# ABSTRACT

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| Title of Document: | DESIGNING FOR THE SPECTRUM: An Educational Model for the Autistic User |
| | David Paul Leestma, Masters of Architecture, 2015 |
| Directed By: | Associate Professor Madlen Simon, AIA |

According to the Center for Disease Control children are being diagnosed with autism with greater frequency today than in the past, partially due to the refinement of diagnostic techniques and increased vigilance on the part of parents, pediatricians and teaching professionals. The educational system for those with autism however has not caught up to the growing population. The students are often overlooked by the school district and given classrooms that are detrimental to their sensory perceptions. In order to serve the needs of autistic students, new facilities need to be built and current facilities need to be adapted in order to accommodate this growing population. This thesis imagines a learning environment which both facilitates learning for those with sensory perception issues and creates an environment which fosters social interaction among students regardless of physical and mental capabilities. The design of this learning center will be designed based on research and case studies, followed by the creation of a set a principles, and the application of these principles to a test case.

# DESIGNING FOR THE SPECTRUM
## An Educational Model for the Autistic User

By

David Paul Leestma

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# Acknowledgements

Thank you to my my committee, Mady, Steve and BK, for their guidance and support over the course of this thesis. Thank you to all those who helped me put my final presentation together. Thank you to all my friend and family who have supported me throughout this process.

# Dedication

This thesis is dedicated to a specific person in my life who I have looked up to and who has guided me throughout my life. Her dedication to special education and teaching those with autism was the inspiration for my thesis and without her I would not be where I am today. Thank you mom.

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# 1. Introduction

According to the Center for Disease Control the number of students with autism is growing rapidly. From 2000 to 2010 the prevalence of autism has gone up from 1 in 150 to 1 in 68[1] (Figure 1.1). The need for schools which are designed to accommodate the autistic student is growing. As more students are identified as autistic there needs to be more facilities to educate the students, their parents, and teachers, as well as school administrators and designers (Figure 1.2). The typical school is not designed to accommodate the specific needs of those with autism and other disabilities.

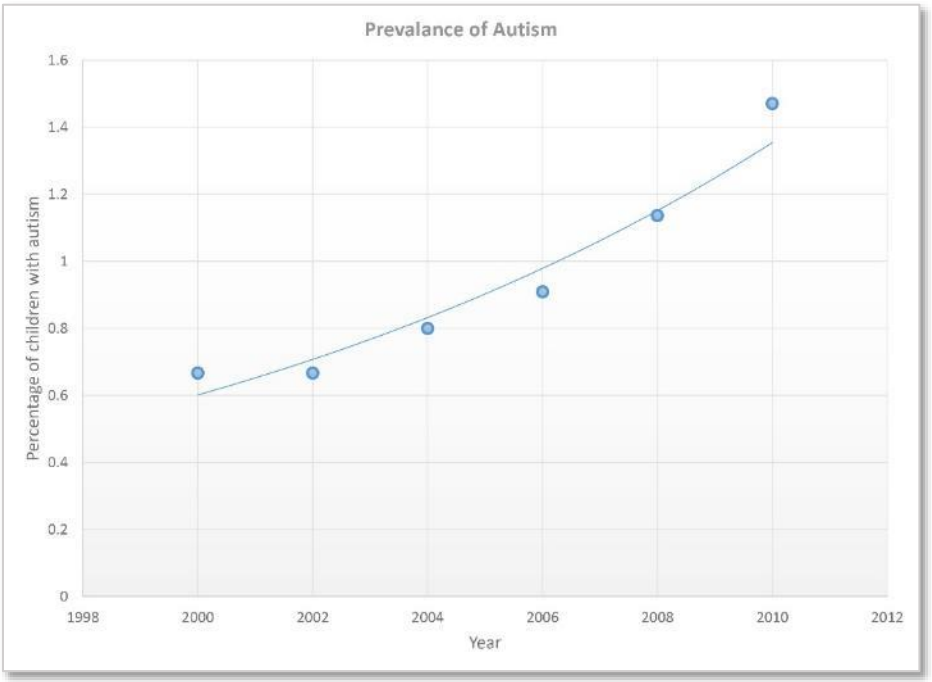



*Figure 1.1: Prevalence of Autism (image by author, data compiled from Center for Disease Control)*

[1] Center for disease control, *Community Report from the Autism and Developmental Disabilities Monitoring (ADDM) Network*.

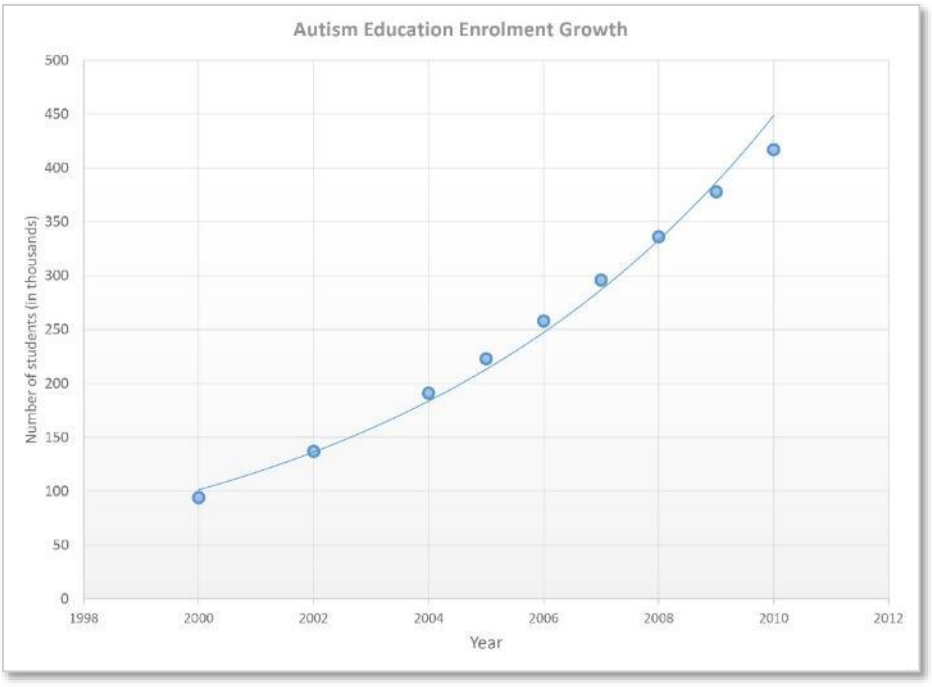



*Figure 1.2: Autistic Enrollment Growth (image by author, data compiled from National Center for Education Statistics)*

The right to a beneficial education is something that should be available to all students regardless of how their mental or physical condition is defined in medical or legal terms. For those with autism, education is one of the most important factors in enabling them to live fuller lives. Education teaches them the important social and life skills that are otherwise difficult for those effected with this disorder to master.

The Education for All Handicapped Children Act of 1975 (EHA) was the first step in giving equal rights to education for those with mental and physical disabilities. The act states that all students are to be provided with a "free appropriate public education" within the "least restrictive environment." Before the EHA, Individuals with disabilities constituted one of the most disadvantaged groups in society and this legislation attempts to provide protection of the rights of those with disabilities.

However, the definition of "least restrictive" has not been legalized and thus many students with autism are placed in classrooms and schools that ignore their needs and are not conducive to learning. As growing numbers of students are diagnosed with autism there will be an increase in the need for appropriate educational facilities.

This thesis intends to design an environment which addresses the needs of autistic users by using architectural principles that are intended to foster social interaction among peers and mediate the sensory perceptive issues that autistic individuals face. Such facilities will need to take into consideration accommodations for the autistic by following design principles based on, lighting, acoustics, colors and patterns, flexibility, transitions, predictability, escape spaces, safety, and durability. The research described in this document will provide an in-depth analysis of educational facilities, both ones that are designed for students with autism and ones that are not. Emphasis is placed on achieving an educational facility that is designed around the sensory and social issues that affect the autistic community and creating a model set of design principles. The facility will be able to teach parents and educators about the impact that the built environment can have on an autistic individual.

It is the role of the designer to take the needs of the user and interpret them to make a thoughtful architecture by balancing technology, functionality and aesthetics. This thesis will develop and employ a number of architectural design principles that will provide an environment that encourages and fosters learning, promotes social integration, and reimagines the form of the learning environment through the eyes of

someone with autism. This will be accomplished through the study of the room, the building, and the campus in an educational setting.

The demonstration of the application of the principles derived from the research on environments for the autistic will be through the design of a facility for the College of New Jersey connected with the School of Education and the School of Nursing, Health, and Exercise Science. The program provides a center for teaching those with autism ranging from ages 3-21. The center will also have program for diagnostics and early intervention for children under the age of three. Joined to a college campus, the center can serve as a learning facility and education lab for the special education majors, who will be able to gain real life experience working with autistic children at the center. The center would also provide spaces for the parents of children with autism to be better educated on the disability and learn about best practices for raising their children. The center will be able to serve as a didactic learning environment for parents and educators. By seeing the way the center is designed and how the architecture has an influence on their children or students', parents and future teachers will be able to adapt their own environments, whether a house or classroom, to what is best for the autistic individual.

# 2. Defining the Problem

## *Understanding the User*

To understand the specific accommodations and requirements of a user it is imperative to understand the type of student who will be using this facility. Autism is not a single disorder, but a spectrum of closely-related disorders albeit with a shared core of symptoms. In the fifth revision of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Autism Spectrum Disorder (ASD) is a range of conditions classified as neurodevelopmental disorders. The spectrum identifies disorders ranging from less severe to more severe and includes Asperger Syndrome, Atypical Autism or Pervasive Developmental Disorder not otherwise specified (PDD-NOS), Childhood Disintegrative Disorder, and Autism Syndrome (Figure 2.1). Every individual on the autism spectrum has problems to some degree with social skills, empathy, communication, and flexible behaviors. Within and between the spectrums the different classifications can vary from more severe to less severe[2] (Figure 2.1).

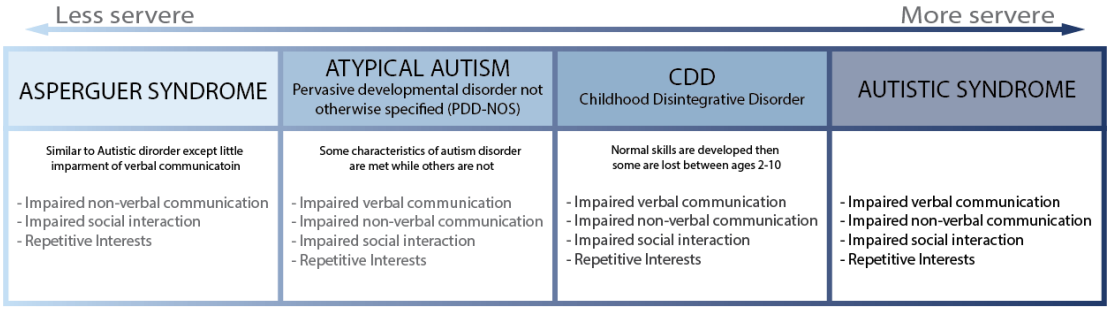



*Figure 2.1: The spectrum of Autism disorders (image by author)*

[2] Maloney, Gilmour, and Kuhn, *Life Journey through Autism: Navigating the Special Education System*.

According to the Autism Spectrum Resource Center, only 20% of people on the autism spectrum have Autistic Syndrome otherwise known as classic autism. The overwhelming majority fall somewhere on the milder range of the spectrum. The major symptoms of Autism are social communication difficulties, language disabilities and repetitive behaviors, with many related signs and symptoms including sensory problems, emotional difficulties and uneven cognitive abilities (Figure 2.2)

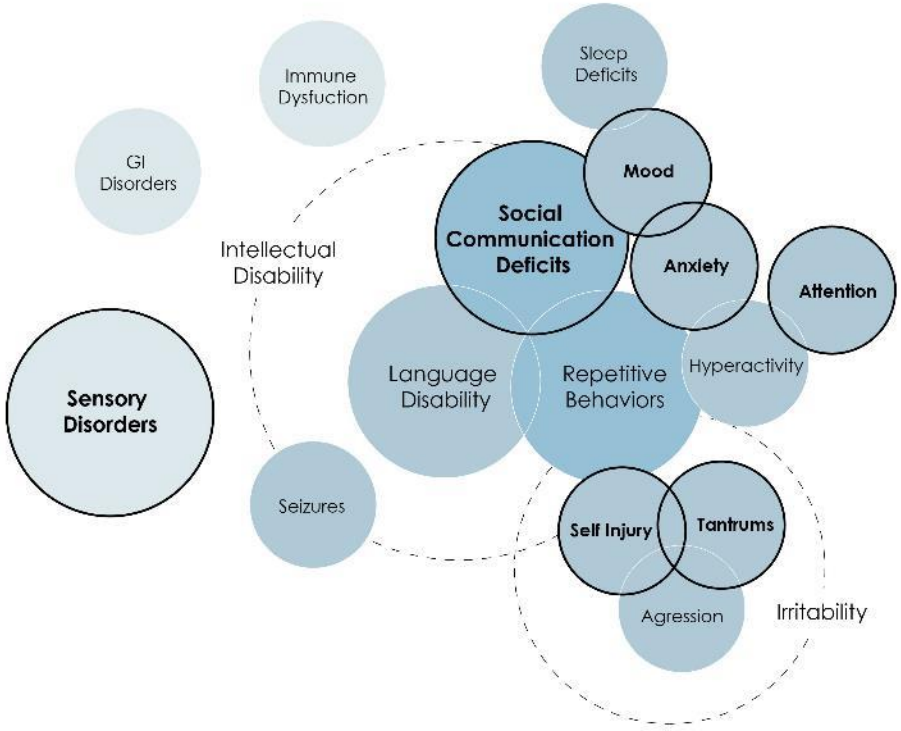



*Figure 2.2: Core features of autism and related symptoms (image by Author, data from Autism Speaks)*

Social communication symptoms;

- Unusual or inappropriate body language, gestures, and facial expressions (e.g. avoiding eye contact or using facial expressions that don't match what he or she is saying).
- Lack of interest in other people or in sharing interests or achievements (e.g. showing you a drawing, pointing to a bird).

- Unlikely to approach others or to pursue social interaction; comes across as aloof and detached; prefers to be alone.
- Difficulty understanding other people's feelings, reactions, and nonverbal cues.
- Resistance to being touched.
- Difficulty or failure to make friends with children the same age.

Language disability symptoms;

- Delay in learning how to speak (after the age of 2) or doesn't talk at all.
- Speaking in an abnormal tone of voice, or with an odd rhythm or pitch.
- Repeating words or phrases over and over without communicative intent.
- Trouble starting a conversation or keeping it going.
- Difficulty communicating needs or desires.
- Doesn't understand simple statements or questions.
- Taking what is said too literally, missing humor, irony, and sarcasm.

Repetitive behavior symptoms;

- Repetitive body movements (hand flapping, rocking, spinning); moving constantly.
- Obsessive attachment to unusual objects (rubber bands, keys, light switches).
- Preoccupation with a specific topic of interest, often involving numbers or symbols (maps, license plates, sports statistics).
- A strong need for sameness, order, and routines (e.g. lines up toys, follows a rigid schedule). Gets upset by change in their routine or environment.
- Clumsiness, abnormal posture, or odd ways of moving.
- Fascinated by spinning objects, moving pieces, or parts of toys (e.g. spinning the wheels on a race car, instead of playing with the whole car).

The ability to diagnose those with autism has increased greatly over the last several years partially due to the refinement of diagnostic techniques and the increased vigilance on the part of parents, pediatricians and teaching professionals. According to the Center for Disease Control the prevalence of autism has increased by 220% from 2000 to 2010. The majority of the increase can be attributed to the growth in autism awareness so more parents are testing their children, better diagnostic techniques, and a change in the definition of autism. Although the exact cause of

autism is currently unknown it is believed to be caused by genetic problems, severe infections to the brain, or exposure to toxins.

There is no known cure for autism. In some cases, medications and dietary restrictions may help control symptoms. Intervention should begin when the child is young and early intervention and preschool programs are very important as it has been clearly shown that such interventions can improve the social and cognitive functions of a child with autism.

### *History of Autism*

Autism is a little understood disorder due to its recent appearance and youth as a disorder. Although autism was first coined over 100 years ago the awareness and understanding of it has not emerged until recently. The term “autism” was coined by Eugen Bleuler in 1908 to describe severely withdrawn schizophrenic patients. In 1943 Dr. Leo Kanner published an article entitled, “Autistic Disturbances of Affective Contact,” in which he used the term autistic to describe the symptoms after conducting a study with 11 children. In 1944 Hans Asperger, independent of Kanner, wrote about a group of children he called autistic psychopaths. In most aspects they resembled the children of Kanner's description. In 1967 psychologist Bruno Bettelheim popularized a theory on autism that "refrigerator mothers," as he termed them, caused autism by not loving their children enough. Although completely false, the study showed the lack of understanding at the time of what autism was. In 1977 research on twins found that autism is largely caused by genetics and biological differences in brain development. In 1980 "Infantile autism" was listed in

the Diagnostic and Statistical Manual of Mental Disorders for the first time, making it a classified mental disorder. Since the 1980s, numerous advocacy groups such as Autism Speaks and the National Autism Society have increased the awareness of the disorder in society. However, autism as a known disorder has existed for less than a century, making it relatively young among recognized medical conditions. [3]

[3] Sole-Smith, "The History of Autism."

### *History of Education for Those with Autism*

The Education for All Handicapped Children Act (EHA) in 1975 was the first act which gave those with mental disabilities the same right to education as their neurotypical peers. Before 1975, American schools educated only one out of five children with disabilities. More than 1 million students were refused access to public schools and another 3.5 million received little or no effective instruction. Many states had laws that explicitly excluded children with certain types of disabilities, including children who were blind, deaf, and children labeled "emotionally disturbed" or "mentally retarded." Some students who had mental disabilities were placed in mental institutions and, although the idea is no longer in practice, the stigma that is associated with those with mental disabilities in a learning environment still exists. During the 1950s and 1960s family organizations and advocacy groups began forming and fighting for the rights of children with disabilities. This advocacy and campaigning led to the U.S. Congress passing the EHA.

The EHA requires public schools to provide students with a broad range of disabilities, including physical handicaps, mental retardation, speech, vision and language problems, emotional and behavioral problems, and other learning disorders, with a "free appropriate public education." It also mandated that school districts provide such schooling in the "least restrictive environment" possible. The EHA was a huge step forward for disabled education, not just those with autism. In 1983 the law was extended to include parent training and information at the state level, which allowed knowledge of the disorder to spread and increased advocacy. Parent training was also essential as many parents at the time did not know how to raise a child with

autism and this is still a common problem today. In 1986, early intervention programs for children with autism were introduced as well as education services for preschoolers. Research has shown that early intervention programs for children with autism have greatly improved their development. [4]

Another piece of legislation that had a great impact on the lives of people with disabilities was the Americans with Disabilities Act (ADA) of 1990. Although not specifically related to educational needs, this Act affirms their civil rights and prohibits discrimination against those with disabilities. Title three of the act prohibited disability based discrimination in any place of public accommodation, which included most places of education. ADA legislation is the most widely known and understood piece of legislation set in place for people with disabilities. Furthermore, it is the piece of legislation that has resulted in guidelines and laws that require architectural accommodation.[5]

Also appearing in 1990 was the Individuals with Disabilities Education Act (IDEA) which expanded the services and eligibility of the EHA. The act required schools to provide individualized or special education for children with qualifying disabilities. In 1991 autism received a separate designation under IDEA, ensuring that students with autism will receive Individualized Education Programs (IEPs) and appropriate educational programming. IDEA was reauthorized in 1997 and 2004, which expanded the act to include students with disabilities to be included in state and district-wide

[4] Osgood, *The History of Special Education : A Struggle for Equality in American Public Schools*.
[5] Osgood, *The History of Special Education : A Struggle for Equality in American Public Schools*.

assessments. Also, regular education teachers are now required to be a members of the IEP team. The amendment in 2004 called for more accountability at the state and local levels, as more data on outcomes is required.[6] [7]

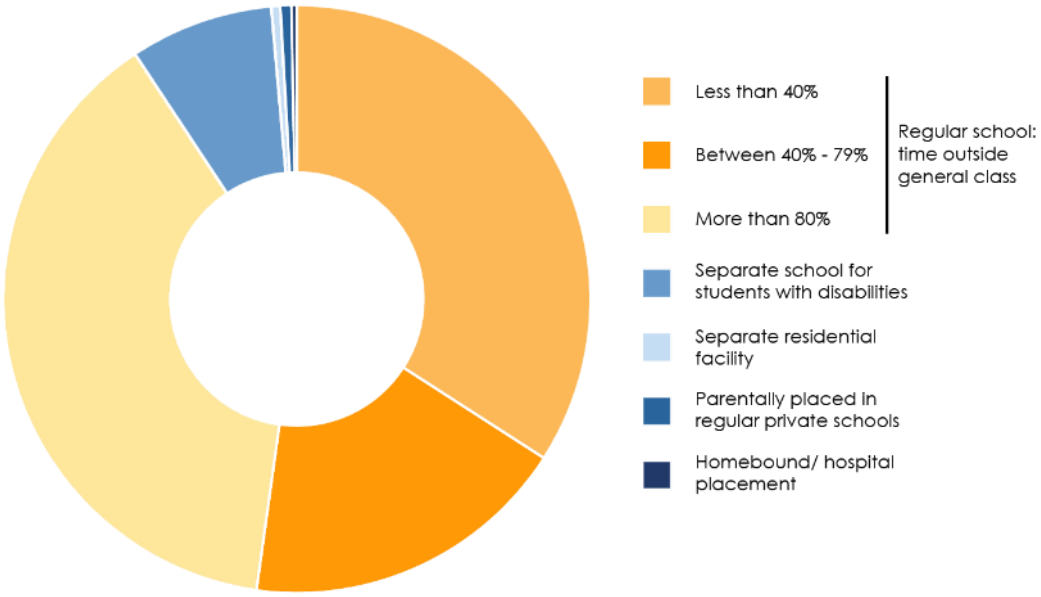



*Figure 2.3: Distribution of students 6 to 21 years old by educational environment (image by Author, data compiled from National Center for Education Statistics)*

The current trend in autism education is integrating the autistic child into the neurotypical classes. The majority of students with autism learn at a regular school while spending sometime in general classes (Figure 2.12). This allows the child to have interactions with peers their own age. But, this also puts the autistic students in an environment which could be distracting and cause a negative effect on their ability to learn.

