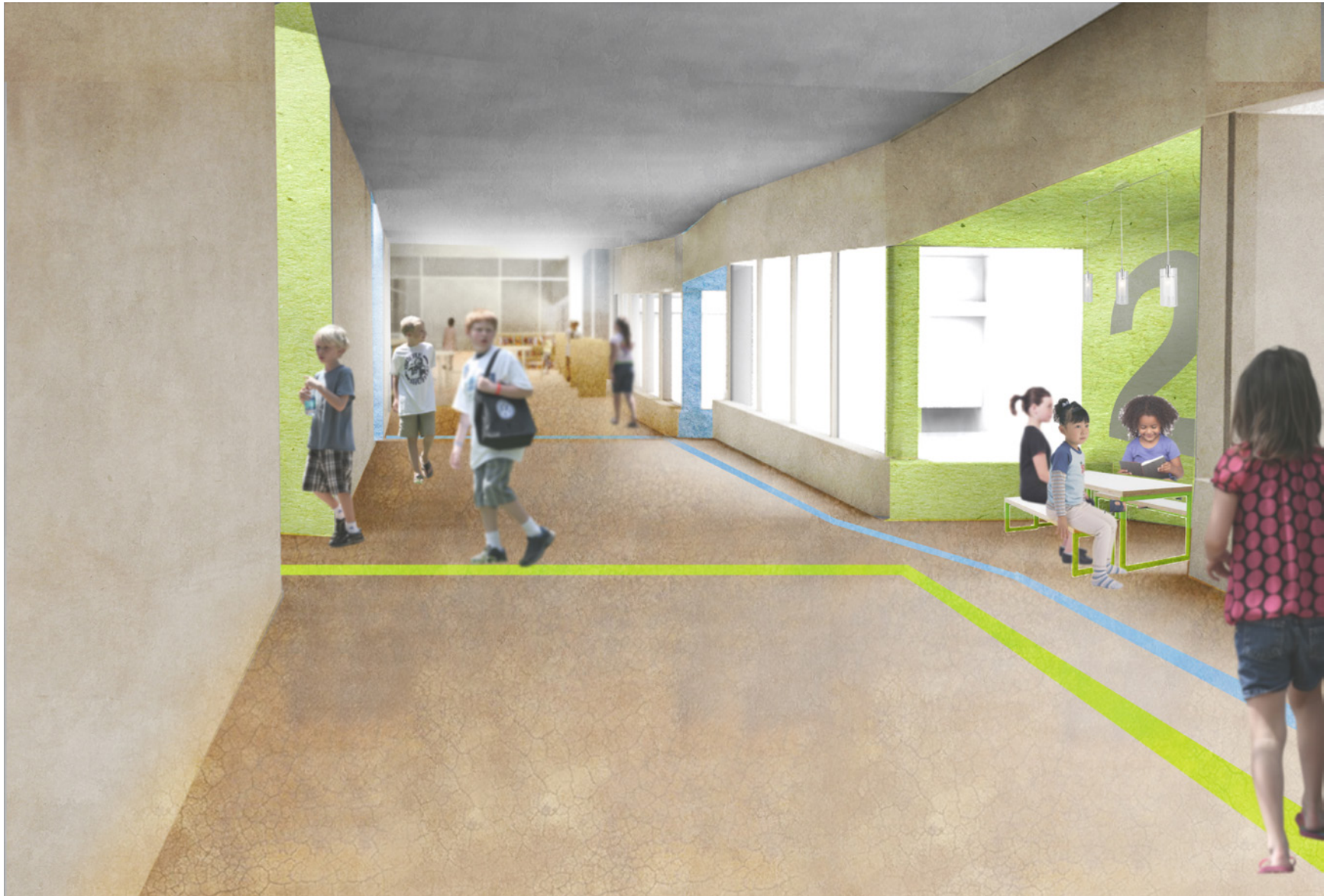
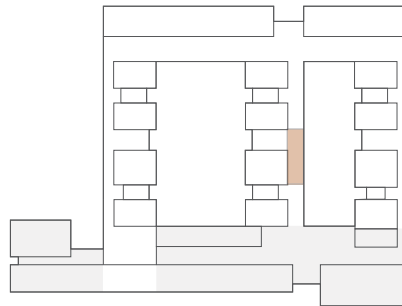