[6] U.S. Department of Education, *Thirty-Five Years of Progress in Educating Children With Disabilities Through IDEA*.
[7] Osgood, *The History of Special Education : A Struggle for Equality in American Public Schools*.

The problem facing the autistic students today is that the classrooms they are subject to are not conducive to their learning needs. In order to be given a "free and appropriate education" in the "least restrictive environment" the current classroom and school for students with autism needs to be redesigned. The concept of inclusion also needs to be reevaluated. It is important for those with autism to be interacting with members of their own peer groups, both autistic and neurotypical, in order to build social skills. But does the distraction that is due to being in a typical classroom cause more harm than benefit? Is there a way to create a learning environment which is conductive to the special needs that autistic children require and that can serve as a model of design for future classrooms?

### *Educational Process for Those with Autism*[8]

The education process for those with autism differs greatly from that of a neurotypical student. The education services begin earlier and last longer than those in a typical program, where the age range is from 5 to 18. The age range for students with disabilities is often from birth to 21. Under IDEA children with disabilities are able to receive services up to the age of 21, so typically a student will be enrolled in school until that time to get as much education as possible. The educational path of an autistic student can be broken into distinct periods: early intervention services, preschool services, school services, transition, and age of majority (Figure 2.13). The bases for the education process for a student with autism through school is the Individualized Education Process (IEP)

[8] Maloney, Gilmour, and Kuhn, *Life Journey through Autism: Navigating the Special Education System*.

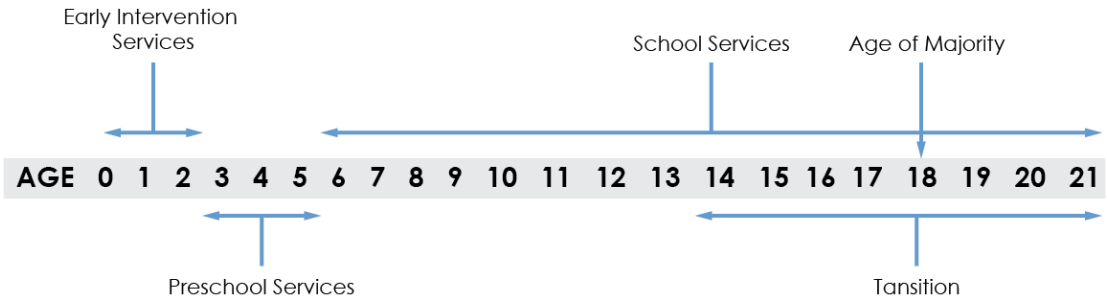



*Figure 2.4: Timeline of services for autistic students (image by author)*

*Individualized Education Programs*

The Individualized Education Plan is a written document that outlines a child's education and creates a program that is tailored to the individual student to provide the maximum benefit. Programs are developed on a student by student basis because a program for one student will not necessarily work for another. The IEP is a legal document which outlines the child's special education plan and goals for the school year, services needed to help the child meet those goals, and a method for evaluating the student's progress. The IEP involves numerous people, most importantly the child's parents, teacher, a representative of the public agency other than the teacher, and the child if appropriate. Due to the amendments to IDEA in 2004, parents are entitled to participate in the IEP meeting as equal participants with suggestions and opinions regarding their child's education. Parents may bring a list of suggested goals and objectives as well as additional information that may be pertinent to the IEP meeting. Parents of autistic individuals need to be educated on what is best practice for their children just as much as the teachers, in order for the parents to be able to take a hand in their child's education.

*Early Intervention Stage*

The early intervention stage takes place between birth and two years of age. Research has shown that the sooner a child receives early intervention services, the greater likelihood for positive outcomes. During this stage the child will receive home-based services under an Individualized Family Service Plan (ISFP). Children can begin accessing services before receiving an actual diagnosis. Early intervention addresses five main developmental areas: physical, cognitive, communication, social and emotional, and adaptive skills. They focus on educating the child and providing early intervention services in the normal environment, which is usually the home. The federal requirements for early intervention programs recognize parents as the child's primary teacher and require parent involvement in therapies.

*Preschools Services*

Preschool special education services differ from early intervention in that preschool services are school-based while early intervention are typically home-based services. The preschool services are the stage when children with autism are first in an environment dedicated to and designed for learning.

*Schools Services*

School services refer to the time period in which the autistic child is enrolled in a primary school system, be it public or private. The IEP program is started during the school years of 6-21. The program for the student is based on his/her individual needs and what the student will respond to best. This period is significant due to two events which happen during the teen years, the *Transition* and the *Age of Majority*.

*Transition*

The transition phase of the IEP was added to IDEA along with the 1997 amendment. The purpose of the transition plan is to prepare students receiving special education services for meaningful employment, schooling, and independent living after high school. For students with more severe skill deficits, the transition plan will include options such as sheltered employment and referral to county services, as well as discussions about possible future living arrangements, such as independent living or group homes. The transition plan includes information regarding instruction, related services, community experiences, development of employment, other post-school adult living objectives, acquisition of daily living skills, and functional vocational evaluation, if appropriate.

*Age of Majority*

The age of majority is the age when a child is legally considered an adult. In most, but not all states, the age of majority is 18. When a person reaches the age of majority, certain rights accrue. This includes the right to vote, marry, and sign contracts. Unless there is a guardianship or conservatorship established, the child will now receive notice of IEP meetings, may choose who attends these meetings, and can give consent on an IEP. The child will have complete control over his or her education.

### *Sensory Perception Issues in Autism*

The main issue that this thesis attempts to address is the sensory issue that has an effect on the way that autistic individuals are able to learn. It is important to understand the senses and how they impact our understanding of the world. The following sensory system can be distinguished;

- Vision- the faculty of seeing
- Hearing- the faculty of perceiving sounds
- Vestibular system- the structure within the inner ear which detect movement and changes in the positions of the head
- Olfaction (sense of smell)- faculty for perceiving odors and scents
- Gustation (sense of taste)- faculty for perceiving the sensation of a soluble substance in the mouth and throat by contact with that substance
- Tactile system- the faculty of perceiving touch, pressure, pain, and temperature
- Proprioceptive system- the faculty of perceiving stimuli produced within and organism, especially relating to the movement and position of the body.

French philosopher Etienne Bonnet Condillac claimed that judgment, reflection, and understanding all originated from the senses. Sensory organs respond to external stimuli such as heat, light, and sound and transmit that information to a sensory nerve by converting it to electrical and chemical signals. These signals are interpreted by the brain and processed into information we can use. The process of perception forms the basis for everything that we know about the world. Therefore all of our knowledge is a product of our perception and changes to our perception can change how we view the world. The process of perception has several phases. It starts with some kind of a stimulus which triggers the next stage of sensation. Sensation is a process that is incapable of analysis and takes into account no external objects.

Sensation deals with the affective such as pleasure and pain or the representative such as, taste, touch, and smell. At the level of perception there is no understanding that things can have meaning beyond what is perceptually available. Once the incoming information passes through certain area within the brain the sensory perceptions are joined with appropriate cognitive information and are bound to general types of things in memory. The perception of the pen for example, is joined with the concept of writing.[9]

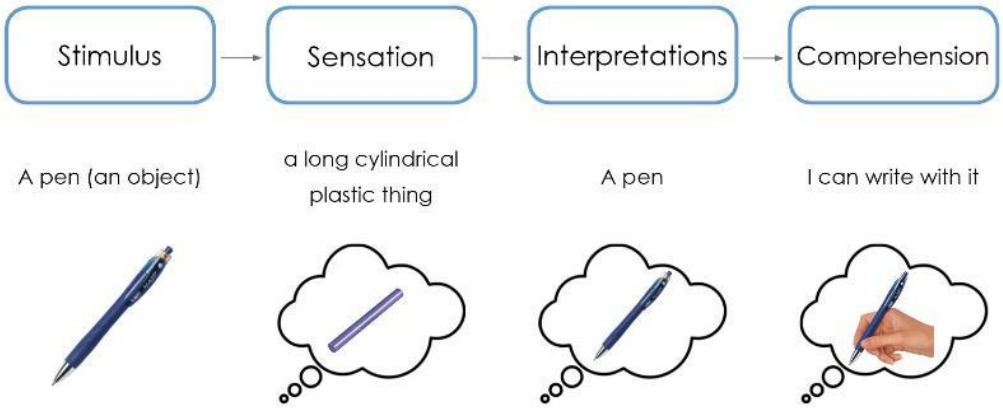



*Figure 2.5: The process of perception (image by author)*

For individuals with autism, the physical medium through which the sense is perceived, such as the eyes or ears, is functioning properly. However, the process of perception is different and does not work in a fashion similar to neurotypical individuals so the environment that is perceived is different.

[9] Bogdashina, *Sensory Perceptual Issues in Autism and Asperger Syndrome : Different Sensory Experiences, Different Perceptual Worlds*.

The difficulty in understanding how the process of perception works for autistic individuals is that the process varies from person to person and can even fluctuate for an individual. As one autistic individual stated, "What I do realize is that I do not see the world as others do. Most people take the routines of life and day to day connections for granted. The fact that they can see, hear, smell, touch and relate to others is 'normal'. For me, these things are often painfully overwhelming, non-existent or just confusing.[10]" These different sensory perceptions can cause pain, distress, anxiety, fear of confusion and cause autistic individuals to act in abnormal ways when they are trying to block out the unwanted stimuli. Some of the most common difference in sensory perception are intensity, sensory overload, gestalt perception, fragmented perception, delayed perception, distorted perception, sensory shutdowns, and compensation.

*Intensity- Hypersensitive*

Hypersensitive means the channel between the stimulus and brain is too open; as a result too much information gets in for the brain to handle. This can cause things such as the noise from a vacuum cleaner to become several times louder than it really is or cause a light touch to feel like a cattle prod. To block out the stimulus which the brain cannot tolerate, an autistic individual might rock themselves, swing back and forth, hit their ears, press their eyes, twist, flap or spin.

[10] Jon Daly, *Sensory Issues in Autism*.

*Figure 2.6: A neurotypical view compared to hypersensitive (image by author)*

*Intensity- Hyposensitive*

Hyposensitive is the opposite of hypersensitive, the channel is not open enough and as a result not enough information gets to the brain and it is deprived. An individual's senses can become so deprived to the point that they are unable to feel their own body or clearly see the world around them. To get their nervous system working better an autistic individual might bang on doors or objects, seek out loud noises, wear tight clothing or self-injure. [11,12]

[11] Bogdashina, *Sensory Perceptual Issues in Autism and Asperger Syndrome : Different Sensory Experiences, Different Perceptual Worlds*.
[12] Jon Daly, *Sensory Issues in Autism*.

*Figure 2.7: A neurotypical view compared to hyposensitive (image by author)*

*Sensory Overload*

Sensory overload happens when there is too much information to process and it becomes overwhelming for the individual. The brains of autistic individuals are not able to filter out irrelevant information such as background noise, patterns on walls, the feeling of clothing or people moving. An autistic individual has to process everything at once instead of what is relevant at the time. Someone vulnerable to sensory overload needs to be in control of their environment as this will have a direct impact on their senses. In the word of an autistic individual "The sensory overload caused by bright lights, fluorescent lights, colors and patterns makes the body react as if being attacked or bombarded, resulting in such physical symptoms as headaches, anxiety, panic attacks or aggression."[13]

[13] Ibid.

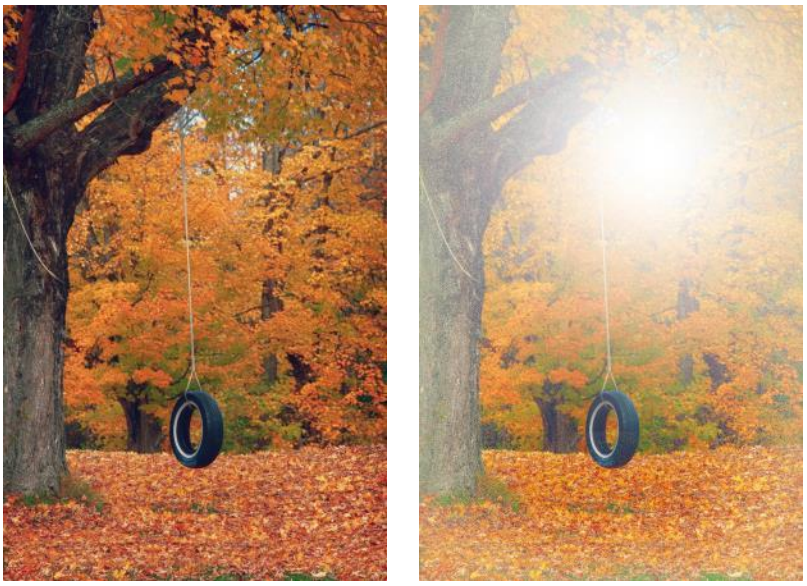


*Figure 2.8: A neurotypical view compared to sensory overload (image by author)*

*Gestalt Perception*

Gestalt perception is the inability to filter foreground and background information, so everything is perceived as a ”whole” rather than a combination of different items. This can happen in any of the senses. Someone who experiences visual gestalt has difficulty focusing on a single detail of a scene and finds it almost impossible to separate it from the whole picture. Someone with gestalt perception will have difficulty if one slight detail is changed. For example, if a picture on the wall is not straight or a piece of furniture has been moved this changes the gestalt of the whole scene and the environment will feel unfamiliar and therefore can cause fear, stress and frustration. Small changes are often harder to manage than big ones: the ordering of books could be very difficult, whereas going to a new place could be fine as the individual has no memory of the place.

*Figure 2.9: A neurotypical view compared to gestalt perception (image by author)*

*Fragmented Perception*

When too much information needs to be processed at the same time, people with autism may not be able to break down the whole picture into meaningful units, this is referred to as fragmented perception. An individual might process part of a scene or sentence and completely ignore the other parts. One possible cause for seeing things as disconnected might be lacking the facility to process all the relevant parts of something at once. This could result in overly narrow focusing of attention or insufficient memory resources to handle the task. Individuals with fragmented perception might have problems interacting with people because people can appear as several unconnected parts. This also leads to a further difficulty in interpreting facial expressions and body language.

*Figure 2.10: A neurotypical view compared to fragmented perception (image by author)*

*Delayed Processing*

Delayed processing is when the process of perception takes a much longer time for those with autism than a neurotypical individual. This makes it hard to understand or learn new things. Processing can become delayed if there is too much information coming at once. As one autistic individual described it, "As a child it appeared as though I didn't feel pain or discomfort, didn't want help, didn't know what I was saying, didn't listen or didn't watch. By the time some of these sensations, responses or comprehensions were decoded and processed for meaning and personal significance, and I'd accessed the means of responding, I was fifteen minutes, one day, a week, a month, even a year away from the context in which the experiences happened." Delayed processing can make it hard to learn things in the right context. If

an individual learns a skill in one location they may not be able to transfer that skill to a new one and will have to relearn it. [14]

*Figure 2.11: A neurotypical view compared to delayed processing (image by author)*

*Distorted Perception*

Distorted perception is when senses get distorted or misinterpreted such as seeing a small shop as smaller than it actually is, poor awareness of ones one body, double vision, or seeing everything in two dimension. Distorted perception becomes worse in a state of information overload.

[14] Ibid.

*Figure 2.12: A neurotypical view compared to distorted perception (image by author)*

*Sensory Shutdown*

Sensory shutdowns happen when someone can't deal with all the information coming in such as when they are experiencing a sensory overload. All or some of the senses are being overloaded and the person is unable to cope. They manage the overload by shutting down one or some of their sense to block out the stimuli and enable another sense to work better. Often individuals will withdraw and retreat into their own world by ignoring any stimuli around them. [15]

[15] Bogdashina, *Sensory Perceptual Issues in Autism and Asperger Syndrome : Different Sensory Experiences, Different Perceptual Worlds*.

*Figure 2.13: A neurotypical view compared to sensory shutdown (image by author)*

*Compensation*

Because of fragmented or distorted perception or delayed processing, a person may compensate through other more reliable senses to build a better understanding of their environment. Touch and smell are more reliable senses so many children touch and smell their environments to get a better understanding of what is around them.

*Sensory Perception and Education*[16]

The sensory perception issues that affect autistic individuals have an impact on their performance in the classroom as they directly effect the way an autistic individual processes information and learns. With respect to how the brain of an autistic individual works in relation to learning, there are three basic categories in which

[16] Temple Grandin, "The Effect of Sensory and Perceptual Difficulties on Learning Styles."

those with autism can be grouped into in: sensory oversensitivity, perceptual problems, and difficulties organizing information.

Sensory oversensitivity varies from child to child. It can range from mild (slight anxiety when the environment is too loud, too bright, or too chaotic) to severe, with an individual going into a screaming tantrum every time he or she is in a place such as a large supermarket. Some individuals on the spectrum are attracted to objects that move rapidly and others will avoid them. When senses are disordered, the attention and concentration that learning requires becomes difficult and in some cases, impossible. Children who spend their days fearful of people and places who, through past experience, have been overwhelmed by their senses, have little chance to relax enough to take notice of the learning opportunities being presented. This makes the teaching and learning process very difficult for the children because they have to be in an environment in which they feel safe and that they understand.

Problems with perceptual issues often determine the style of learning that will be most effective. A child with poor auditory perception may hear sounds poorly and perceive the sounds coming in and out like a poor phone reception. This child is more likely to learn best with visually presented information. On the other hand a child with visual perception problems may learn best through the auditory channel as that is easier for them to process. Some nonverbal individuals have both visual and auditory processing problems. They may learn best through their sense of touch and smell. For instance, to learn to dress they may need to be hand-over-hand "walked" through putting on socks or pouring cereal. They may learn letters and numbers best when

they can touch them, and trace their shape with their hands or fingers. Representative objects rather than visual charts can be useful in helping these individuals know when it is time to transition to a new activity. Schools need to be adaptable in order to teach students with all degrees of perception issues and be able to adapt the environment to a student's specific needs.

Some individuals may be able to receive information, but have trouble organizing it or making sense of the information. Some individuals may be hearing words correctly, but not understanding them. Problems with organizing information effect a child's ability to form categories that are the foundation for later concept formation. Difficulties that people on the spectrum have with multi-tasking would also fall into this category. These difficulties are highly variable and range from mild to severe depending on which brain circuits connected and which ones did not.

An autistic child's ability to learn in a traditional classroom is often compromised because of these difficulties previously described . The schools which are able to adapt to their student and offer flexible learning methods and learning environments are able to have a much greater influence on the lives of their students.

# 3. Theories of Design: Literature Review

## *Richer & Nicoll*[17]

One of the first publications on autism was that of Richer and Nicoll in 1971. They attempted to achieve two main goals through a design playroom space. The authors aimed to achieve two main goals: reduce the frustration and reduce the flight behaviors.

*Reduce frustration*

- Subdividing space in smaller areas allowed overstimulation and an excessive number of social interactions are avoided. A retreat box was also provided in which the child could escape from the stimulus.
- Space for activities such as climbing, rolling, sliding, etc. was provided.
- Stereotypes were not stopped, toys which could easily be played with in repetitive movements were included in the playroom.

*Reduce flight behaviors*

- Structures and fixtures were robust and firmly anchored, so that there was no need to interrupt the children's games with safety warnings or instructions from the caretakers.
- Areas were provided in which the children could demand two types of social interaction: a close tactile contact, and a rough and tumble play.
- In some areas, physical boundaries forced social interaction

The experiment also involved a number of instructions given to the caretakers. The main instruction that was given was to avoid approaching the children as much as possible. The experiment resulted in seeing an increase in the number of social interactions between children.

The design criteria employed by Richer and Nicoll can be summarized into:

- Subdivision of spaces

[17] John Richer and Nicoll Stephen, "A Playroom for Autistic Children, and Its Companion Therapy Project."

- A controlled sensory experience in subdivided spaces
- Use of light dimmers to allow staff to control lighting within the room
- Inclusion of a retreat space
- Minimizing the intrusion of teachers or assistants as much as possible to leave the children to play as they will
- Safety and sturdiness of furniture of fixtures
- Elements and materials that are durable

### *Khare & Mullick*[18] [19]

Khare and Mullick have been exploring how the create a universal design for educational spaces centered around a user with autism. The following design principles were extrapolated from the experimental environmental design considerations created by the two authors:

- Provide physical structure: Spaces should be organized with a clear physical structure that defines different area for different activities
- Maximize visual structure: organize visual environment by means of concrete visual cues.
- Provide visual instructions: indicate the steps to perform certain actions though visual cues
- Offer opportunities for community participation: students should be involved with the daily activities of the school
- Present opportunities for parent participation: parents should be involved in school activities
- Present opportunities for inclusion: provide an environment for children with autism that allows them to interact with their neurotypical peers.
- Maximize future independence: create an environment in which a student can learn every day and vocational skills
- Offer generous space standards: autistic individuals need large amounts of personal space

[18] Khare and Mullick, "Educational Spaces for Children with Autism; Design Development Process."
[19] Khare and Mullick, "Designing Inclusive Educational Spaces with Reference to Autism."