Figure 52. Academic Corridors



Academic Corridors

The corridors rely on daylighting from side windows for illumination to minimize the need for potentially stressful electric lighting. Electric lighting is instead used to accent seating nodes within the corridors. Each grade-level includes a pair of classrooms with a common platform between ramps. This platform serves as a hub for each grade. It contains the entries for both classrooms and includes seating for gathering and supplementary instructional space. Each hub has its own unique color to assist in wayfinding. Further wayfinding devices include the use of picture-symbols for signage and colored lines that run along the corridor floors guiding students to their specific classroom.

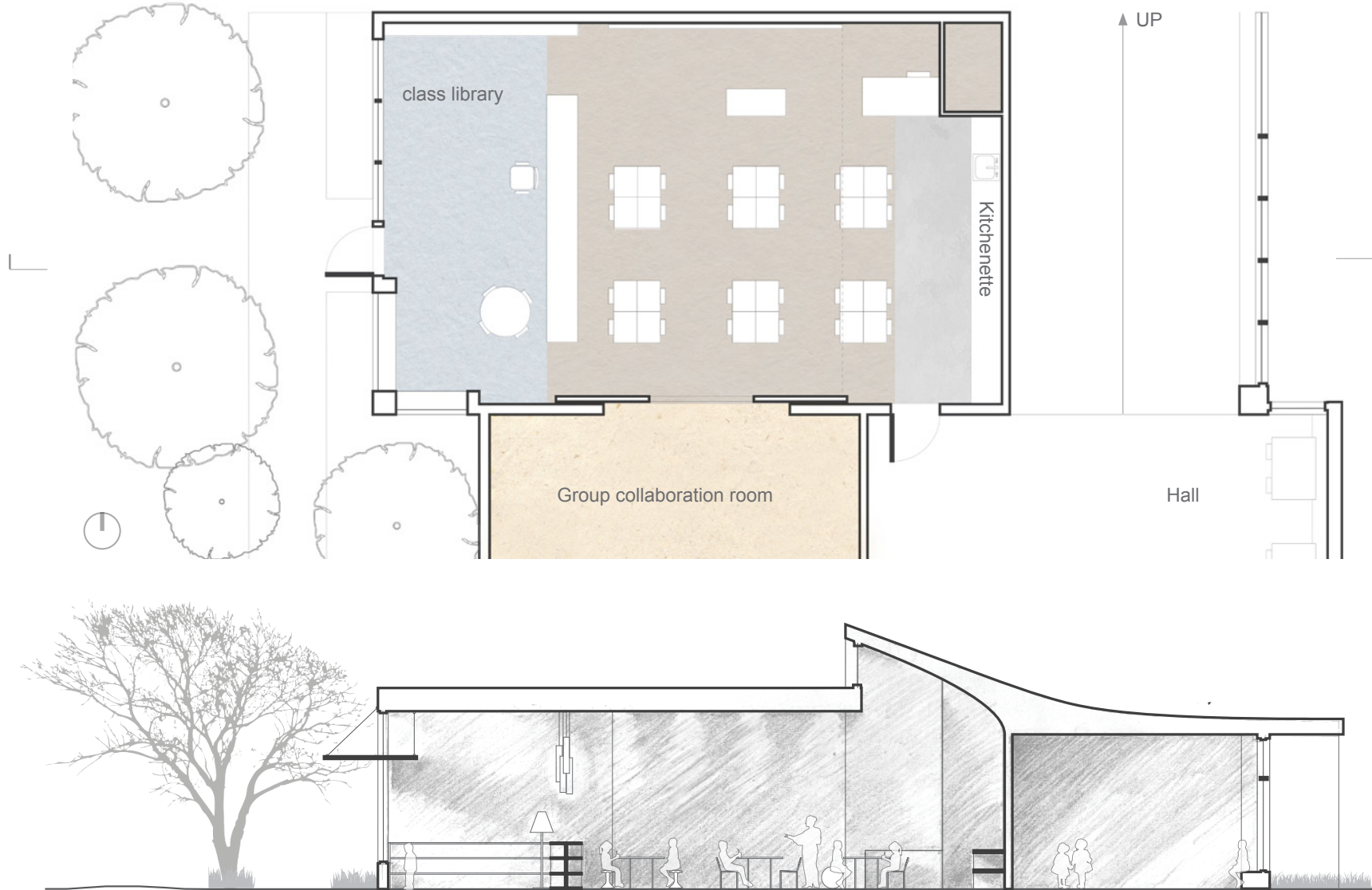
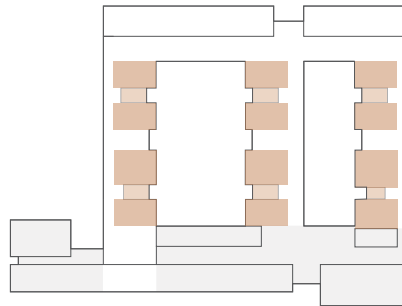