- Provide withdrawal spaces: there is a need for quiet areas where students can escape to if they are being overwhelmed

- Maximize safety: minimize the risks that students have, often which are caused by themselves

- Maximize comprehension: there should be a clear arrangement of spaces and direct routes to and from them free of clutter

- Maximizing accessibility: impairments in movement coordination and balance demand a physically accessible building

- Provide assistance: there should be space enough to help a pupil with autism in doing their learning activities in all types of spaces

- Maximize durability and maintenance: equipment, furnishing, fixtures, fittings, and materials and systems in general should be durable taking into account the abuse the student will give them

- Minimize sensory distractions: environments should not present elements that can become any sort of sensory distraction.

- Provide sensory integration: include multisensory stimuli within the environment

- Provide flexibility: environment has to be flexible enough to accommodate a wide range of functional skills and different teaching paradigms.

- Provide monitoring and assessment: it is necessary to control or monitor pupils with the lesser degree of distraction and intrusion.

### ***Humphreys[20]***

Humphreys creates a variety of design criteria which are to be considered in deigning building for autistic individuals. He suggests:

[20] Humphreys, "Architecture and Autism."

*Clam order and simplicity*

The sense of calm and simplicity should exist throughout the building and is not limited to the way in which the plan and sections have been designed, but also applies to the use of materials.

*Minimal details*

Any unnecessary detail should be avoided. Reducing the background visual stimulation to a minimum allows teachers to create the stimulation according to each child's needs.

*Proportions*

The author suggests trying to confer harmonious proportions on buildings and spaces designed for people with autism.

*Natural light*

An extensive use of natural light is important, but dazzling sun, deep shadows or excessive contrast produce visual overstimulation. Skylights and clerestory windows can help in getting diffuse lighting.

*Proxemics*

Autistic individuals they may need more space for social relationships

*Containment*

This concept refers to the need to monitor children with ASD as well as the opportunity for them to wander, in a safe place where a child with can walk freely.

*Observation*

There is a need for supervision without interfering with the student's activities

*Acoustics*

People with ASD often have to make an enormous effort to differentiate sounds, and are more sensitive than other people to noises. The acoustic properties of materials and constructive elements and systems must be taken into account.

## ***Christopher Beaver***[21] [22]

Beaver is a British architect who has worked on multiple project designing for those with autism as well as written about the subject. He has explained his specific strategies when designing a residential-educational building which can be summaries in the following main points;

- Corridors should be designed in such a way that they are not any longer mere spaces dedicated just to circulate. They can be used for play or rest, this approach appropriates the space for the students' needs.
- Sufficient space is needed to allow for the development of children's activities without the excess of proximity between students.
- Curved surfaces are liked by autistic children as they can flowing hem around a corner tactilely and create a better transition that a sharp angle.
- Acoustic need to be considered, which mean avoiding hard polished materials as they reflect the most sound. Beaver also stated that although material like carpet are better for acoustics they are harder to clean and maintain
- Safety is important when designing for those with ASD. Beaver specifically mentions showers and toilets and that pipes should be hidden so students cannot injure themselves on them, but the main ideas is to be aware of the perception issue that could cause injuries

[21] Christopher Beaver, "Autism-Friendly Enviroments."
[22] Christopher Beaver, "Designing Environments for Children and Adults with ASD."

- Underfloor heating and cross-ventilation are preferred as this limits the amount of ventilation systems needed in the building which can cause and excessive amount of noise.

- Windows can become safety concern and prevent this there should be locks placed upon windows or mechanisms that will prevent their opening. Glazing should be made of safety glass to limit the possibility of a student breaking the glass.

- Lighting could be hidden to sight, thus achieving indirect and diffuse illumination. Beaver specifically states that traditional fluorescent lights should be avoided as those with ASD are more sensitive to the flicker of these lights. Dimmers should also be installed on all lights to allow control of the level of lighting.

- Quiet rooms are important to the design as they give an area for the child to escape to if they are being overwhelmed by their environment. This also helps to prevent the unwanted behavior to expand to other students, as one student could cause many other to get upset.

- Sensory rooms and gardens should be provided, which generate multiple types of stimulus.

- Color palettes should be chosen to provide a welcoming environment, but not one that is over stimulating. Muted and cooler colors can have a calming effect

### *Magda Mostafa*[23]

The Sensory Design Theory was developed by Magda Mostafa after being given the project of designing the first education center for autism in Egypt. The theory builds on the sensory sensitive approach in that it stipulates that favorably altering the sensory environment can be conducive to positive and constructive autistic behavior. According to Mostafa, "Sensory design theory presents a flexible and adaptable tool which acts as a catalyst for architectural design criteria development for architectural

[23] Mostafa, "ARCHITECTURE FOR AUTISM: Autism ASPECTSS™ in School Design."

environments based on their sensory qualities, and in response to autistic sensory needs."

By looking at a series of common sensory environment problems, such as acoustics, texture, lighting Mostafa developed a set of design principles summarized by the acronym ASPECTSS: Acoustics, Spatial sequencing, Escape spaces, Compartmentalization, Transition Zones, Sensory Zoning, and Safety.

*Acoustics*

This criterion proposes that the acoustical environment be controlled to minimize background noise, echo and reverberation within spaces used by individuals with ASD. The level of such acoustical control should vary according to the level of focus required in the activity at hand within the space, as well as the skill level and the severity of the autism of its users. For example, a gym could handle a higher level of acoustics than a classroom.

*Spatial Sequencing*

This criterion is based on the idea of the affinity of individuals with autism to routine and predictability. The criteria requires that spaces be organized in a logical order based on the typical schedule of such spaces. The organization of spaces should reflect the schedule of the students and how they move throughout the day. There should be minimal disruption between spaces.

*Escape Spaces*

Spaces need to be provided that offer respite for the autistic user from the overstimulation found in their environment. Such spaces may include a small partitioned area or crawl space in a quiet section of a room, or throughout a building in the form of quiet corners. These spaces should provide a neutral sensory environment with minimal stimulation that can be customized by the user to provide the necessary sensory input.

*Compartmentalization*

There needs to be a limit to the sensory input within each space or environment. Each compartment should include a single and clearly defined function and consequent sensory quality. The sensory qualities of each space should be used to define its function and separate it from its neighboring compartment.

*Transition zones*

The presence of transition zones helps the user recalibrate their senses as they move from one level of stimulus to the next. Zones can take on a variety of forms from a distinct node that indicates a shift in circulation to a full sensory room that allows the user to re-calibrate.

*Sensory Zoning*

Spaces should be organized in accordance with their sensory quality rather than their programmatic function, which is typical in architectural design. Grouping spaces according to their allowable stimulus level, spaces are organized into zones of high-stimulus and low stimulus.

*Safety*

Safety is more of a concern for children with autism than their neurotypical peers, due to the fact that those with autism may have an altered sense of their environment and could easily injure themselves by running into walls to falling down stairs.

## *Alternate Theories of Design and Education for Autism*

In contrast to the previously presented theories, there are opposing views on how the education process for an autistic individual should be designed. These theories take the approach that introducing an autistic child to a neurotypical setting is the best way to educated them. This includes placing them in classroom with neurotypical peers and designing schools for autism with unregulated stimulus.

*Inclusion Classrooms*

An inclusive classroom is described as one classroom hosting both general education students and students with disabilities. Inclusion provides special needs children with the necessary services and supports within a general education classroom. There are numerous government provisions in place today in order to maximize the opportunities for students with autism to be taught in a general education setting. There are both positives and negatives of an inclusion classroom setting on students with autism.

Fully inclusive classrooms are an ideal location for social interaction between autistic individuals and their neuro-typical peers.[24] By integrating the autistic student into an environment where they can interact with other student they are able to develop their social skills. Inclusion exposes all children to diversity. Such diversity is naturally encountered in the real world. Whether or not a child has an intellectual disability, children will eventually encounter many different people throughout their lives. According to the ideas behind inclusion classrooms, a school setting is the ideal environment to notice and adjust to these differences. An inclusion classroom can inspire and challenge students with intellectual disabilities to excel.[25]

Inclusion however is a philosophy. As school budget cuts deepen, teachers are asked to do more with less. Budgetary restrictions make it unrealistic to expect that students with disabilities will receive the attention they need and deserve within a regular classroom. Many general education teachers also do not have the training to teach these specialized education students. General education teachers are apprehensive about the idea of inclusion because of their lack of education and experience teaching students with autism. Traditional professional development in early childhood education does not prepare teachers and staff to meet the individual learning needs of young children with disabilities. Many training programs do not require courses or practicum experience in working with children with disabilities, their families, other professionals, or in home visiting. Large numbers of graduates are leaving teaching

[24] Wiele, "The Pros and Cons of Inclusion for Children with Autism Spectrum Disorders: What Constitutes the Least Restrictive Environment?"
[25] Reynolds, "The Choice of Educational Settings."

education programs without having had a course or field experience in working with children with disabilities or in related fields.[26]

In inclusive classrooms there is a risk that students with disabilities will be rejected by their peers. Neurotypical students and students with autism mightnot spontaneously interact just because they happened to be in the same classroom. Students with autism do not interact readily with others regardless of whether they are surrounded by their peers or not. Part of the reasoning behind students with autism not engaging in social interaction could be because the general education classroom overstimulates students with autism. Students with autism may find the noise of the regular classroom to be distracting or painful, the colorful materials being distributed throughout the class to be over stimulating, and the physical organization of the classroom to be inadequate for identifying where to go and what to do. [27,28]

Every student with ASD should not be included in a general education class. Those with lesser severities of the disorder such as students with Asperger's wouldn't benefit from a segregated classroom, but there are drawbacks associated with inclusion classrooms for the medium to severe levels of autism.[29] Interaction with neuro-typical students, at some level, however is beneficial to students of all severities. There are certain social skills which can only be gained through interacting with other. For those with more severe cases of autism the question is how much

[26] Chang, Early, and Winton, "Early Childhood Teacher Preparation in Special Education at 2- and 4-Year Institutions of Higher Education."
[27] Mesibov and Shea, "Full Inclusion and Students with Autism."
[28] Ochs et al., "Inclusion as Social Practice: Views of Children with Autism."
[29] Richard L Simpson, Sonja R de Boer-Ott, and Brenda Smith-Myles, "Inclusion of Learners with Autism Spectrum Disorders in General Education Settings."

interaction is necessary and how can that be introduced into an environment which is designed to accommodate those with ASD.

*"Neuro-Typical" Approach*[30]

In contrast to the sensory sensitive approaches, others argue the opposite. The "Neuro-Typical" approach to design is the opposing view. Instead of controlling the stimulus in an area and designing not to overload the senses of the students, the approach creates a real life environment. The approach argues that an autistic individual needs to learn in 'real' world settings if they will ever be able to use their acquired skills outside of the classroom. Proponents of the " neuro-typical" simulated environments claim that sensory sensitive environments actually cause less, not more, universal access and integration into the larger population. Individuals with autism often have very poor generalization skills, so they struggle with applying previously learned behavior to new situations. If an individual learns how to use a bathroom in one particular setting they may not be able to generalize that skill and use it in another setting. If these individuals are unable to transfer skills they become imprisoned to the select few autism specific environments where they acquired the skills. The approach also argues that the sensory processing abnormalities which are present in many individuals with autism are not universal to every individual with autism. As stated by Christopher Henry, "If sensory processing dysfunction is not universal to autism then it might be hard to advocate for sensory sensitive environments if they hinder

[30] Henry, "Designing for Autism: The 'Neuro-Typical' Approach."

generalization skill development, which appears to be a more universal difficultly for individuals on the autism spectrum." [31]

Not all people agree with the "neuro-typical" design theory. The first major criticism of the theory is whether a " neuro-typical" environments represent the best environments in which people learn. If not, then they are advocating for designed environments that fail both mainstream and autistic individuals. Many building such as schools, grocery stores, banks and retail stores do not provide many aspects such as daylighting and natural ventilation, which are important to good design. Should architects replicate the environments that students will have or that they should have? Proponents of the sensory sensitive theory also argue that student need an environment to help them acquire a skill before they can generalize it. Individuals can only generalize skills that they possess. A third argument against replicating 'neuro-typical' environments is that such settings do not improve generalization skills, but merely mask poor ones. Students should be able to use their skills in all environments not just a neuro-typical, so the teaching of these skills is more important than the environment in which they are taught. "Neuro-typical" environments attempt to simulate the real world so the individuals with autism never actually have to generalize skills. The last argument against the "neuro-typical" approach stems from a larger question about society's responsibility towards individuals with disabilities. Should individuals with disabilities be required to habituate themselves to the "typical" standard if they want access and acceptance into the larger society? If a

[31] Ibid.

typical environment uses stairs as the main form of circulation should an environment designed in the “neuro-typical” approach follow the same approach despite the uses having limited mobility?[32]

The sensory sensitive and ” neuro-typical” approaches have conflicting opinions on how to design an environment for autism. However, both have valid point in the design of schools and how the built environment can have an impact on individuals with autism. The key is to find a way to implement both theories. Environments need to design to mitigate the stimuli in certain situations where it would be harmful to the students and  at the same time allow those with autism to experience the real world. Blending programs or combining school types is one way to accomplish the mix of these design theories.

[32] Ibid.

# 4. Precedent Analysis

## *Schools for Autism*

*ADVANCE School for developing skills of special needs children*[33]

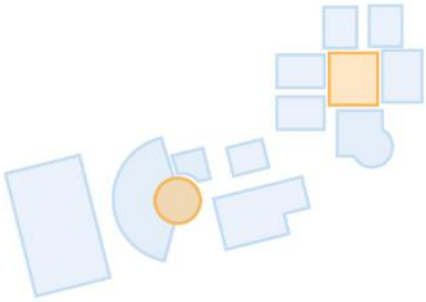
| | |
|---|---|
| Architect: Magda Mostafa | Location: Qattameya, Cairo |
| Setting: Rural | Context: Stand-alone school |
| Year Built: Under construction | Number of Students: 100 |
| Ages: N/A | Size: N/A |

Facilities: Therapy areas, diagnostic center, sports center, sensory garden, hydrotherapy and assisted living for 20 students.

The building is the first to be designed based on the 'sensory design theory' first published by Special Needs Design Associate, Magda Mostafa. Building on the premise of architecture as a sensory environment and a source of controllable stimulation- spatial organization, acoustics, texture, color, pattern and lighting. The building is organized using concepts such as sensory zoning, spatial sequencing & compartmentalization, transitional sensory space, graduated acoustical treatment and the provision of " escape" spaces. The building includes addition program in addition to a typical school

[33] Quirk, *An Interview with Magda Mostafa: Pioneer in Autism Design*.

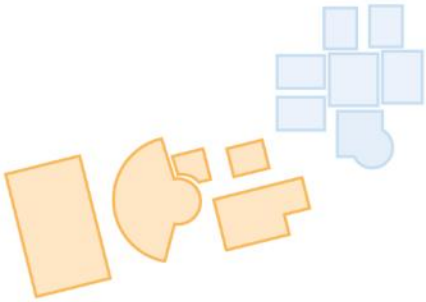
Floor Plan



Central Organization Space

Program

Sensory Room



Stimulus level

Connection to Green Space

*Figure 4.1: Analysis Diagrams (images by author)*

*The Gateway Centre*

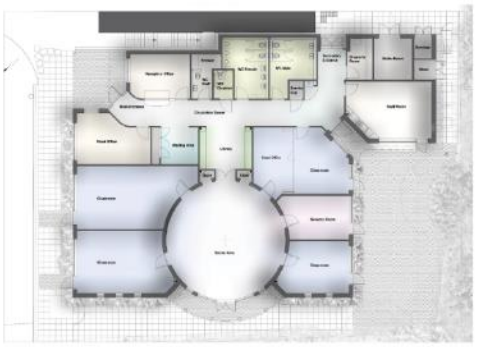
| | |
|---|---|
| Architect: GA Architects | Location: Twickenham, UK |
| Setting: suburban | Context: Addition to typical school |
| Year Built: 2008 | Number of Students: 15 |
| Ages: 11-16 | Size: 5,500 sq ft |

Facilities: Sensory room, theatre, outdoor play area, therapy room, access to gym and fitness center

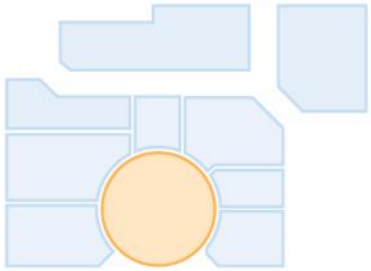
The center is built as an addition to the already existing Twickenham Academy. Emphasis is placed on developing independence and social skills, enabling students to take full advantage of opportunities to be included in the main school classes at Twickenham Academy. Typically the students obtain their academic education within the mainstream school. The center provides programs and strategies to support the students learning, communication and interaction skills so that they can be taught within a mainstream school. The center has access to all facilities and buildings in the Twickenham Academy, including the fitness center and gym with trampolines. The center is centered on one large central room referred to as the "social area" which serves as a consistent feature of the building allowing way finding to easily happen within the building. The building's classroom are all connected to this social area so movement around the building always happens through this space. The connection to the typical school also provides the students with a connection to neurotypical peers, allowing them to interact with mainstream student and foster social skills which might be neglected if there was no interaction. The center needs the neurotypical school attached to it and cannot serve on its own as the required program would not have been met by the center alone.

*Figure 4.2: exterior courtyard space (image by GA Architects)*

*Figure 4.3: Elevation of center (image by GA Architects)*

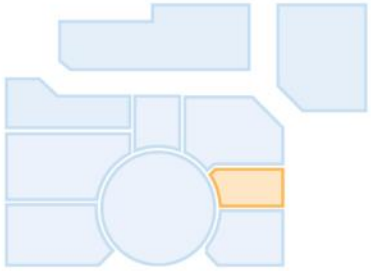


Floor Plan

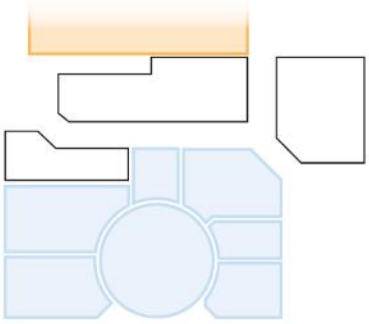


Central Organization Space

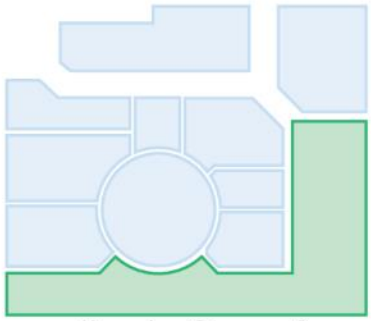
Program



Sensory Room



Stimulus level



Connection to Green Space

*Figure 4.4: Analysis Diagram (images by author)*

*MUJC Developmental Learning Center*[34]

| | |
|---|---|
| Architect: USA Architects | Location: Warren, NJ |
| Setting: Suburban | Context: Stand-alone school |
| Year Built: 2007 | Number of Students: 200 |
| Ages: 3-21 | Size: 167,000 sq ft |

Facilities: Indoor track, health and fitness center, competition pool and zero entry pool

The ideas behind the school argue that students need to learn in " real" world settings if they will ever have a chance to use their acquired skills outside of the classroom. This logic for replicating " neuro-typical" environments, argues against the sensory sensitive approach. If individuals are unable to transfer skills they become limited to the select few autism specific environments where they acquired the skills, and in this sense imprisoned. The school addresses the special needs of the students in a revolutionary way, bringing the "real world" experiences indoors, creating a community within a self-contained, controlled environment. USA Architects designed the main corridor as a "replica of a typical American main street." This "street" includes the Commerce Bank, Warrenville and Berkeley Hardware Store, Carmen's Barber Shop, Ferratti's Plant Nursery, Towne Deli Diner, Manufacturing lab, ShopRite, and a mock apartment complete with living and dining room, kitchen, bedroom, laundry and game rooms. The building takes a different approach to design from the other precedents studied in that instead of designing the stimulus to the students' needs, the building introduces the students to a typical environment they might experience in the real world.

[34] Henry, "Designing for Autism: The 'Neuro-Typical' Approach."

*Figure 4.5: "Main Street" within the school (image by USA Architects)*

*Figure 4.6: Cafeteria designed to resemble a dinner (image by USA Architects)*

*Eden Institute*[35]

| | |
|---|---|
| Architect: KSS Architects | Location: Princeton, NJ |
| Setting: Suburban | Context: Stand-alone school |
| Year Built: 2012 | Number of Students: 55 |
| Ages: 3-21 | Size: 38,000 sq ft |

Facilities: Kitchens, gymnasium, physical therapy rooms, vocational and education centers, offices, observation rooms, weight rooms

The school is located on the edge of a mixed-use development. The location provides teachers and students with a strong sense of community, shared athletic and event resources, ample open space, and many outdoor walking trails. The school is envisioned as a house and an office, and centers on its vocational and therapy. The house is the main area for students and is a life-learning space for students to learn routine activities such as maintaining an apartment or working as cashier. The Eden institute was design to create a sense of community between the teachers, students, and administrators working with the building. The school is clearly organized around the programmatic features by placing the learning and classroom spaces of the school on the northern part of the building and the utilities and administrative space on the southern half. This separates the program by what the student will be using and the stimulus in those rooms is due to their specific program type. Programs such as the gym and cafeteria are placed away from classrooms as these areas are much higher in stimulus than a classroom and moving between them would too harsh for the students. Both "wings" of the building are connected through an inner courtyard, which serves as a play space. The school incorporates many features, such as increased insulation between walls to aid in noise dampening between rooms, wider

[35] Merilee Meacock, interview.

hallways to make sure student do not feel congested walking between classes, a central courtyard to organize the entire building and act as a way finding device, and warm materials so the building does not seem overbearing or institutional. The walking and exercise path allows student to get out of the classroom and move around which can aid in calming them down if they are experiencing too much input and cannot process the information. The school also includes a program for early intervention in addition to its special education spaces for student 3-21. In an interview with the designer of the building, Merlee Meacock, she stated that while designing the building she realized that many decision she made unconsciously due to following good design principles, but after researching the subject she realized that they specifically helped with designing for autism.