Figure 53.1 Representative Classroom Plan (Above)

Figure 53.2 Representative Classroom Section (Below)



Classrooms

Each classroom is 925 sf, which is slightly larger than the 900 sf that the Seattle Public Schools Facilities Master Plan calls for. This is due to the range in students' desired personal space. Typically students with ASD prefer more personal space. Classrooms within a grade level are paired together and share a common small group collaboration room. Sliding doors open from the classrooms into this space. Small groups can work independently from the rest of the class or the door can be held open allowing for an expanded classroom space. Finally, opening all sliding doors allows for an entire grade-level to share one combined classroom.

Each classroom is organized into three zones (See *Figure 53.1*). Students enter from the hall into the service zone containing the highest level of sensory information including the kitchenette, student cubbies for backpacks, and additional storage. The central zone is focused on desk learning and includes a primary and secondary teaching wall. The dual teaching walls encourage the teacher to move throughout the classroom for instruction thereby minimizing a sense of a particular front and back of the classroom. The zone adjacent to the window wall is organized around “rug-time” instruction. This zone includes the class library and anticipates that students are learning while seated on the floor.

Sensory information control is a priority within the classroom design. Clerestory lighting from above, along with windows to the side, contribute to a diffused daylighting strategy. The view-windows are additionally equipped with roll-down shades to fine-tune lighting conditions and to allow teachers to block out potential

visual distractions from outside. Trees and landscaping between the classroom and the outdoor paths act as a screen from potential outdoor distractions. Extra storage space minimizes clutter and therefore visual distractions within the classroom. Finally, given the amount of time students spend learning while seated on the ground, sub-floor heating is used to contribute to more consistent and comfortable temperatures within the classroom.

The classroom addresses a range of spatial and learning needs. If a student feels overwhelmed and needs to remove herself or himself from a group situation, a refuge space is available in the form of a window seat. Here the student can calm down while still remaining in the classroom. Furthermore, a range of furniture allows for varying degrees of movement according to the student’s preference.