*Figure 4.7: Entrance Lobby (image by KSS Architects)*

*Figure 4.8: Courtyard play area (image by KSS Architects)*

*Figure 4.9: The cafeteria (image by KSS Architects)*

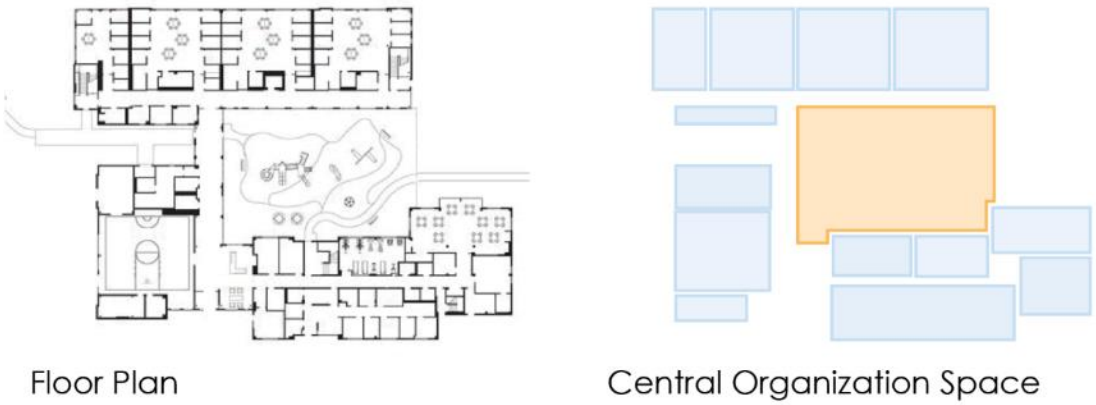



*Figure 4.10: Analysis Diagrams (images by author)*

*Kentish Town School Autistic Resource Base*[36]

Architect: Haverstock Associates Location: London, UK
Setting: Urban Context: Addition to typical school
Year Built: 2011 Number of Students: 16
Ages: 5-11 Size: 5,500 sq ft

Facilities: Sensory Room, Therapy Room

This design respects the existing Victorian building by replicating similar forms and by using traditional material, but reinventing them in a contemporary way. The existing spaces together with the new accommodations have been re-organized to offer clarity to the school layout. This not only addresses the critical issues in the existing school, but also allows for clear age progression of the students, generous circulation, and improved acoustic conditions. The school is attached to the Kentish Town Church of England Primary School. It allows autistic children to be taught alongside their mainstream peers and is intended to integrate the autistic students in a neurotypical environment. The Kentish school was influenced by a previous project by Haverstock aAssociates, the Netley Primary School Autistic Unit. In that school the architects designed full floor to ceiling windows to allow in as much sunlight as possible as sunlight has proven be beneficial to students. The teachers however, found that student were being distracted by what was happening outside and had to cover the windows with paper to prevent student from looking outside. They corrected this in the Kentish town project by having clearstory windows which allowed light in, but blocked views out.

[36] "Kentish Town ASD Unit."

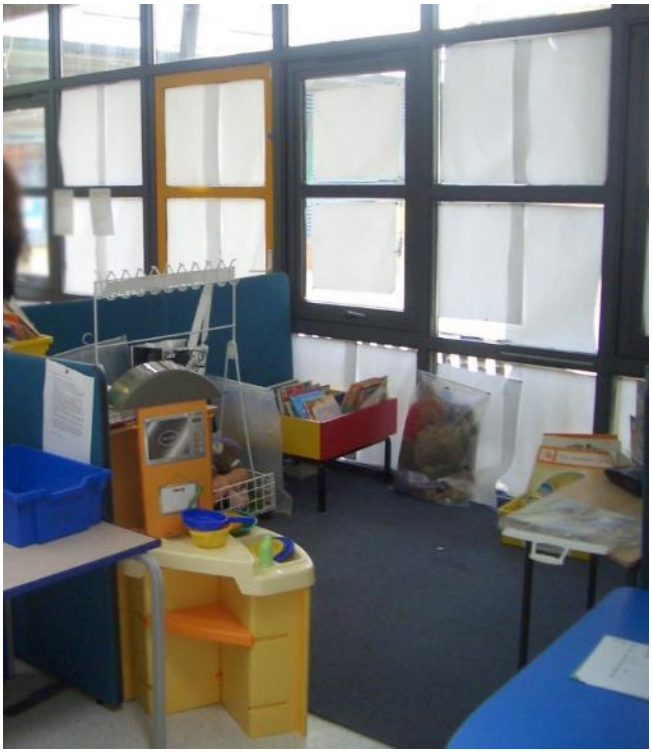


*Figure 4.11: Netley Primary School Autistic Unit (image by Archdaily.com)*

*Figure 4.12: Kentish Town School Autistic Resource Base Gym (image by Haverstock Associates)*

*New Struan Centre for Autism*[37]

Architect: Aitken Turnbull Architects Location: Alloa, UK
Setting: Suburban Context: Stand-alone school
Year Built: 2005 Number of Students: 42
Ages: 8-18 Size: 27,000 sq ft

Facilities: multi-sensory room, splash area, library, early learning center, area for visiting therapists

The T-shape plan creates a clear distinction between public and private. Avoidance of artificial lights was important in the design as autistic children are very sensitive to them. Instead natural daylight was incorporated. The ” gull wing” roof has been developed to encourage as much natural light as possible into the building. The pointed center of the ” gull wing” forms a glazed atrium that runs the length of the buildings and floods the space with daylight. Children with autism are sensory sensitive and many feel extremely uncomfortable in fluorescent lit rooms. Bringing natural daylight into the school was therefore important to encourage development in a safe and stimulating environment. Seven classrooms are located on either side of the atrium, each incorporating floor-to-ceiling windows with a brise-soleil to diffuse direct sunlight. Color-coded doors lead to an external play area and allow pupils to easily remember which classroom to return to.

[37] “A Centre for Autism.”

*Figure 4.13: Day lite spine of building (image by Aitken Turnbull Architects)*

*Figure 4.14: Wayfinding exterior doors (image by Aitken Turnbull Architects)*

## *Special Needs Schools*

*St. Coletta School* [38]

| | |
|---|---|
| Architect: Michael Graves | Location: Washington D.C. |
| Setting: Urban | Context: Stand-alone school |
| Year Built: 2006 | Number of Students: 150 |
| Ages: 3-23 | Size: 99,000 sq ft |

Facilities: art rooms, music rooms, gymnasium, kitchen facilities, sensory room hydrotherapy pool, basketball court, playground, amphitheater, physical therapy rooms, horticulture room

St. Coletta was founded in 1959 by a couple with a child with Down Syndrome. They had a negative history with finding an educational system, so they decided to establish the school. The colors and simple forms make it very fitting for the people that the building serves, as it is playful and inviting. The buildings was built vertically in a series of two-story "school houses." The houses are grouped by ages, and designed so to work as their own self-contained units with all the necessary programs features needed within each house, such as quite rooms, bathrooms, and kitchens. The houses are attach to a double-height central hall with a skylight, referred to as the "village green." Although this space serves as a way finding and organizing mechanism for the school it's acoustical are lacking. The space allow for too much echo with could send some students into shock when entering or cause some to get distracted by the noise. The storage in the building is also lacking. Many rooms have been converted into storage areas due to the fact that special needs schools need specialized equipment and not enough space was originally provided.

[38] "St. Coletta of Greater Washington."

*Figure 4.15: playful forms of exterior (image by Michael Graves Architecture and Design)*

*Figure 4.16: main corridor and board room (image by Michael Graves Architecture and Design)*

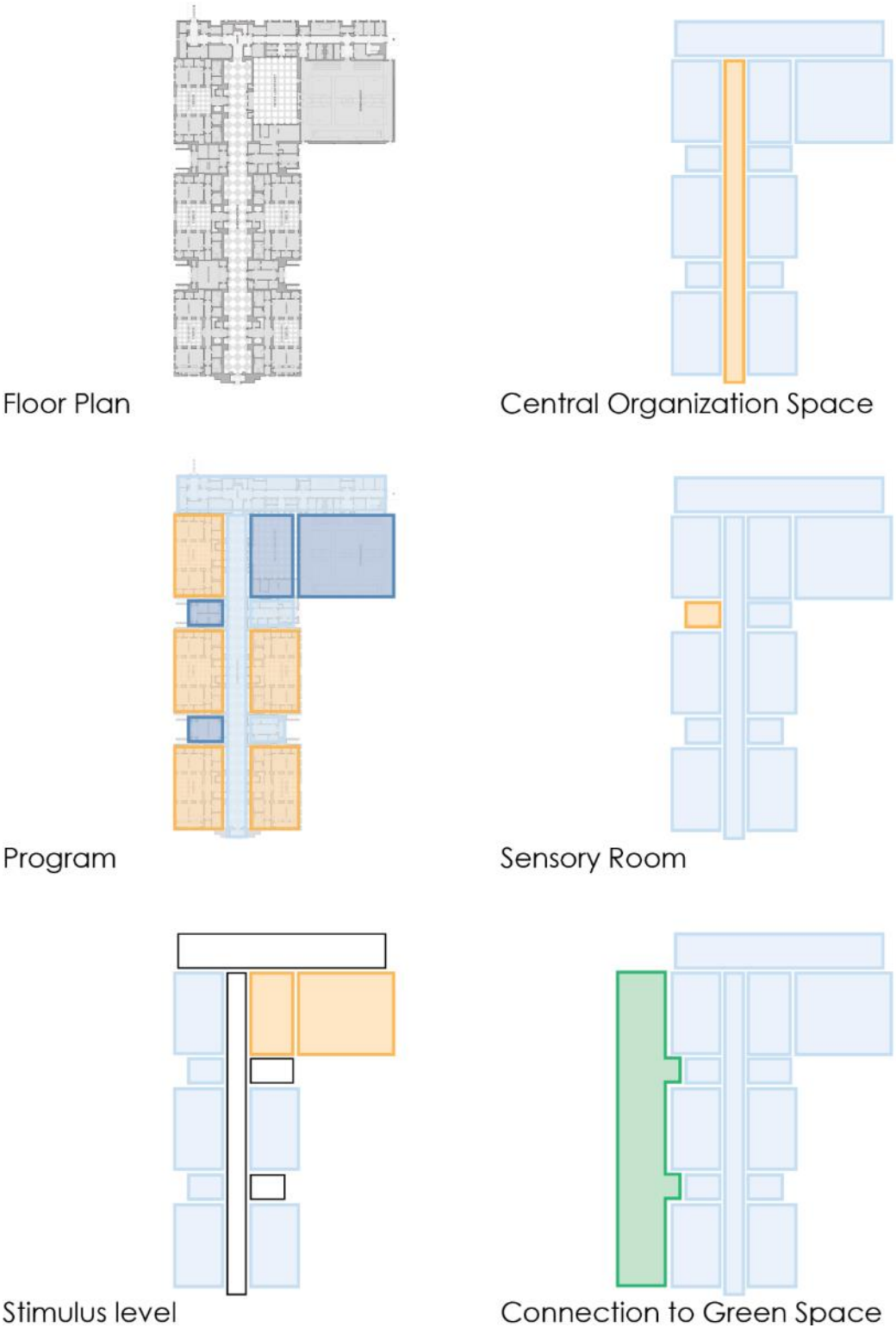



*Figure 4.17: Analysis Diagrams (images by author)*

*Reece School*[39]

Architect: PBDW Architects
Location: New York City, NY
Setting: Urban
Context: Stand-alone school
Year Built: 2006
Number of Students: 90
Ages: 5-13
Size: 21,200 sq ft

Facilities: Gymnasium, speech therapy rooms, occupational therapy rooms, art rooms, quiet rooms

The school exists within an urban fabric, a block away from Central Park. The School is equipped with twelve classrooms, eight quiet rooms, and several special-use classrooms, a multi-purpose gymnasium, and a student library. Each classroom accommodates six, eight, or twelve students with two teachers per classroom. The use of color played an important role in the design of the building. Sun shining through colored glass panels incorporated into the curtain wall provides a splash of color in each classroom that moves throughout the day. The color combination differs in each room and the unique pattern allows children to identify their classrooms.


*Figure 4.18: Classroom space (image by PBDW Architects)*

[39] "Reece School – PBDW ARCHITECTS."

## *Housing for Autism*

*Sweetwater Spectrum Housing*[40]

| | |
|---|---|
| Architect: LMS Architects | Location: Sonoma, CA |
| Setting: suburban | Type: group homes on campus |
| Year Built: 2009 | Number of Residents: 16 |
| Ages: 18+ | Size: 13,000 sq ft |

Facilities: Orchards, organic gardens and greenhouses, therapy pool, shared common areas, teaching kitchen.

Sweetwater Spectrum is a new national model of supportive housing for adults with autism, offering life with purpose and dignity. The four four-bedroom homes include common areas as well as a bedroom and bathroom for each resident. Sweetwater Spectrum also incorporates a community center. The community looks to create appropriate, high-quality, long-term housing for adults with autism in a way that could be replicated nationwide. The new community is designed to address the full range of needs of individuals with autism spectrum disorders, maximizing residents' development and independence.

[40] "Sweetwater Spectrum."


*Figure 4.19: Site plan of complex (image by LMS Architects)*


*Figure 4.20: kitchen and dining space (image by LMS Architects and Tim Griffith)*

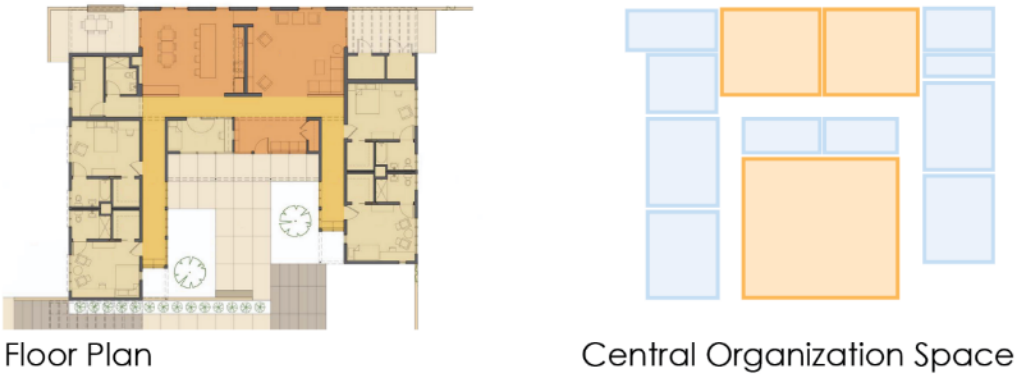



*Figure 4.21: Analysis Diagrams of housing unit (images by author)*

*Sunfield Residential School*[41]

| | |
|---|---|
| Architect: GA Architects | Location: Stourbridge, UK |
| Setting: rural | Context: Group home on campus |
| Year Built: 2004 | Number of Residents: 12 |
| Ages: 6-19 | Size: 7,500 sq ft |

Facilities: Living, dining and kitchen facilities, commercial laundry, sensory room, game room, play areas.

The facility is one of ten residential homes which are part of the Sunfield system of residential schools set over 58 acres of parkland. The Sunfield Approach is a unique and highly successful program of educational, communication, therapy and daily living practices. The building accommodates housing for 12 children with profound Autism. This comprises single bedrooms, bathrooms, living, dining and kitchen facilities, commercial laundry and a sensory room. A creative design of the circulation space and living accommodation combined with a sense of home away from home for residents established the building as a model of good practice to visiting care providers.

[41] "Sunfield Residential Unit."

*Figure 4.22: Hallway (image by GA Architects)*

*Figure 4.23: Bedroom (image by GA Architects)*

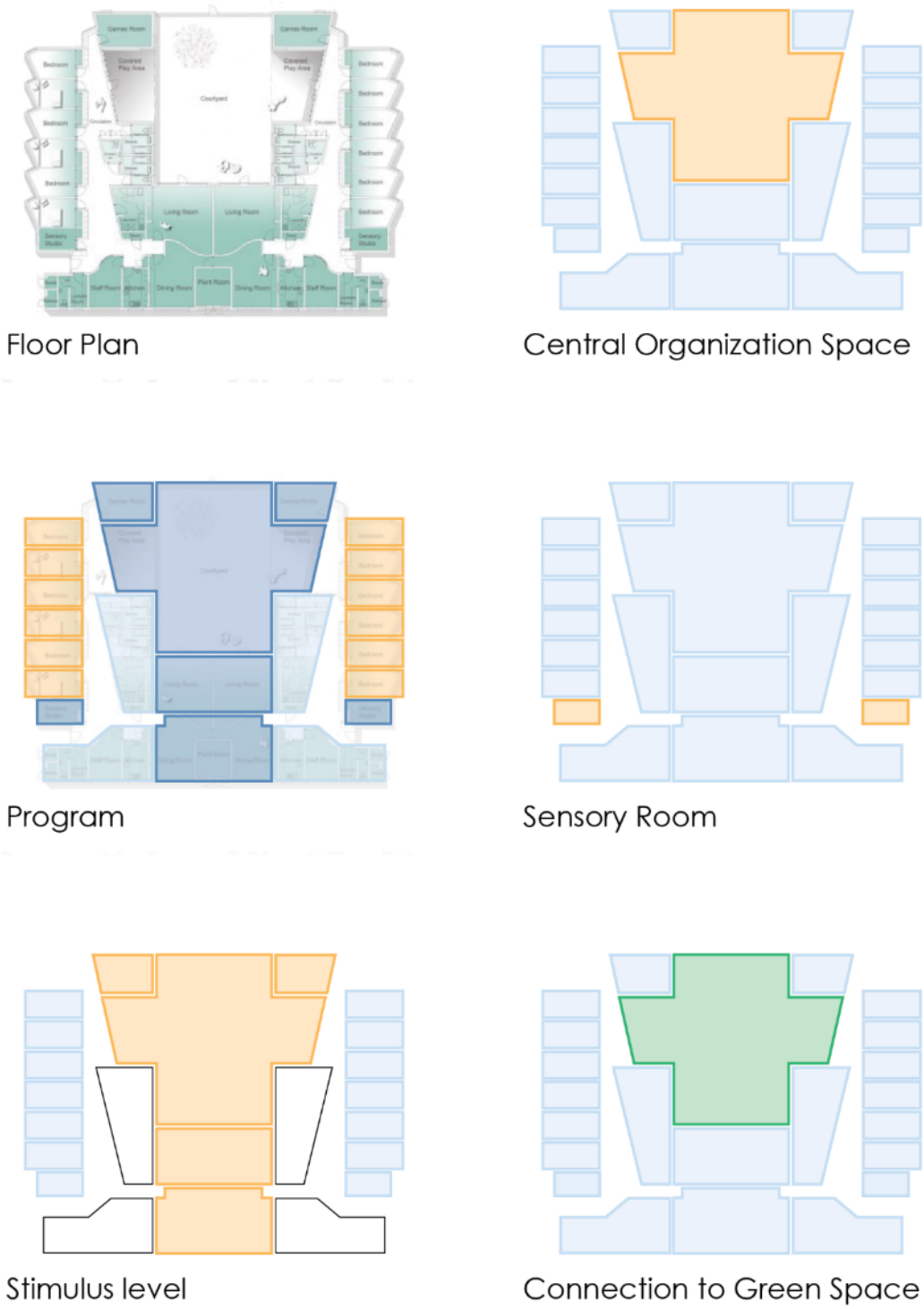



*Figure 4.24: Analysis Diagrams (images by author)*

### *Typical Schools (inclusive and non-autism)*

*Bear Tavern Elementary*

Architect: N/A
Location: Titusville, NJ
Setting: Suburban
Context: Stand-alone School
Year Built: 1961
Number of Students: 400
Ages: 5-11
Size: 75,000

Facilities: Gymnasium, art rooms, music rooms

*Figure 4.25: Special education room (image by Jill Leestma)*

*Stewart Middle School*[42]

| | |
|---|---|
| Architect: KieranTimberlake | Location: Washington DC |
| Setting: Suburban | Context: Campus |
| Year Built: 2008 | Number of Students: 350 |
| Ages: 10-15 | Size: 72,500 |

Facilities: Constructed wetlands, green roofs, art studios, library, black box theater, choral and instrumental music rooms, teaching kitchen.

The design of the school transform the facility into a teaching landscape, not only inside its classrooms, but also on site, with rooftop gardens and a constructed wetland in the school's quadrangle as working examples of the school's commitment to sustainability. Teachers have integrated the building into the curriculum, educating students about materials and systems. The new school has sparked communal social action and inspired changes in school operations, including a new emphasis on local, organic foods in the cafeteria. It has engaged students to make the connection between the building's systems and the world outside the building.

*Figure 4.26: exterior facade (image by KirenTimberlake)*

[42] "Stewart Middle School."

### *Conclusions*

After examining the different precedents, similarities in the ways that schools are designed for those with autism became apparent. As seen in the previous diagrams of each facility, the common themes among the different plan layouts includes: a central organizing space; a clear distribution of program; a separation of high stimulus areas from low stimulus areas; escape spaces for students; and a connection to nature through a green space. Many of the buildings also shared similar feature in terms of materiality, color, lighting, acoustics, location, amenities, and required facilities. The size of schools designed for autism are different from a typical school. By comparing the number of students, gross square footage of the school, and the square footage per student it is clear that while a typical school is often larger and has a larger number of students attending, a school designed for autism has a more generous square footage per student. (Figures 4.27, 4.28, 4.29).

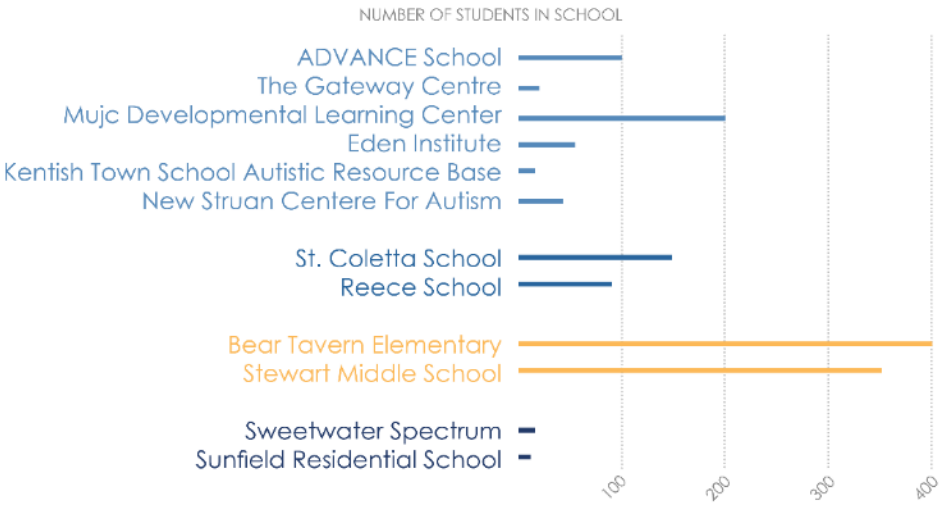



*Figure 4.27: Comparison of the number of students at each precedent school (image by author)*

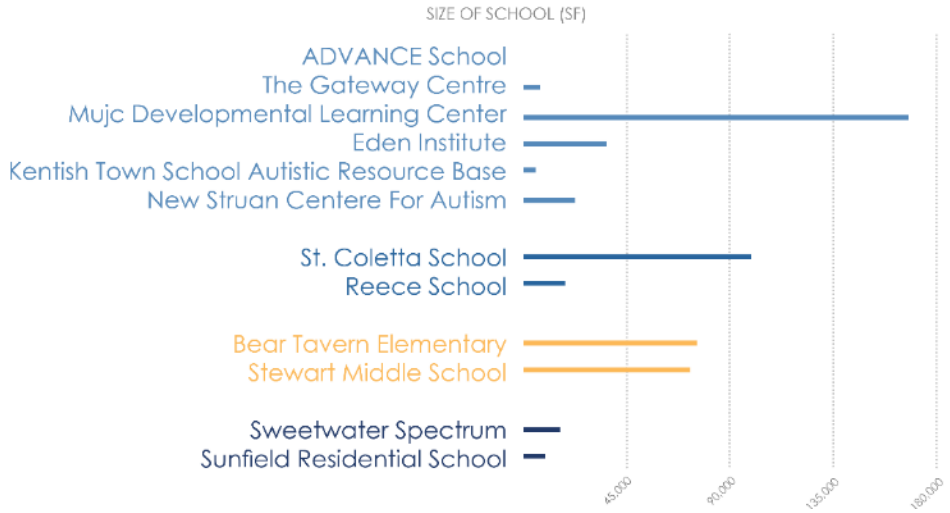



*Figure 4.28: Comparison of the gross square footage of each precedent school (image by author)*

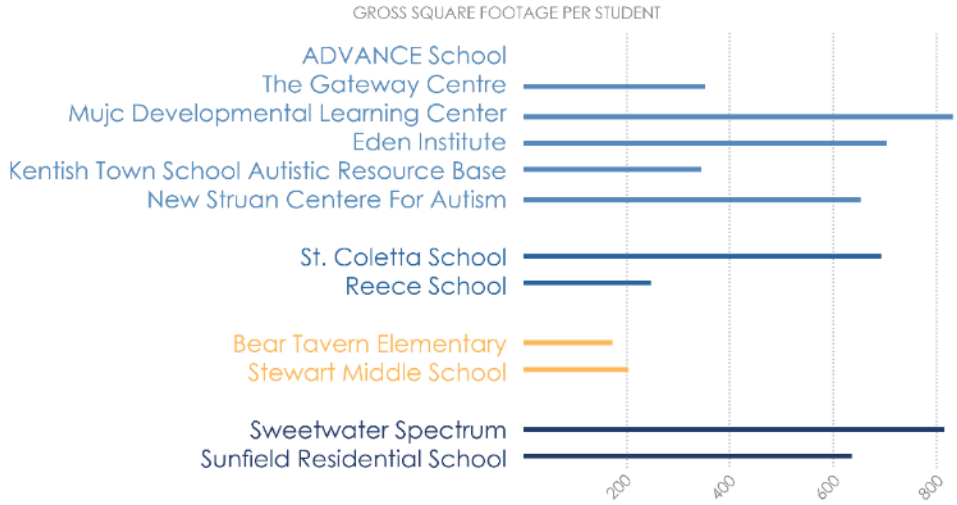



*Figure 4.29: Comparison of the number of students of each precedent school (image by author)*

This is due to the extra spaces required for the addition facilities associated with an autism education program. There is a need for facilities for physical therapy, occupational therapy, speech therapy, psychomotor therapy, sensory rooms, quiet rooms, and observation rooms. Those additional program requirements greatly increased the gross square footage of the school. Another reason for the increase in square footage per student is the attention that students with autism need. The average

student to teacher ratio in the United States is 16:1 while special needs schools have a ratio of 6:1 or lower.[43] This student to teacher ratio means that there will be more teachers and aids in the classrooms along with the students, so teacher needs must be considered as well. Students with autism also cannot be packed into classrooms like neurotypical students. A classroom size that is too large will also negatively affect an autistic child in many ways. The large numbers of students will cause distractions, there can be a lack of personal space, and a decrease in the attention available to each student can be detrimental to those who need modifications and extra help.

[43] "Rankings of the States 2012 and Estimates of School Statistics 2013."

# 5. Principles of Design

A series of design principles were created through the analysis of literature, precedent studies and interviews. These principles are designed to be applied to any building that will house an autistic user. The principles are broken into three categories: distractibility, tectonics and materiality, and spatial organization. The principles of distractibility relate to the stimuli that student can receive within the building and a way to control the various stimuli. Tectonics and materiality relates to the way the building is physically put together and the materials involved. Spatial organization refers to how the spaces of the building are organized in relationship to each other and how someone moves through the space.

## *Distractibility*


*Figure 5.1: Ways the built environment can distract students with autism (image by author)*

### *Acoustics*

Parents and teachers ranked acoustics as the most influential feature of the sensory environment on autistic behavior. Loud noises and sounds from things such as movement and systems should be mitigated through design. In most cases the sense of calm that comes with quieter spaces encourages better behavior in students and allows them to focus on learning.

Design Guidelines;

- Carpets on the floor reduce the impact of foot traffic and absorb sound
- Rough and textured finishes can break up sound waves and reduce noise reverberations
- Classrooms should be placed an appropriate distance from road to reduce he noise from traffic and sound barriers should be used to mitigate the noise
- There should be ample insulation between room to prevent noise from other areas of the school penetrating into rooms
- Hard surfaces should be avoided in the classrooms
- Mechanical systems need to be insulated well to reduce noise
- Natural ventilation should be used as much as possible to reduce noise of HVAC systems

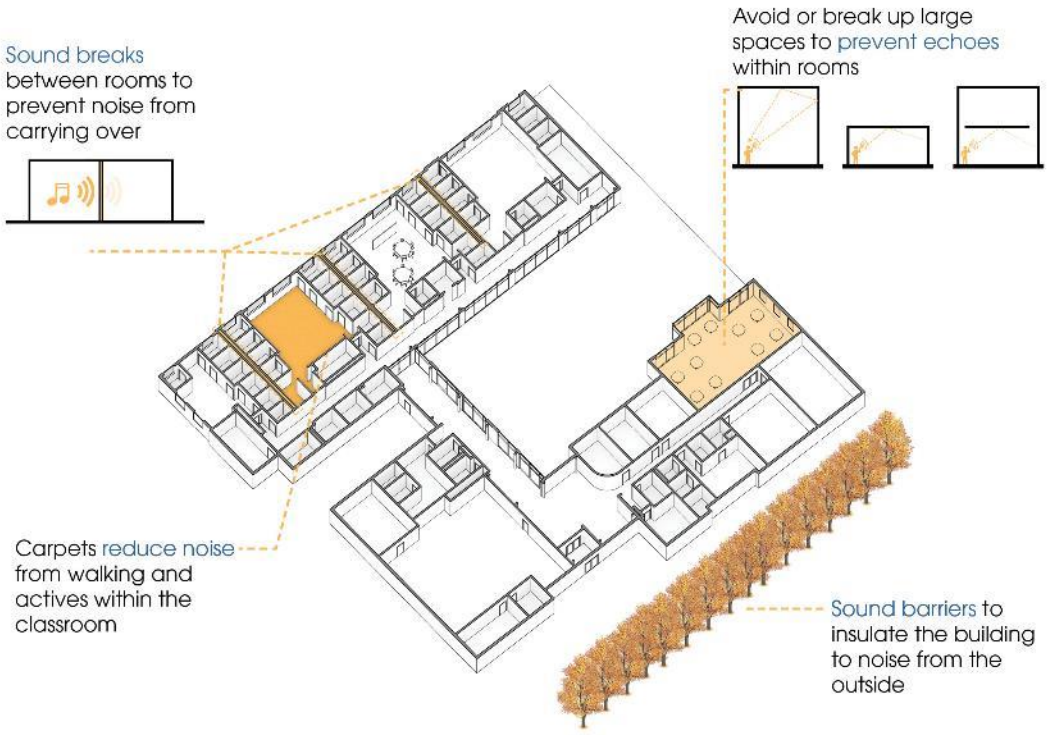



*Figure 5.2: Design implementations to control acoustics (image by author)*

*Lighting*

The use of direct fluorescent lighting should be avoided. Individuals with autism are very vulnerable to the sub-visible flicker, which can cause headaches, eyestrain, and increased repetitive behavior. Lighting also needs to be controllable because different

activities require different amounts of light. Natural light improves academic performance, relaxes students, permits better concentration, and reduces hyperactivity in children. However views to the outside and other distractions should also be controllable to prevent students from being distracted by what is happening outside.

Design Guidelines:

- Natural light should be provided in all rooms and used as much as possible
- Windows should be placed above eye level, such as skylights and clearstories to reduce the view to the exterior, or should be translucent to allow light in but block views
- Lights in classrooms should be equipped with dimmers to allow greater control over the lighting
- Florescent lights should never be used

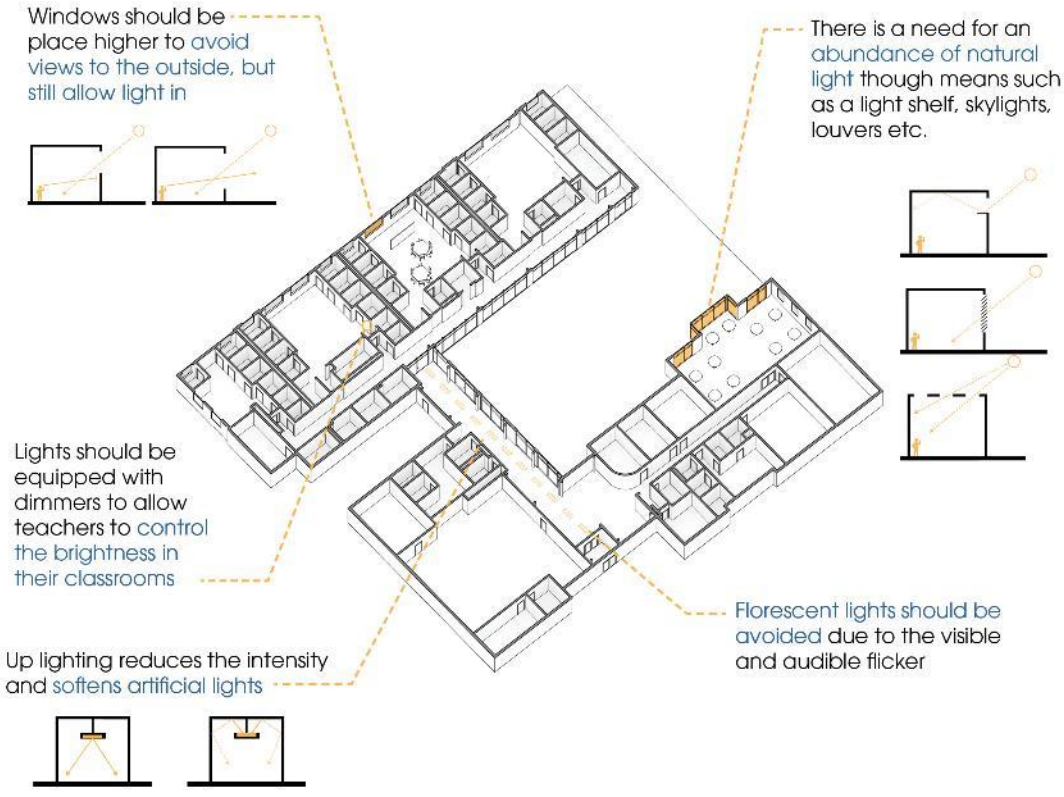



*Figure 5.3: Design implementations to control lighting (image by author)*

*Colors and materiality*

85% of autistic children see colors with far greater intensity than a neurotypical student.[44] Because autistic individuals may have a significant increase in color differentiation, small changes in color can dramatically affect their behavior. Grids and busy patterns should be minimized in areas that require student to focus, such as a classroom. Minimizing any offending stimuli can help improve autism spectrum students' ability to perform successfully in the classroom.

Design Guidelines:

- Cheerful colors, whether subtle or bold depending on user population, eliminate the users' and visitors' impression of institutionalism and create a better environment.
- Cooler colors such as blues, greys and purples have a calming effect on students
- Different colors should be used to differentiate different areas of activity with a space and from space to space.
- Wall surfaces should be simple and devoid of geometric or complex patterns

[44] Jon Daly, *Sensory Issues in Autism*.

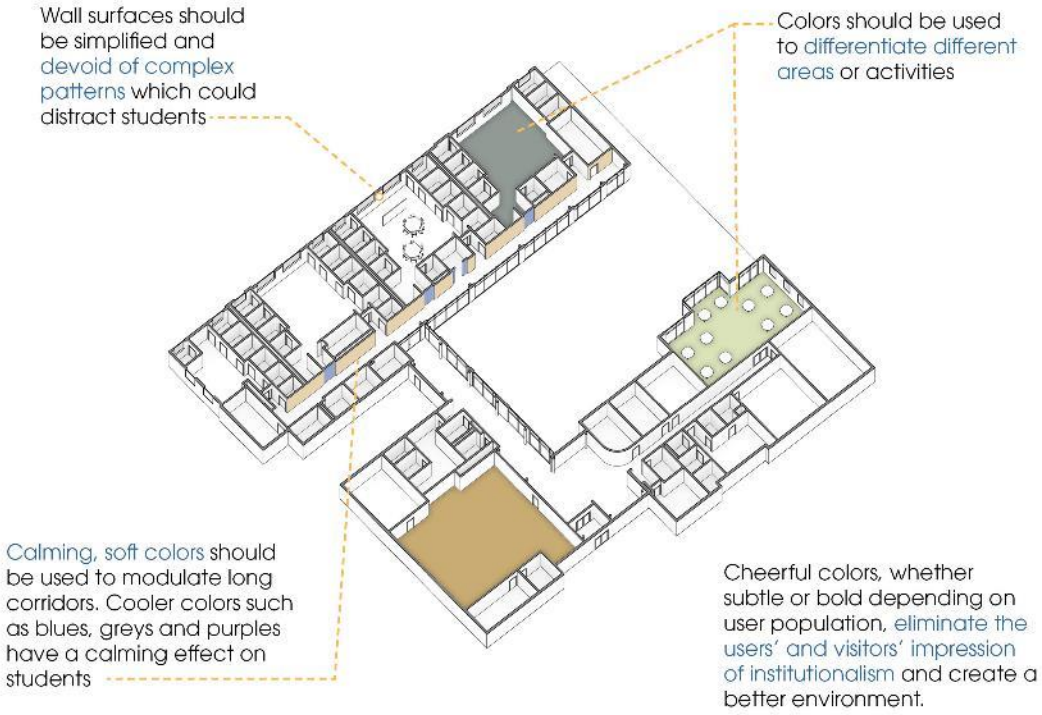



*Figure 5.4 Design implementations to control colors/materiality (image by author)*

### *Spatial Organization*


*Figure 5.5: Spatial considerations for designing environments for autistic individuals*

*Adaptability*

Spaces should be allowed to change to the children's needs and to allow the students and teachers to rearrange or subdivide the spaces as needed. Finishing, materials and spatial organization should be able to be manipulated not only by the staff but also by students. An environment which is able to adapted and change to the user's needs is able to perform more function than a room with a set purpose. The environment could also change stimulus level based on the activity, divide the space up into multiple small areas of activity, or exist as one large space. However, if the environment is too flexible an individual might live in constant fear that the environment will suddenly be changed.

Design Implementations;

- Moveable walls in classrooms and gathering spaces would allow multiple arrangements in rooms
- Modular furniture can be turned and stacked in different ways
- Creating an open floor plan that can be adapted to the individual needs of the teacher or student

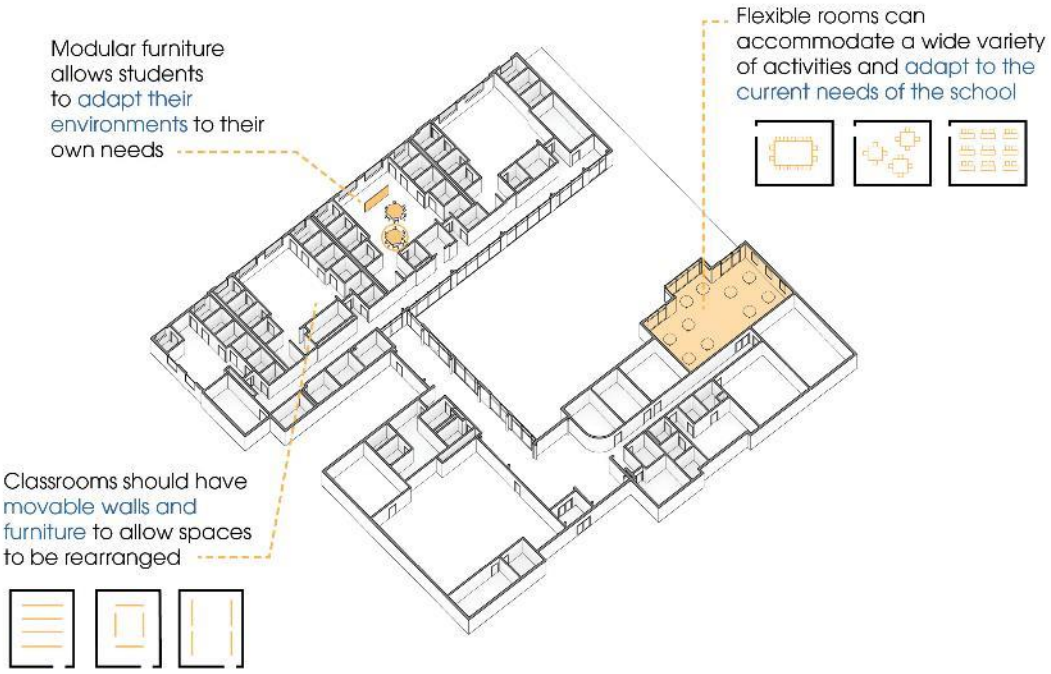



*Figure 5.6: Design implementations of adaptability (image by author)*

*Transitions*

Spaces should flow as seamlessly as possible from one activity to the next and should be organized in accordance to their sensory quality rather than the typical architectural approach of functional zoning. For example instead of placing a school gym near the classrooms as they are closely related in their function and user, it would be better to place them in opposite areas with administration placed between them even though there is little programmatic relationship between those spaces. With transitions between areas of high stimulus to areas of low stimulus or from one activity space to the next, there should be a threshold space which allow the student to recalibrate their senses. Without the transition space, the shock of going from an area of low stimulus to high stimulus could send students into fits.

Design implementations;

- Transition spaces should activate all the senses- sight, sounds, smell, touch, and taste
- Spaces could be anything from a node to a shift in circulation to a full sensory room which allows the student to reorient themselves.
- The spaces should allow students to anticipate the environment in which they are headed.