Figure 54. Representative Classroom View

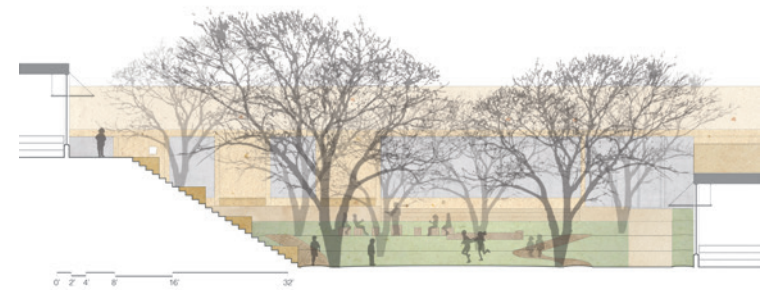
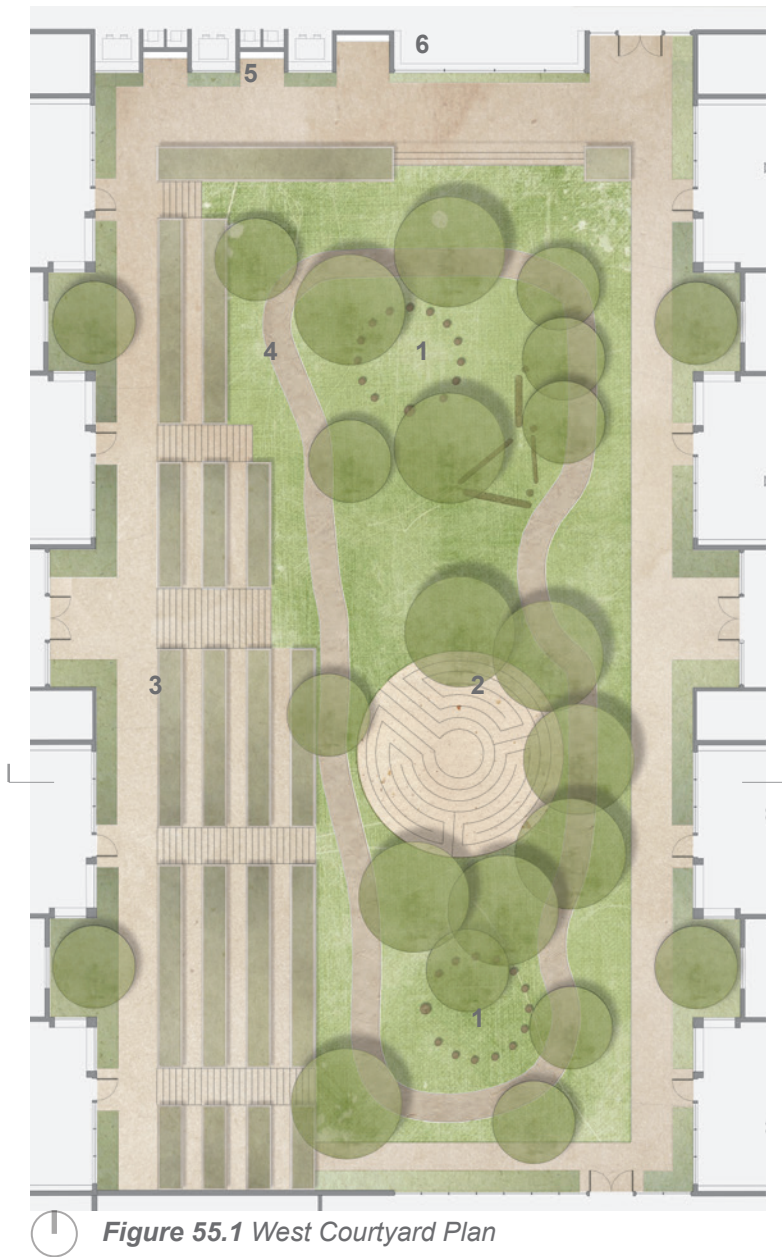
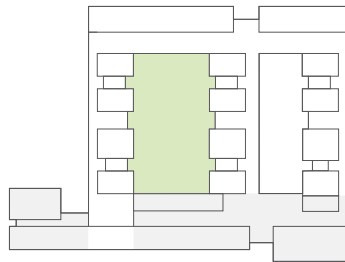


Figure 55.2. West Courtyard Section Looking North

- 1 Outdoor Classrooms
- 2 Labyrinth
- 3 Garden terraces
- 4 Walking Path
- 5 Sitting niches
- 6 Learning Commons



Courtyards

The adjacency of enclosed courtyards to the classrooms and learning commons facilitates a close relationship between outdoor and indoor learning. A series of terraced gardens reconciles the fourteen-foot grade-change between the west and east sides of the larger courtyard (See *Figures 55.1 and 55.2*). These gardens support sensory therapy activities while adding to the sensory experience of all students.

Each courtyard includes a meandering walking path (See *Figure 56*). Paths can be used for both exercise and for students who learn best while engaged in movement. For more stationary learning both courtyards include fixed outdoor classroom spaces. The west courtyard includes a 30-foot in diameter labyrinth. For many students walking through a labyrinth can be a calming and restorative experience. Occupational therapists may use the courtyards to challenge their students in a more “real-world” and fun experience. For example, instead of using equipment inside the classroom, a therapist may challenge a student by having her or him climb the courtyard’s stair, walk along the trail, or practice balancing while walking across logs.