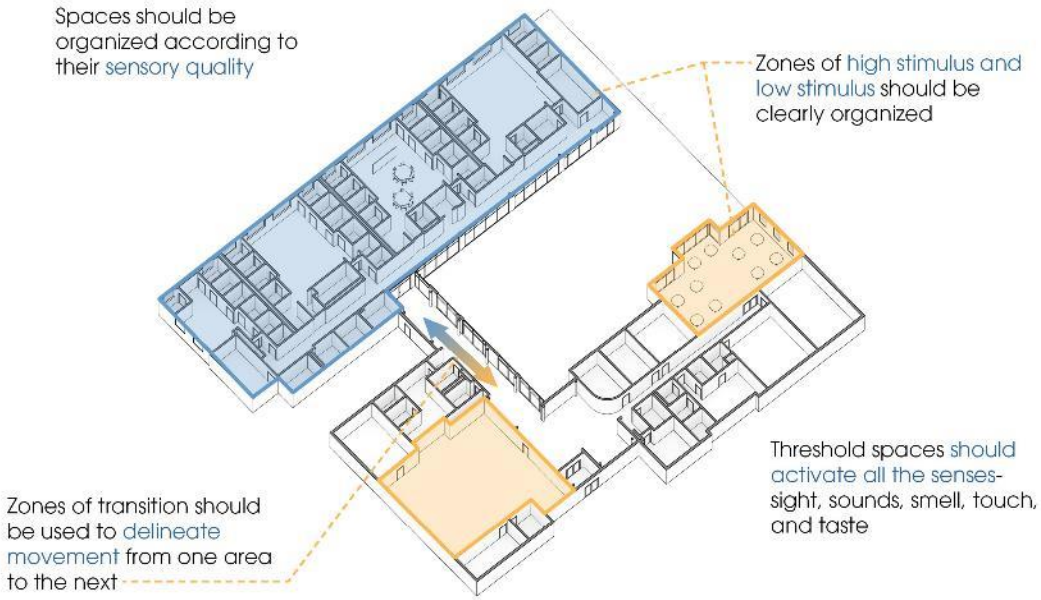



*Figure 5.7: Design implementations of transitions (image by author)*

*Predictability*

Students with ASD will often feel nervous when navigating spaces that are unfamiliar to them so the arrangement of structures should be easily understood and encourage choices as well as problem solving and discovery. The importance of legibility, imaginability, and redundant cueing come into play when those with ASD are navigating buildings. Classrooms and schools should be easy to read with clear signage, numbering, and configuration. The environment must be memorable and

describable in terms of specific landmarks to create a space for students to be able to recall.

Design Implementations;

- Patterns and materials can be used to help guide students through a space by clearly defining circulation paths
- Children should be allowed to view into spaces from a safe vantage point, so they are able to see where they are going and what to prepare for
- Rooms should have easily identifiable markers such as colors and patterns
- Landmarks should be used to orient spaces and allow individuals to orient themselves using spaces such as a courtyard

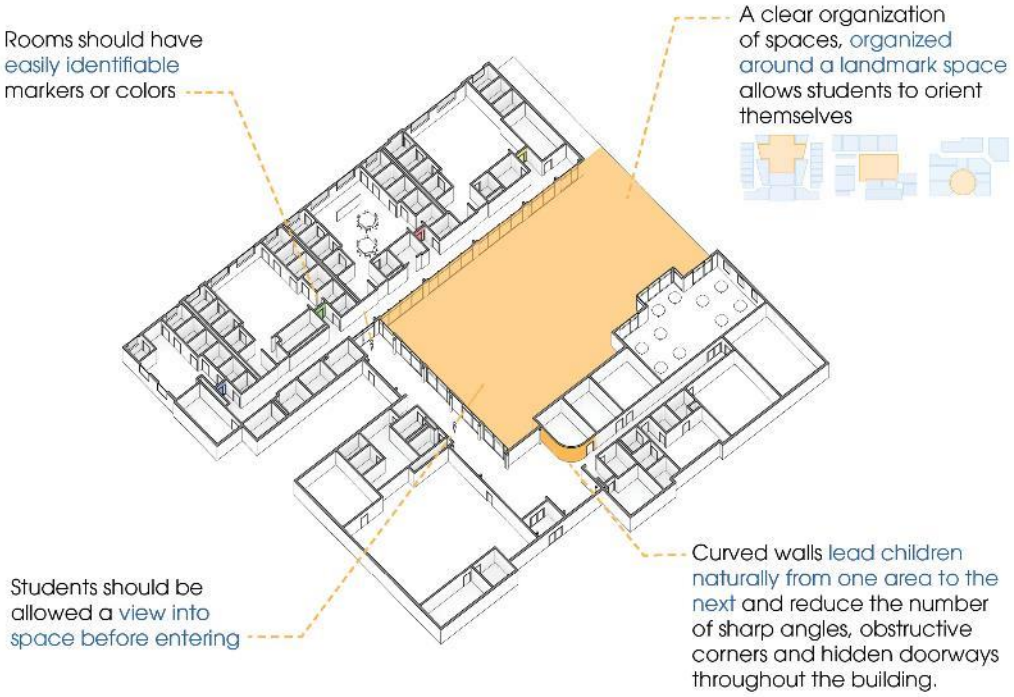



*Figure 5.8: Design implementations of predictability (image by author)*

*Escape Spaces*

Students need spaces that provide areas of respite from the over stimulation in their environments. Having such spaces in a school has been shown to have a huge positive

effect on students in a learning environment because the class and other students can often overwhelm the sensory input of an autistic individual through the stimuli that accompanies a neurotypical classroom setting. Being able to experience an outdoor environment is also important as the fresh air and nature can have a calming effect on the students. Creative outdoor areas can provide students and adults with special needs the opportunity to explore social contact, as well as provide places for tranquility.

Design Implementations;

- The spaces should provide a neutral sensory environment with minimal stimulation
- Escape spaces should allow a degree of customization for the user
- Walking paths and gardens on the school ground create soothing outdoor environments which help to calm students down
- Spaces should also allow areas for the children to exercise

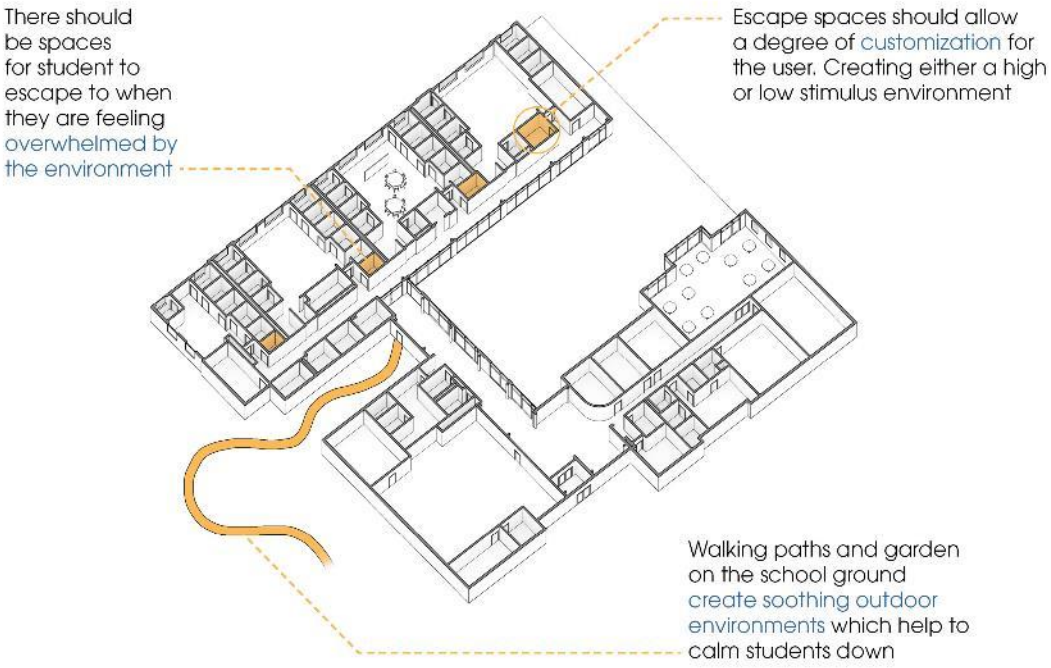



*Figure 5.9: Design implementations of escape spaces (image by author)*

### *Tectonics and Materiality*


*Figure 5.10: Tectonic and material consideration that need to be taken into account when designing for autism*

*Safety*

Children with autism occasionally have an altered sense of spatial orientation, depth perception, and general proprioception, or the ability to sense stimuli arising within the body regarding position, motion, and equilibrium. The miscommunication within the sense makes individuals with autism prone to self-injury. They are also prone to displaying aggressive behaviors and tantrums making them dangerous to themselves and others. The high frequency of those with autism injuring themselves due to being unfamiliar with their environment, mean precautions need to be taken to ensure that the children are being constantly looked after. Autistic individuals also have stronger reactions to dirt, germs, and toxins, so the materials selected within an environment need to take into consideration the chemicals used to create them.

Design Implementations;

- Soft surfaces such as rubber and carpet can reduce injuries.
- Hard materials such as concrete and brick should be avoided or covered.
- Materials should be free of all toxins.
- Locks on doors and stairs prevent students from accidentally injuring themselves.

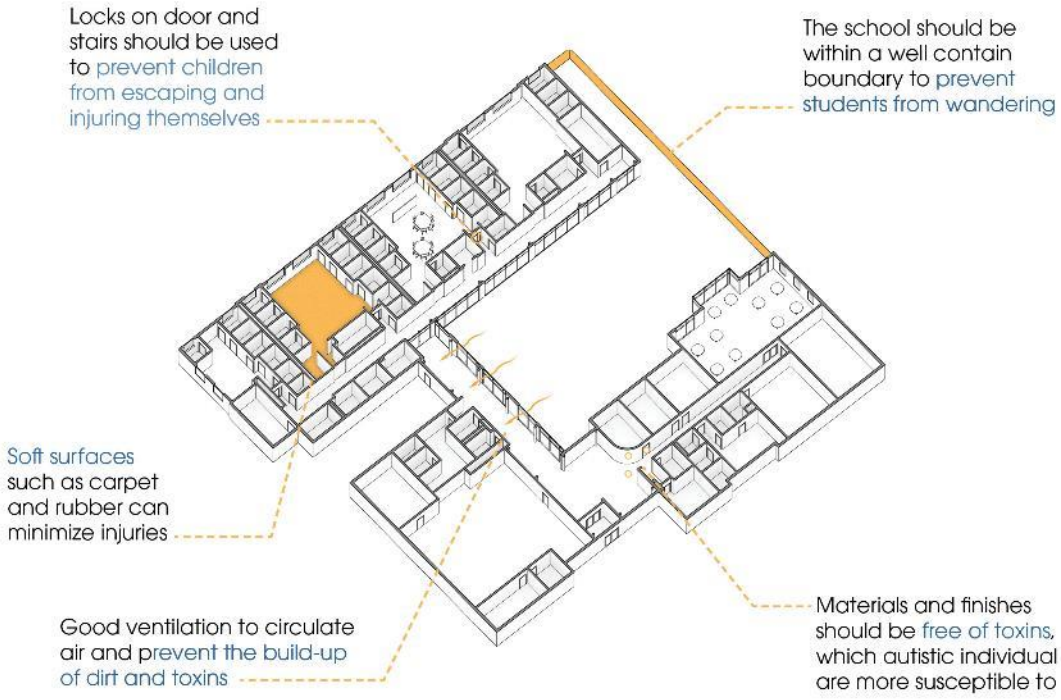



*Figure 5.11: Design Implementations of Safety (image by author)*

*Durability*

Emotional disturbance issues, such as intermittent explosive disorder or bipolar, frequently cohabitate with ASD. Due to this, there exists a need to use durable materials that not only resist the wear and tear of children, but are safe enough that they do not to cause injury to the students. The materials will also have to be easy to clean as children with ASD often have trouble with bathroom procedures and will sometimes soil themselves or vomit in class.

Design Implementations;

- Materials used within the design need to easy to clean and durable.
- Hard shiny surfaces provide surfaces that are easy to maintain.

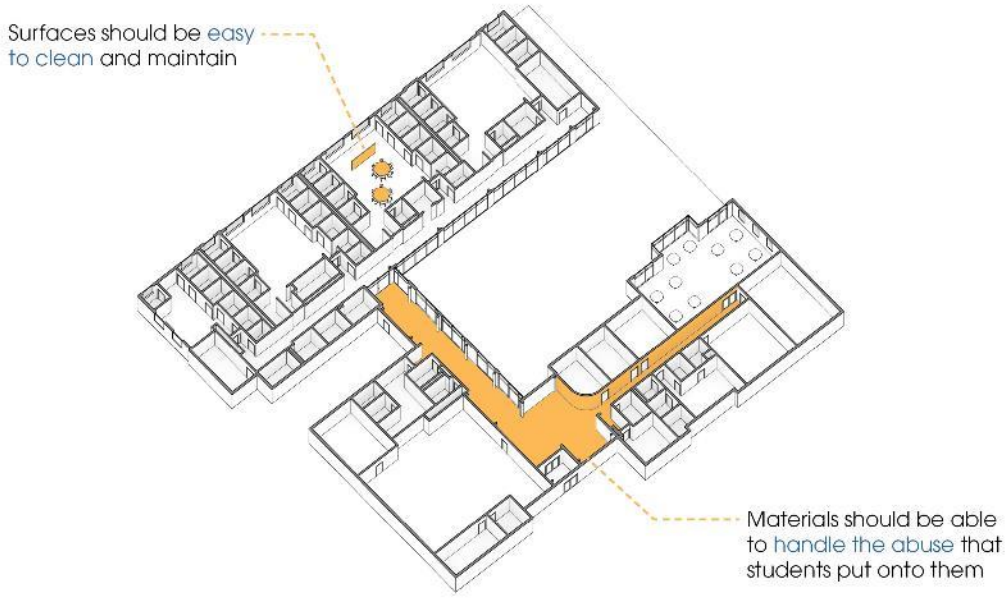



*Figure 5.12: Design Implementations of durability (image by author)*

# 6. Conceptual Framework

### *Program*

The typical school for autism does not involve every member of an autistic individual's life in the education process. In the current school system only the teachers and students are present and other key individuals are missing; the doctors who diagnose the students and the parent who are raising the students. The students are often separated, themselves, throughout the education process. They will move to different schools for different levels in their education and there is little overlap between the different age groups associated with the autistic user.

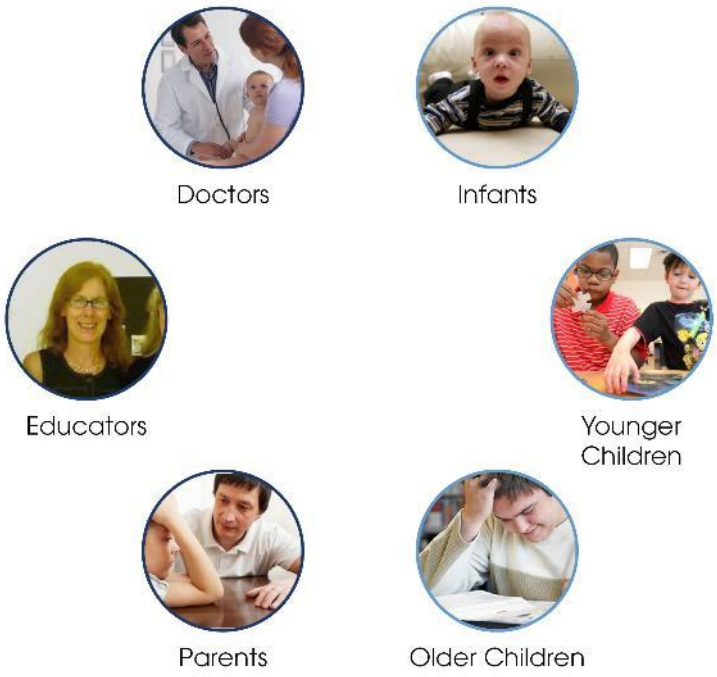



*Figure 6.1: The parties involved with an autistic student (image by author)*

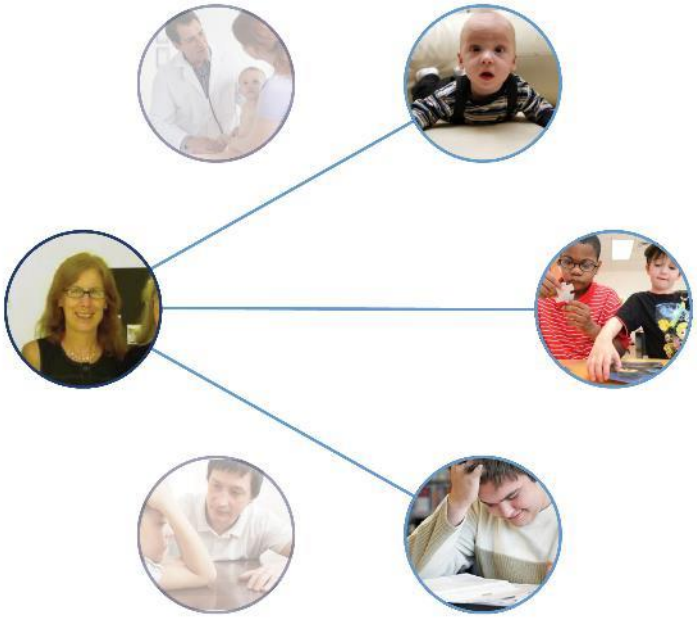


*Figure 6.2: The current model of the school system involving only the students and teachers within the building (image by author)*

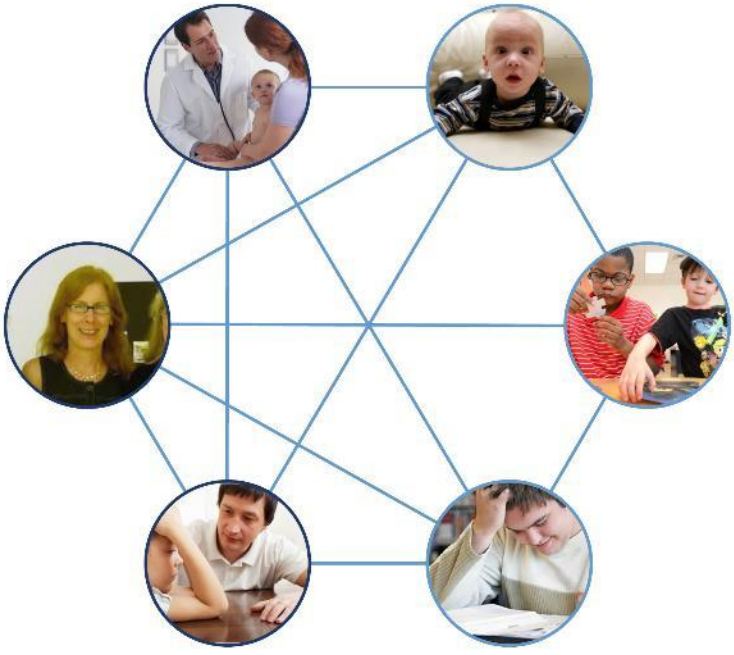


*Figure 6.3: The proposed model which involves all the parties (image by author)*

These previously mentioned parties should be just as involved with the student's growth and education as their parents are and by combining programs for each age group and each specialty into one center, it is possible to bring about collaboration between peer groups and between those who educate and serve the autistic population.

The intent of this thesis is to create a mixed use building that combines the programmatic features of a school, parent education classes, and a diagnostic and early intervention center. By mixing all these program into one building, the center would allow greater collaboration between the parties involved in the life of an autistic individual. The center would be broken down into the following components:

| **Administration** | Stimulus level | SF/room | # of rooms | User | Total SF |
|---|---|---|---|---|---|
| Reception Area | Medium | 1500 | 1 | Teachers | 1,500 |
| Main Offices | Low | 2000 | 1 | Teachers | 2,000 |
| Faculty Lounge | Medium | 450 | 1 | Teachers | 450 |
| Conference Rooms | Low | 400 | 2 | Teachers | 800 |
| | | | | | **4,750** |
| **Diagnostic Center** | | | | | |
| Waiting area/ Reception | Medium | 500 | 1 | Parents, Infants | 500 |
| Eary Intervention offices | Medium | 150 | 6 | Infants, Teachers | 900 |
| Diagnostic testing rooms | Medium | 250 | 2 | Medical, Infants | 500 |
| Office | Low | 150 | 1 | Medical | 150 |
| | | | | | **2,050** |
| **Educational Center** | | | | | |
| Classrooms | Low | 1800 | 5 | Teachers, Studnets | 9,000 |
| Observation Rooms | Low | 50 | 5 | Teachers, Parents | 250 |
| Physical Therapy | Medium | 850 | 1 | Teachers, Studnets | 850 |
| Occupational Therapy | High | 1000 | 1 | Teachers, Studnets | 1,000 |
| Speech Therapy | Medium | 900 | 1 | Teachers, Studnets | 900 |
| Art studios | Medium | 800 | 1 | Teachers, Studnets | 800 |
| Music Studios | High | 1000 | 1 | Teachers, Studnets | 1,000 |
| Group Breakout | Low | 700 | 1 | Teachers, Studnets | 700 |
| Sensory room | High | 250 | 1 | Studnets | 250 |
| Exercise Room | High | 400 | 1 | Teachers, Studnets | 400 |
| Nurse's office | Medium | 550 | 1 | Studnets | 550 |
| Kitchen/food | High | 600 | 1 | Teachers, Studnets | 600 |
| Lunch Room/cafeteria | High | 1200 | 1 | Teachers, Studnets | 1,200 |
| Gym | High | 1650 | 1 | Teachers, Studnets | 1,650 |
| Quite room | Low | 80 | 5 | Studnets | 400 |
| | | | | | **19,550** |
| **Parent Education spaces** | | | | | |
| Classroom | Low | 650 | 1 | Parents | 650 |
| Group meeting spaces | Medium | 1200 | 1 | Parents | 1,200 |
| | | | | | **1,850** |
| **Ancillary Services** | | | | | |
| Bathrooms | Low | 150 | 8 | Everyone | 1,200 |
| Storage Space | N/A | 500 | 1 | Everyone | 500 |
| Circulation | N/A | 8000 | N/A | Everyone | 8000 |
| | | | | | **9,700** |
| **Mechanical/Service** | | | | | |
| Mechanical Space | High | | | Everyone | **1,773** |
| **TOTAL SF** | | | | | **39,673** |
| **Outdoor Spaces** | | | | | |
| play ground | High | | 1 | Studnets | 6,000 |
| Walking/ Exercise Path | Low | | 1 | Studnets | 6,000 |
| Growing gardens | Medium | | 1 | Studnets | 400 |
| | | | | | **12,400** |