Figure 56. West Courtyard View

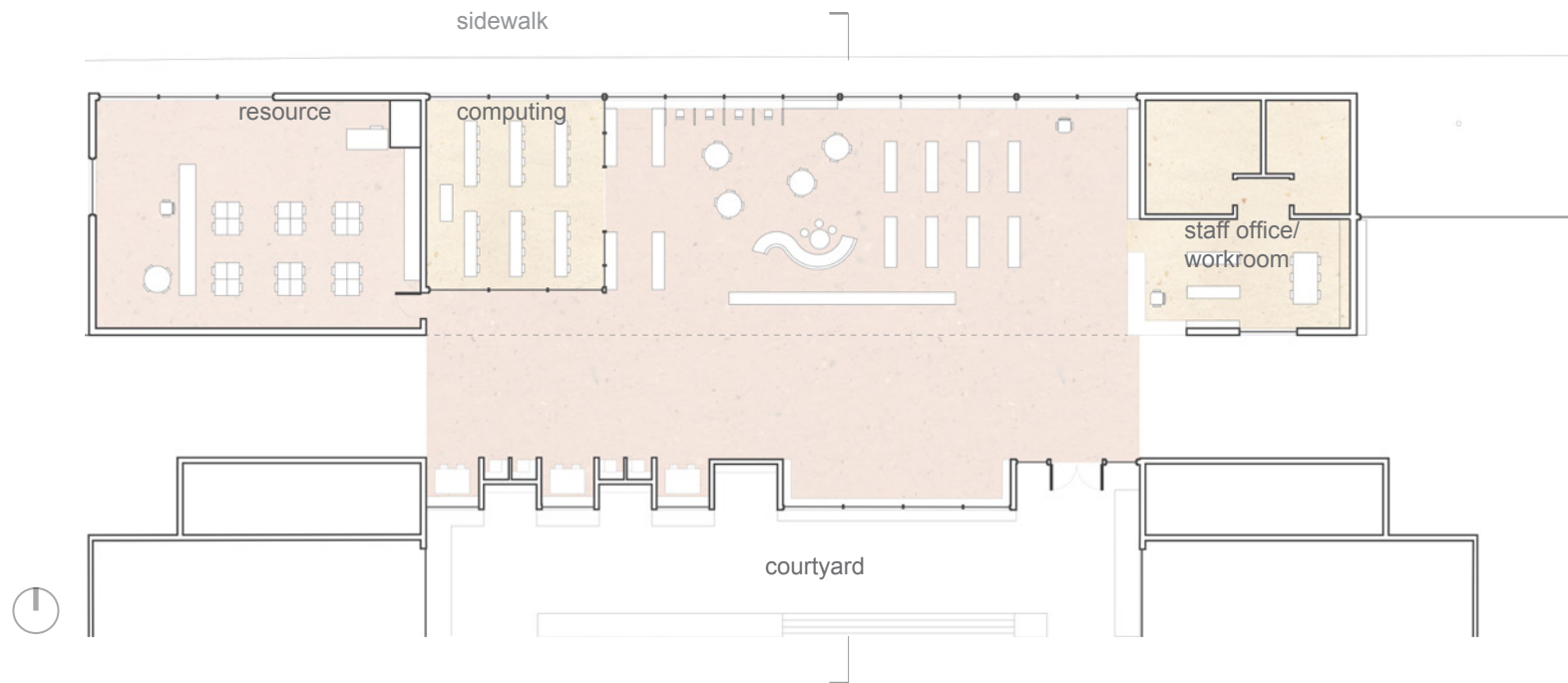
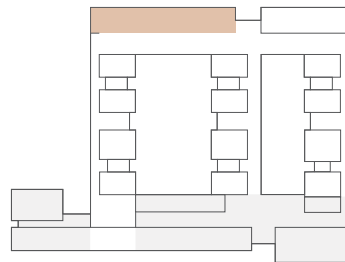


Figure 57.1 *The Learning Commons Plan (above)*

Figure 57.2 *The Learning Commons Section Looking West (below)*



The Learning Commons

The Learning Commons occupies the north end of the building, which includes the traditional library print collection, computing and media center, and resource room (See *Figure 57.1*). The Learning Commons stretches across the circulation space connecting to additional seating opportunities overlooking the courtyard to the south (See *figure 57.2*). This southern edge includes seating niches for individuals and groups in both the interior commons and exterior courtyard. The Learning Commons opens up to a porch along the north end of the courtyard allowing learning to continue outside.

Rather than siloing the different functions of the Learning Commons program can flex and change as needs require. The library print collection is located in the center of the space with the librarian's office to the east. This zone includes a range of seating and spatial opportunities. Students can sit and read or study on softer, more lounge-like furniture, at small group tables, or in a small window seat. Study carrels for older students needing a more focused environment are located along the north end of the space.

The large sliding doors along the east end of the computing and media center allow the space to have a dynamic spatial relationship with the rest of the commons. The doors can either be opened allowing for greater flow into the rest of the commons or can be closed at more focused instructional times. The walls of the computing and media center are glass allowing for a strong visual connection to the rest of the commons while allowing this area to be acoustically distinct. Roll-down blinds give additional sensory control if the space needs further darkening or less visual distractions.



Figure 58. Inside the Learning Commons

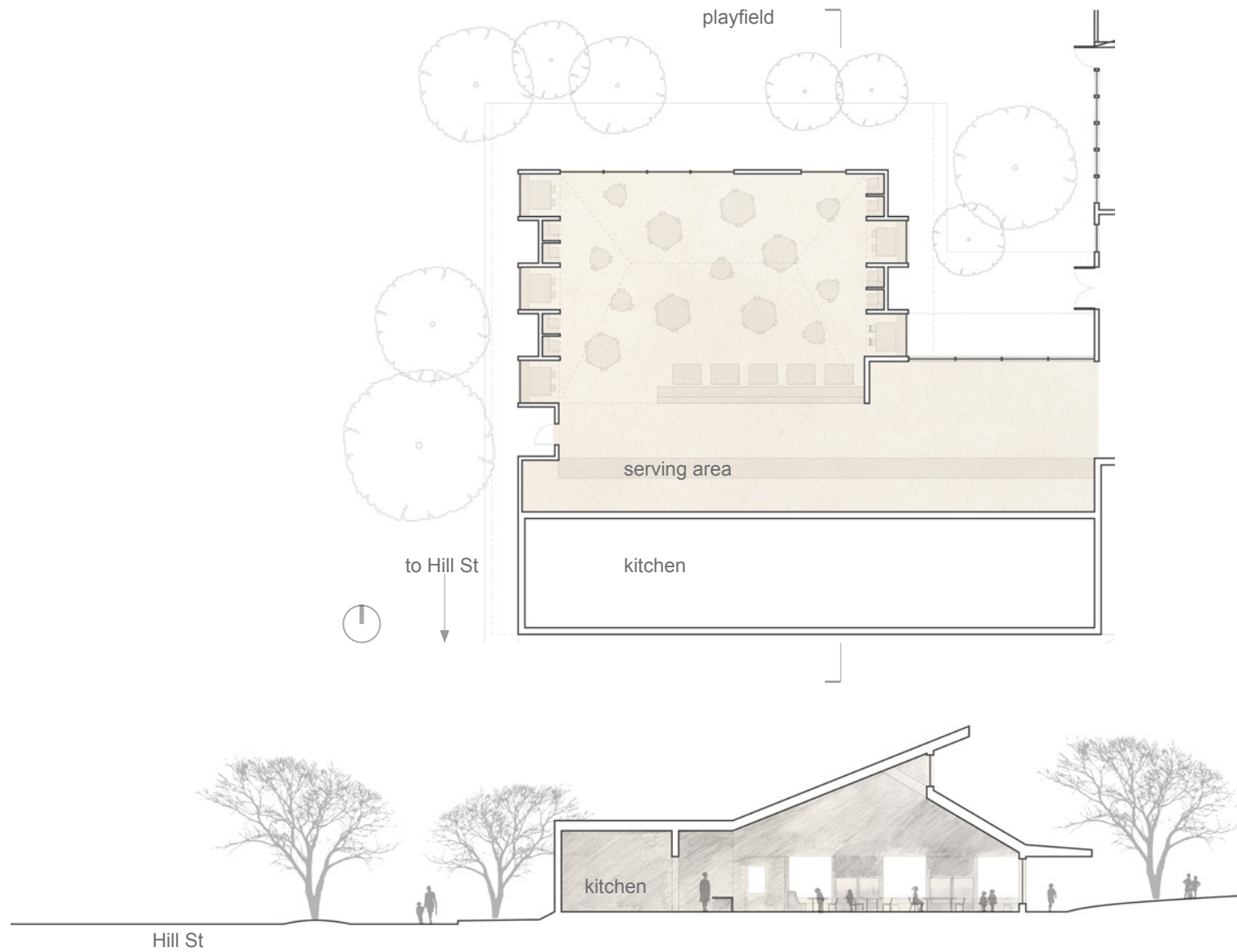
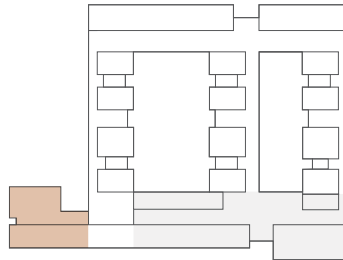