*Figure 6.4: Program break down (image by author)*

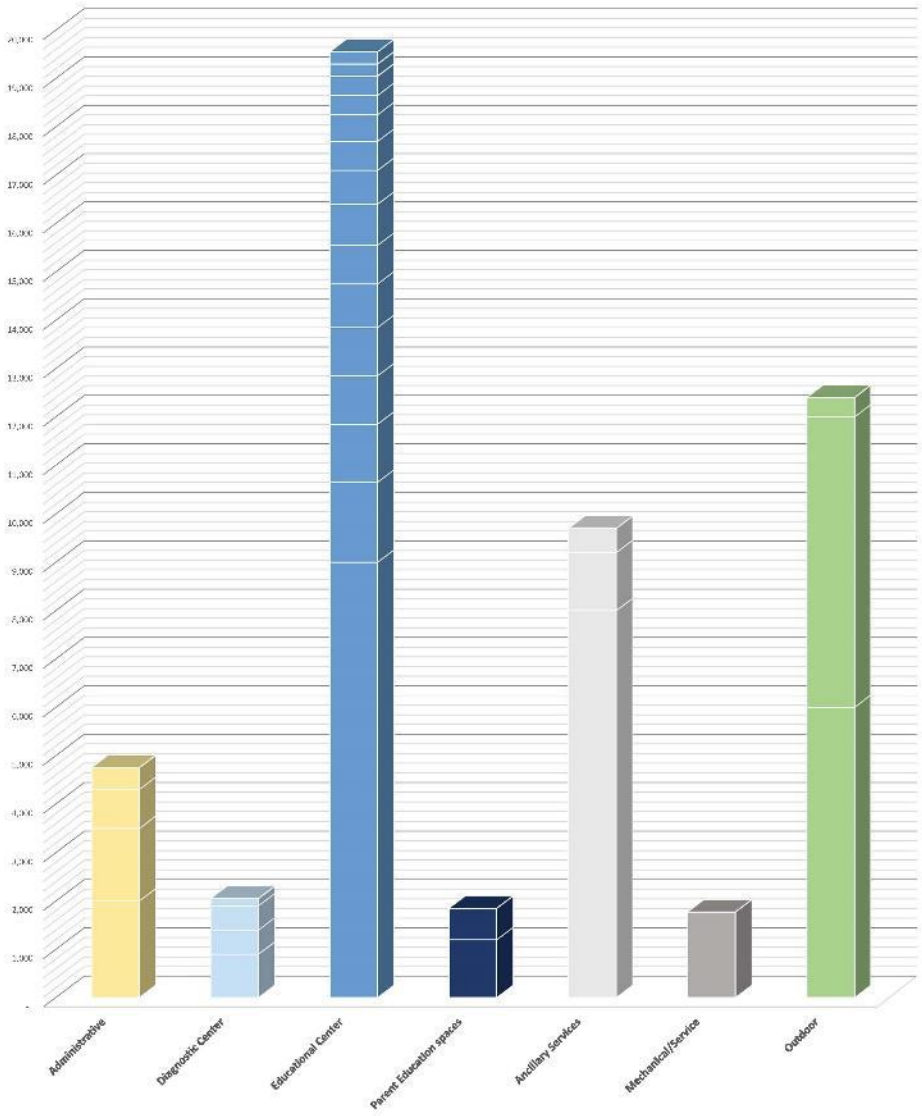



*Figure6.5: Program Breakdown*

### *The User*

The user of this center is more than just a student, the user would involve multiple age groups of students as well as professionals and parents. The user of the center can be classified into the following groups:

*Infants*

Infants and toddlers are children who are not yet qualified for school services or are being diagnosed with autism. Infants who have yet to be diagnosed would be using the diagnostic clinic and working with the doctors and nursing majors there to undergo testing for autism. Children who have been diagnosed with autism already and have not yet reached the school age would be using the services of the early intervention center. They would take work with the therapist employed by the school as well as their parents and education majors to being learning how to adapt to their environments and gain an education. Infants and toddlers would mostly be using the diagnostic center area of the building.

*Lower Age Students*

Lower age students are those who have started school and have yet to reach the age of transition and are classified are early childhood and middle childhood. For the early childhood students they would be most working and using their own classroom for the entirety of the day. Since the early childhood students are least adapted to their environments and have the most lacking skills of all the students. They would eat lunch in their rooms, take their classes there and meet with specialists within the rooms. If needed the students may also use the therapy centers for more specialized

learning. The middle childhood students would begin to use more of the building and resources, such as the cafeteria and therapy services. They are most accustomed to moving around the building and the changes in their environments.

*Upper Age Students*

Upper age students are those who are at the age of transition as well as student who are college level. The students who are nearing the age of transition would be able to use the full resources of the center as well as begin to use the resources offered by the campus. The student could gain real life experience working jobs on campus for the university such as at the library or shops on campus. These students would also have jobs within the school such as working in the cafeteria to prepare meals for themselves and their fellow students. The college level students are students who are enrolled in college classes at TCNJ. They would be using the center for specialized classes or for its resources contained within the therapy wing. They would have the most freedom out of all levels of students at the center.

*Parents*

Parents of student with autism need to learn just as much about the disease as their children or teachers due and education for parents is lacking in a typical school. Parents would be able to take classes and have group meeting session within the center to learn more about how to raise a child with autism. The center would also serve as a didactic learning tool and teach parents about the way that the build environment is able to have an influence on their child.

*Educational Professionals*

The education professionals would consist of the teachers at the school and the education majors who are taking classes at the school of education. The teachers consist of paraprofessionals, licensed teachers, or therapy specialists. Paraprofessional would be serving as an aid for specific students or working as aids for teachers often staying with the same student for an entire day. The teacher would be in charge of the individual classrooms and leading the classes. Therapy specialists consist of physical therapists, occupational therapists, and speech therapists. They would be working within the therapy wing and either working in their specific rooms or in the individual work areas of each classroom. The education majors are students from the school of education who are either majoring in special education or general education. They would serve as student teachers and would fulfil some of the same functions as paraprofessionals. Even if the students were not specifically majoring to work with autism they would gain vital experience working with autistic students in a real classroom setting.

*Medical Professionals*

The medical professionals group consist of doctors and nursing majors from the proposed nursing school. The doctors would work in the diagnostic center, identifying infants with autism as well as researching the effects of the built environment on those with autism. Nursing students from the nearby nursing school would be aiding doctors in the diagnostic clinic.

# 7. Site Considerations

### *Site Selection Criteria*

Site selection included a variety of criteria which were implemented and used as a means to judge the potential of several sites considered. The criteria were chosen because they would have direct impacts on the design and architectural implications of a campus facility and the way in which it is shaped. The site would also have a huge impact on the way the facility would be able to operate as both a campus facility and a facility for students with autism. These standards include; prevalence of autism in the area, university programmatic  requirements, type of college/university, accessibility and land availability on campus, connection to public thoroughfare, a connection to major cities and local residential areas.

The first locational requirement was placing the center where it could have a large impact on the autistic population; an area with a high prevalence of autism. By examining data from the Center for Disease Control (CDC) and National Office of Special Education Services the highest percentage of students identified as autistic are located in the Northeast and West Coast. Based on the most recent data from the CDC, of the states examined New Jersey had the highest prevalence rate of 1 in 45 compared to the national average of 1 in 68. Based on this information the Northeast appears to be the best in which to locate the center

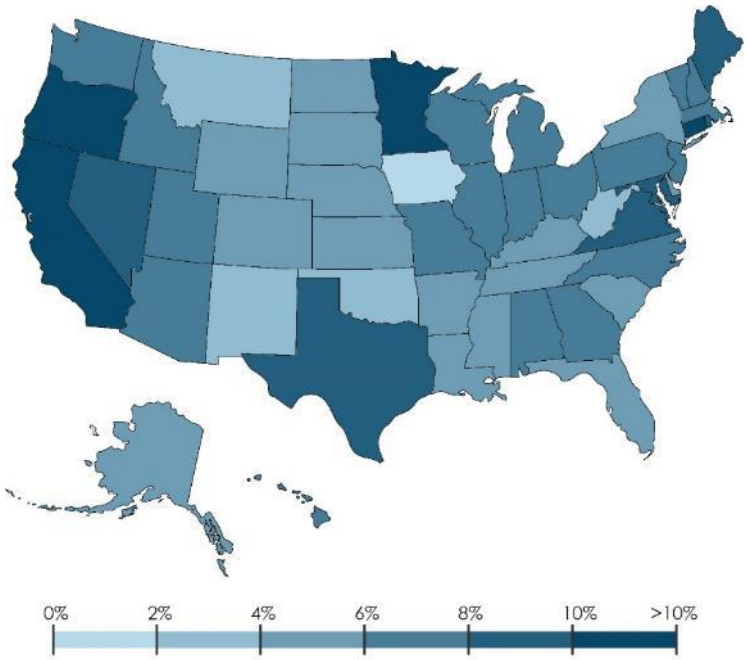



*Figure 7.1: Percentage of Student with Autism out of all student who received special education services under IDEA. 2011 (image by author, data compiled from Office of Special Education)*

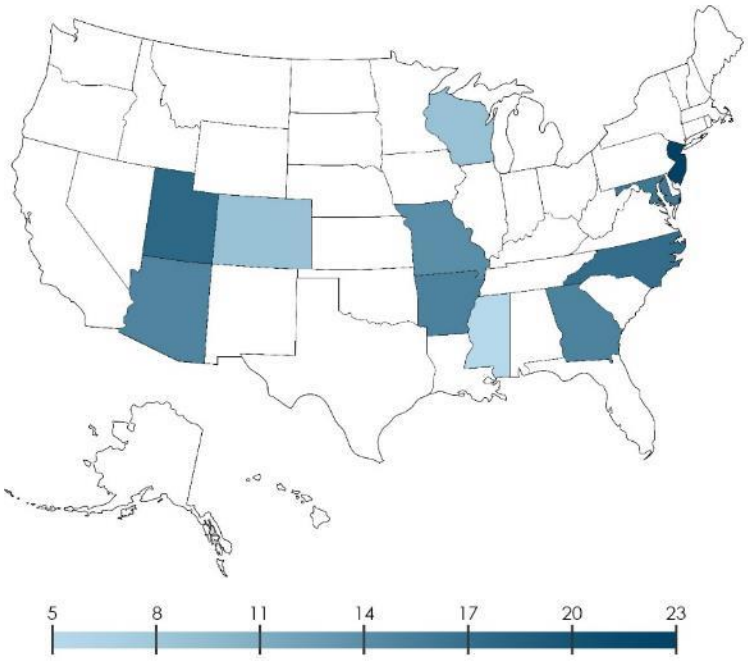



*Figure 7.2: Number of students out of 1000 who are classifies as autistic. 2010 (image by author, data compiled from Center for Disease control)*

The site should to be located in an area that lies between an urban and suburban area in order to best serve the population of student attending this program and their families. A setting that was too rural would not provide the appropriate community resources. A setting too dense or largely urban would be overwhelming for the students and lack a strong connection to the outdoors.

The decision to locate the center on a college campus would allow the center to serve multiple programmatic needs. The center would be able to use all the resources available at the university and give back to the university by providing an opportunity for research and a real life learning environment for special education majors. It was important to choose a school that had a special education program so that the interaction between the university and the center could happen and bring the larger campus community into the center. Finally a university having a board certified behavior analyst (BCBA) program would be desirable.

Using these criteria, the site selection was narrowed down to five feasible locations; The College of New Jersey, Rowan University, Georgian Court, University, Monmouth University, and University of Maryland Baltimore County. Through research on each, the decision was made to select The College of New Jersey as the appropriate site to explore and develop this thesis. The combination of an organized campus fabric as well as the strong support of autism at the school made TCNJ the most appropriate site to place the center

### *History of Site*[45]

The College of New Jersey was established in 1855 by the state legislature as the New Jersey State Normal School. It was the first teacher training school in the state and the ninth in the nation. Originally the school was located within the city of Trenton. In 1928 the school expanded to the current location in Ewing after purchasing a 210 acre tract of land. Graduate study was instituted at the College in 1947. The enactment of the Higher Education Act of 1966 paved the way for TCNJ to become a multipurpose institution by expanding its degree programs into a variety of fields other than education. By 1972, seventy percent of entering students were selecting non-teaching majors.

The college currently emphasizes its strong liberal arts core that forms the foundation for a wealth of degree programs offered through TCNJ's seven schools—the Arts and Communication; Business; Humanities & Social Sciences; Education; Science; Nursing, Health, and Exercise Science; and Engineering

### *Character of Campus*

The architecture of the campus consists of the Collegiate Georgia vernacular, which is a common style for academic campuses. Brick, cast stone, pitch roofs, faux slate shingles are consistent architectural elements throughout the campus. There are a few buildings within the campus that break the Collegiate Georgia vernacular; the

[45] "History."

students center, the new housing development on the western edge of campus, and the new design for the campus STEM center.

*Figure 7.3: Paul Loser Hall (image by TCNJ)*

*Figure 7.4: TCNJ Library (image by TCNJ)*

*Figure 7.5: Education building (image by TCNJ)*

*Figure 7.6: Education building (image by Jill Leestma)*

*Figure 7.7: Green Hall (Image by TCNJ)*

*Figure 7.8 Student center (image by Jill Leestma)*


*Figure 7.9: Western campus redevelopment (image by TCNJ)*

*Figure 7.10: STEM center design (image by TCNJ)*

## *Site Analysis*

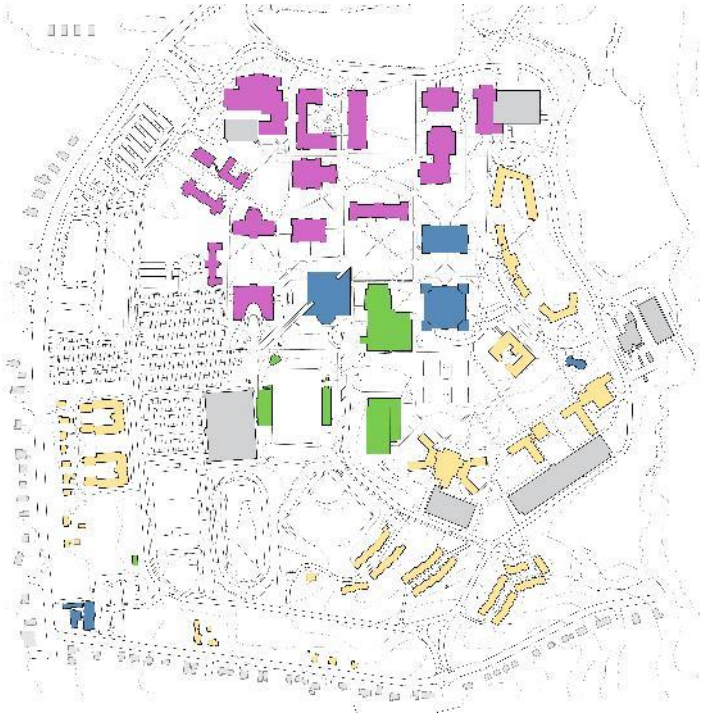


*Figure 7.11: Building types (image by author)*

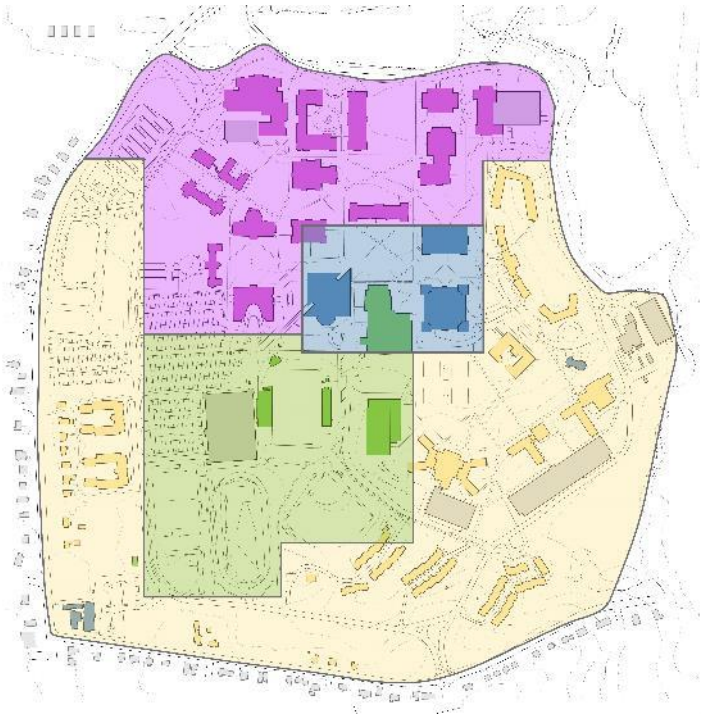


*Figure 7.12: Campus Districts (image by author)*

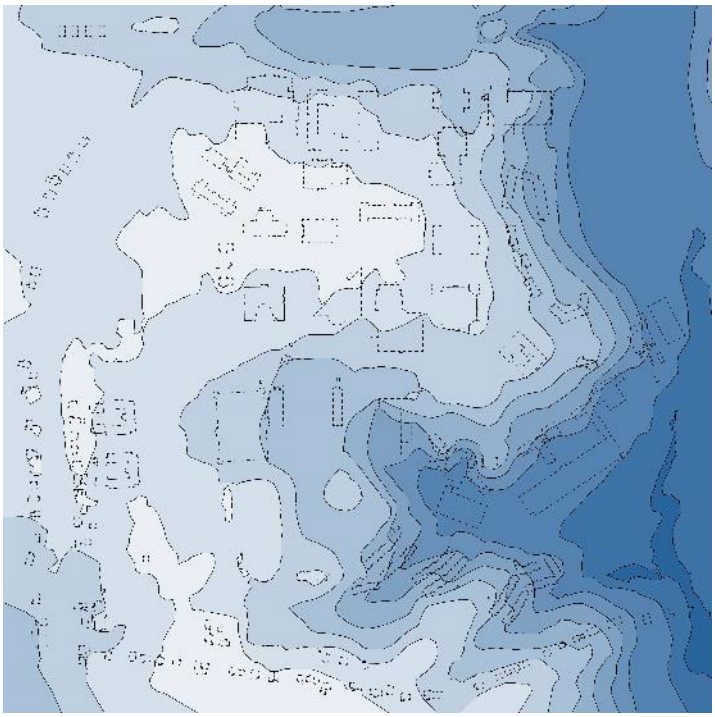


*Figure 7.13: Topography (image by author)*

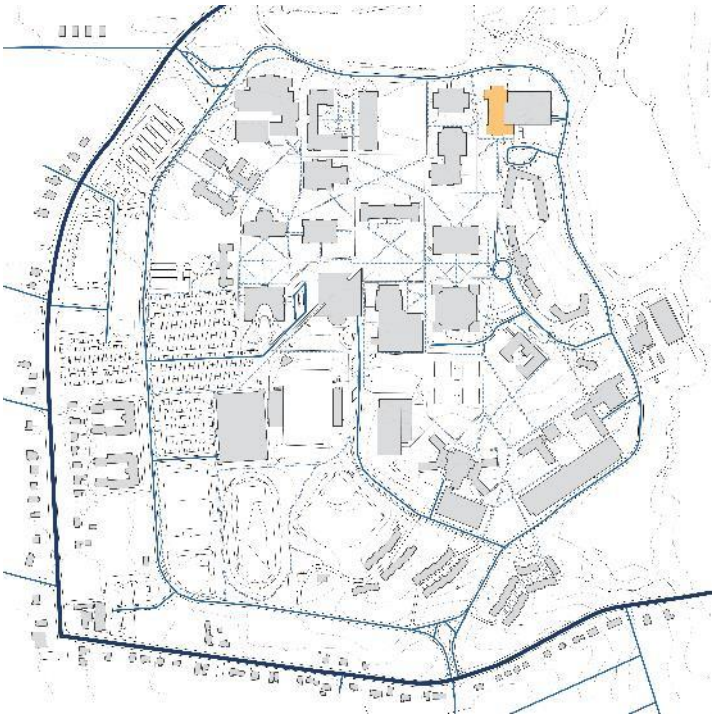


*Figure 7.14: Campus Circulation (image by author)*

## *Potential sites on Campus*

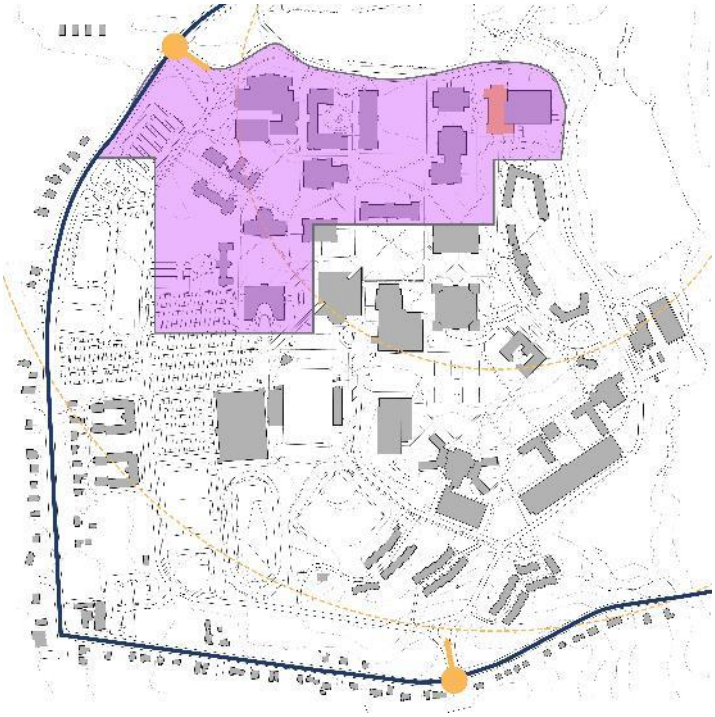


*Figure 7.15: Site criteria overlapped (image by author):*

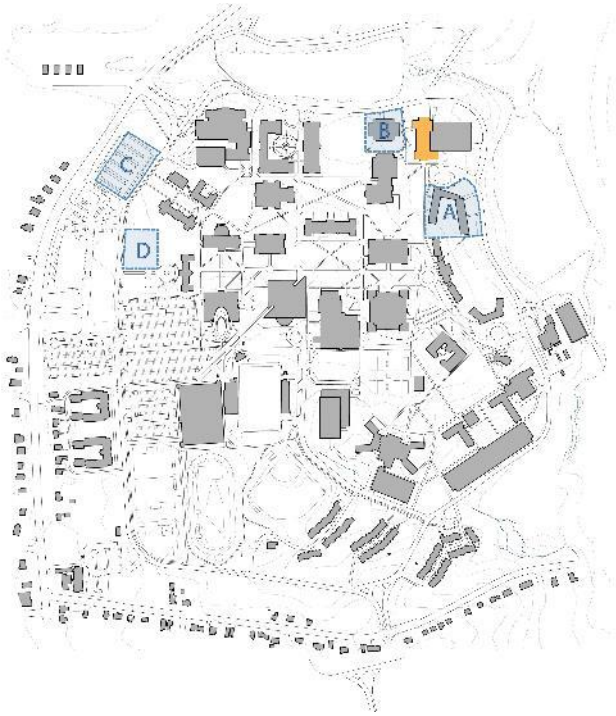



*Figure 7.16: Possible sites (image by author)*

After analyzing the building usage, districts, circulation and topography of the campus. Four sites stood out as optimal locations for the center. Among these more specific criteria was used to determine which site should be chosen to develop the center on. As seen in figure 7.17 sites A and B were the most appropriate to design upon, with site A being the more favorable of the two.