Figure 59.1 Dining Hall Plan

Figure 59.2 Dining Hall Section Looking West

The Dining Hall



One of the most socially demanding times of the school day is often lunch. For this reason it is important for the dining hall to be a carefully designed space separate from the gymnasium. The combination of these two programs is typical within elementary schools, however, their vastly different social dynamics makes the sharing of these two functions in a common space inappropriate.

The dining hall extends to the west and connects to the rest of the school by a corridor, which allows for views in three directions. To the east lies a small courtyard shared with the art room while the playground and field are seen to the west and north. As students approach the dining hall they pick up their trays along the southern wall and retrieve their lunches before moving into the central dining area with its taller ceilings and more expansive spaces. The ceiling slopes to take advantage of the northern light from above to maintain diffused daylight throughout the space.

A range of seating options are available to fit an individual student's social and spatial needs. Toward the center of the room round tables accommodate larger groups of students. Large windows on the north wall look out to a view of the playfield beyond. Seating for smaller groups of three and four students is included in niches along the east and west walls. For individuals that would prefer to sit alone individual bench seats and tables are built into

even smaller pockets. Here a student can choose to orient themselves with their back against the wall and to look out across the lunchroom or can eliminate much of the visual stimulus by orienting themselves to look at the wall. These individual pockets include a skylight above allowing for natural daylight without opening up toward an outdoor view which may be overwhelming.



Figure 60. Inside the Dining Hall



Figure 61. Atlantic Elementary classroom

Chapter 7: Conclusions

Beyond Atlantic Elementary

The strategic approach for exploring the design of Atlantic Elementary includes a schematic plan of the entire site paired with more developed ideas within representative zones. These zones include two relatively high sensory areas (the west courtyard and the dining hall) along with two relatively low-sensory areas (the classroom and the learning center). These spaces suggest the design intent for the remainder of the project. Given this strategy there are opportunities to develop the project further beyond the time frame of this thesis. Acoustic analysis and studies into the tactile nature of materials could elevate the notion of

sensory design as it applies to schools. Similarly, there are opportunities to apply the design principles to other high-sensory areas of the school's educational environment such as the large play field and playground. While the focus of the design exercise is primarily inward looking, the project presents an opportunity to develop the relationship with the immediate neighborhood. This begins not only with developing the building's facade but also looking for opportunities for shared program. Similarly, there are opportunities for an urban response that continues to apply the ideas of sensory zoning.

Public school districts throughout the country maintain the policy of inclusion meaning that all students should be able to learn and thrive within the same school, and to the greatest extent possible, the same classroom. A review of the literature finds, however, that outside of the special education classroom, the design of most schools in the United States fails to sufficiently serve the spatial and sensory needs of those with cognitive or sensory differences. While sited in Seattle's Atlantic neighborhood, this school serves as a broader model for future school design. This thesis shows how designing to the needs of students with autism spectrum disorder results in

spaces that benefit all students. To support successful learning for everyone designers should prioritize issues of sensory information control, predictability, and the integration of a range of options to meet the diversity of needs and preferences. School districts across the country are engaged in an evolving conversation on how policy and educational models can support the inclusion of all students with a range of abilities, preferences and needs. This thesis shows how architecture can support and enhance these efforts resulting in a more robust and interdisciplinary approach to quality education for all.

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