| Site | Reinforces Campus Plan | Site Flexability | Program Flexibility | Impact on other Programs/ Campus | Displacement | Proximity to Education Building | Access to Major Road | Topographic Changes over site | SF of site |
|---|---|---|---|---|---|---|---|---|---|
| A | Yes | High | High | Housing | Centennial Hall | 300' | yes | 10-15' | 80,000 |
| B | Yes | High | Moderate | Pedestrian | Forcina Hall | 170' | yes | 5-10' | 50,000 |
| C | No | High | High | Business school | Parking | 2100' | yes | 0-5' | 75,000 |
| D | Yes | High | High | low | Quad | 2100' | yes | 0-5' | 60,000 |

*Figure 7.17: Site selection criteria (image by author)*

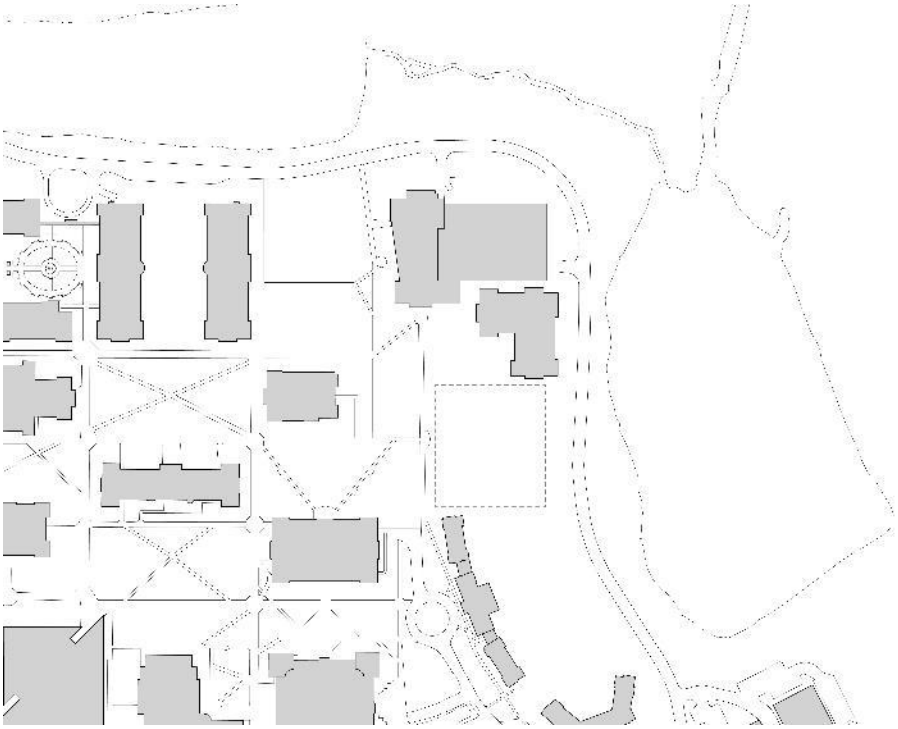


*Figure 7.18: Location of Site (image by author)*

*Figure 7.19: Major axis (image by author)*

*Figure 7.20: View Corridors (image by author)*

*Figure 7.21: Major Spaces (image by author)*

*Figure 7.22: Regulating Lines (image by author)*

*Figure 7.23: Stimulus levels (image by author)*

*Figure 7.24: Wind Direction (image by author)*


*Figure 7.25: Master plan of TCNJ for 2021 (image by TCNJ)*

The proposal for the center would also take into account the master plan for the campus. On the chosen site a dormitory, Centennial Hall, is already slated to be demolished so the one conflict that arose from choosing site A is mitigated. The master plan also proposes a new nursing school located near to the School of Education which could become an opportunity to have nursing student work within the diagnostic center of the education center.

# 8. Architectural response

The building would need to respond on three scales; the campus, the building, and the room. Each taking into account the principles of design stated in chapter 5. The process began by laying out initial schemes based on the site analysis, precedents and the principles of design on both sites A and B (see figure 8.1). Upon designing it was determined that site A offered the most opportunities as it had a direct relationship to the school of education as well as the nursing school which was slated for future construction. This would allow students from both the school of nursing as well as the school of education to work within the center and gain real life experience working with autistic individuals.

### *Design Development*

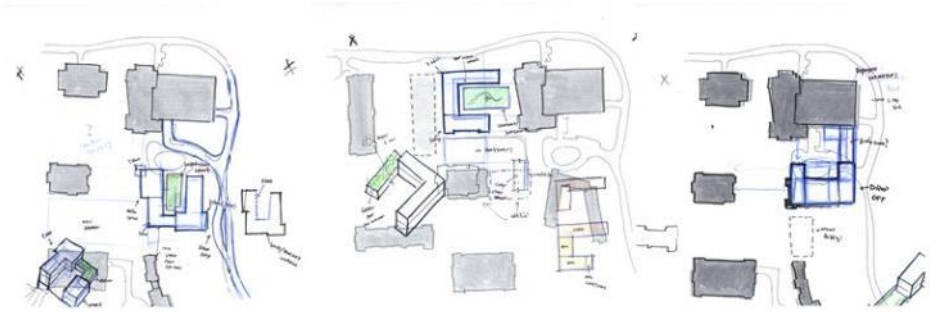


*Figure 7.26: Initial design schemes of sites A and B (image by author)*

After site A was chosen the process of mocking up multiple schemes began by using a physical model and clay. The schemes were broken into 4 different categories; U-shaped, Courtyard, Bar, and clustered (see figure 8.2). After the series of models and diagrams were completed the schemes that were the most successful were the U-shaped scheme as those both allowed a centralized courtyard space for the students to

play in and it act as a way finding tool but also did not close off the building from the campus completely.

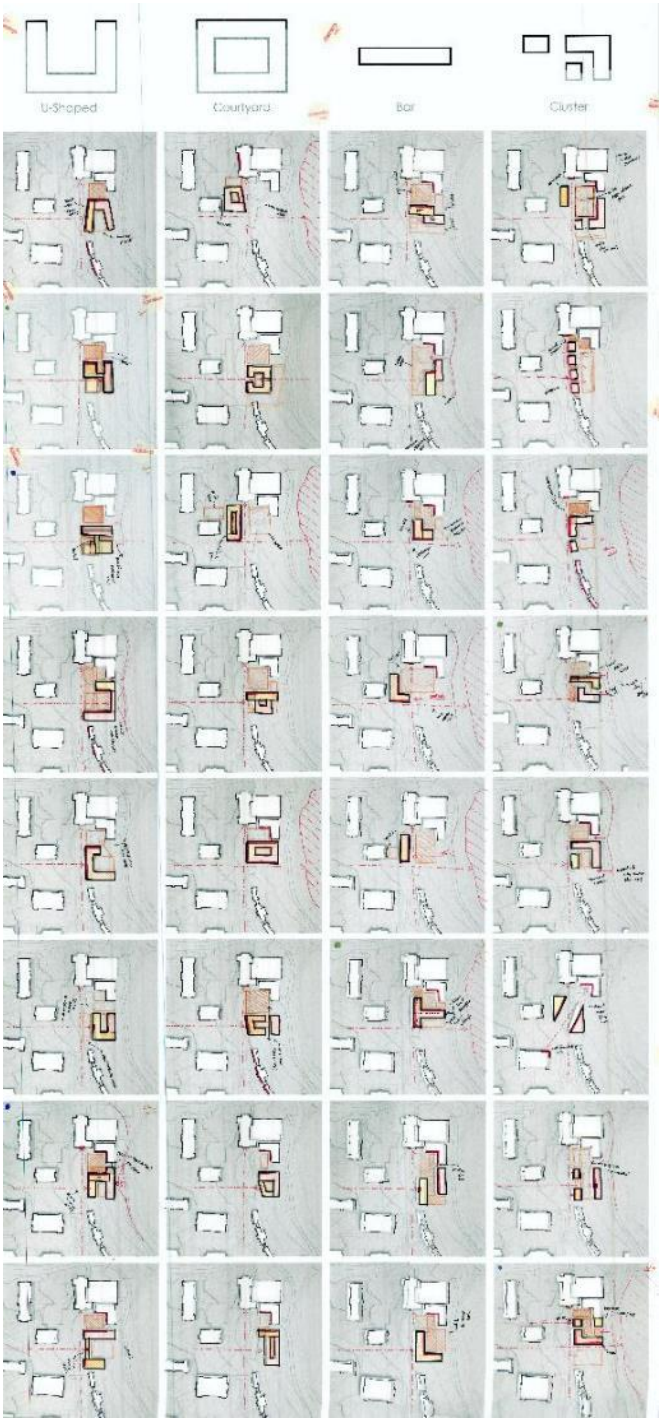



*Figure 7.27: Design exploration of site A (image by author)*

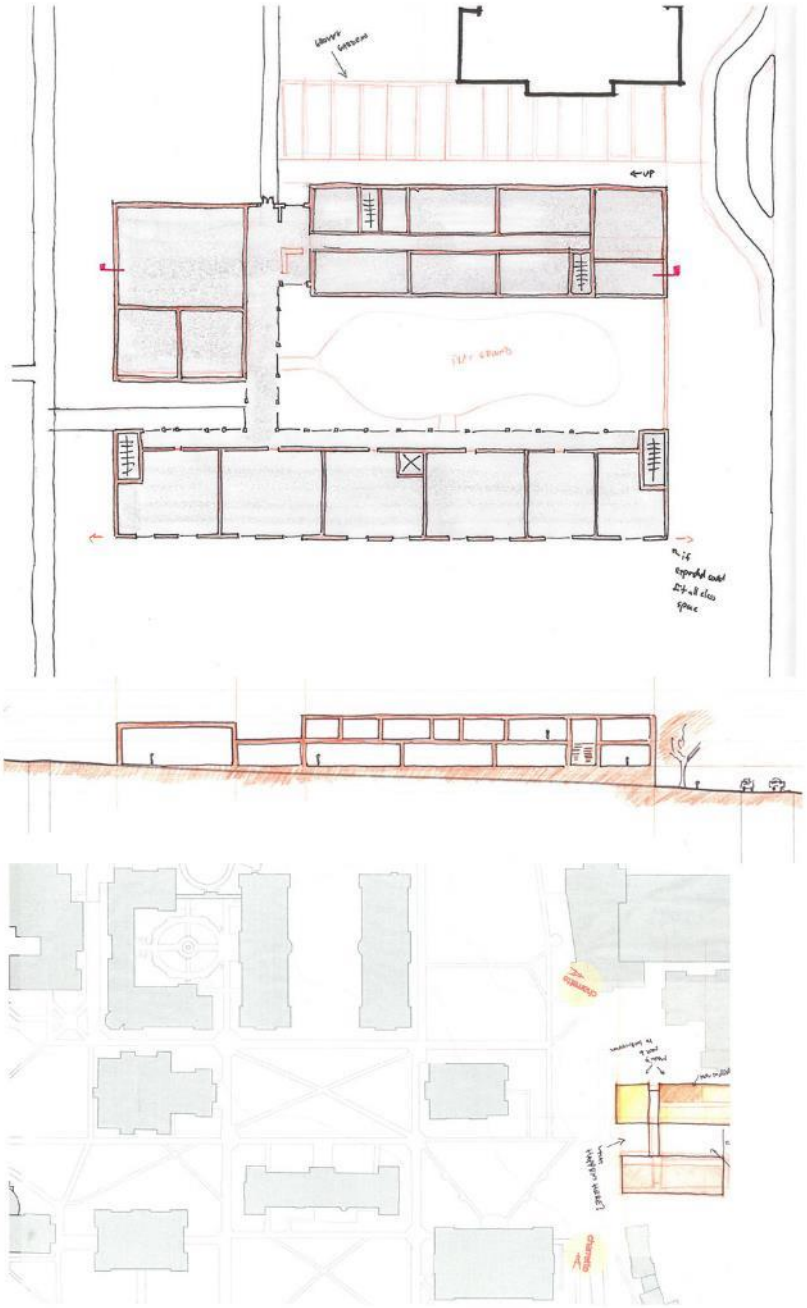


*Figure 7.28: Scheme A (image by author)*

Scheme A attempts to create a narrow courtyard which opens up to the lake to the east and breaks the program up into two wings. One wing houses the high stimulus program and one which housed the low stimulus program. The scheme falls short on address the topographic change and its termination of the major axis

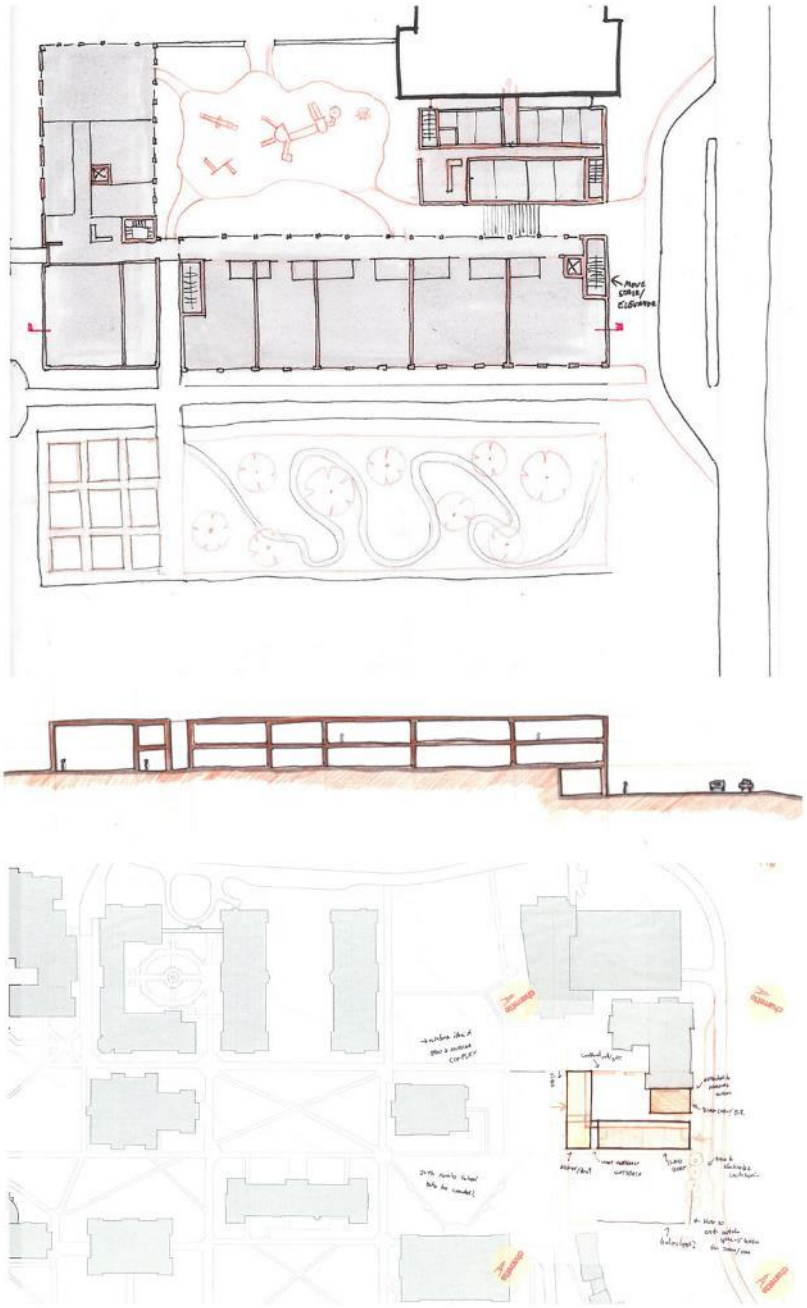


*Figure 7.29: Scheme B (image by author)*

Scheme B attempts to create a combined courtyard with the nursing school and education building. The diagnostic center is removed complete from the center and instead attached directly to the nursing school. The wings of the building are not as defined and the scheme ignores the major axis

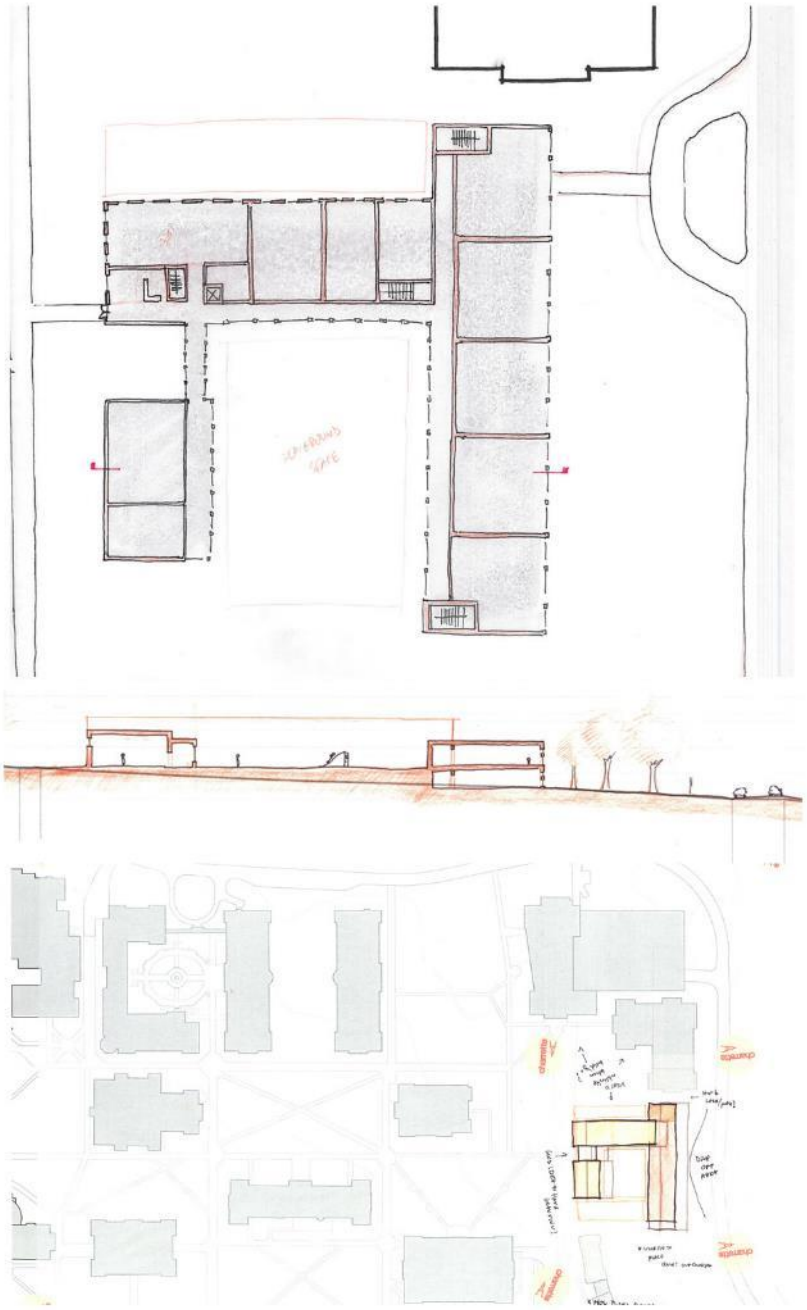


*Figure 7.30: Scheme C (image by author)*

Scheme C attempts to create a wing of classroom to the east and breaks the program up into three major wings with a courtyard opening up to the south in the center. The termination of the major axis is weak as well as the response the topography, however scheme C the strongest of the three initial schemes.

### *Campus Scale*

One of the more important problems of special needs children that have recently come to the forefront of research and literature is the issue of acceptance and respect in society. Through design it may be possible to assist such acceptance.[46]

*Figure 7.31: Campus Plan (image by author)*

By placing the building in a visible location on the campus the center can help raise awareness of the issue of autism and reduce the sigma involved with autism. The

[46] Ibid.

center terminates an important axis leading to view of the eastern campus lake. Due to this the center has an import role in the architecture and organization of the campus.

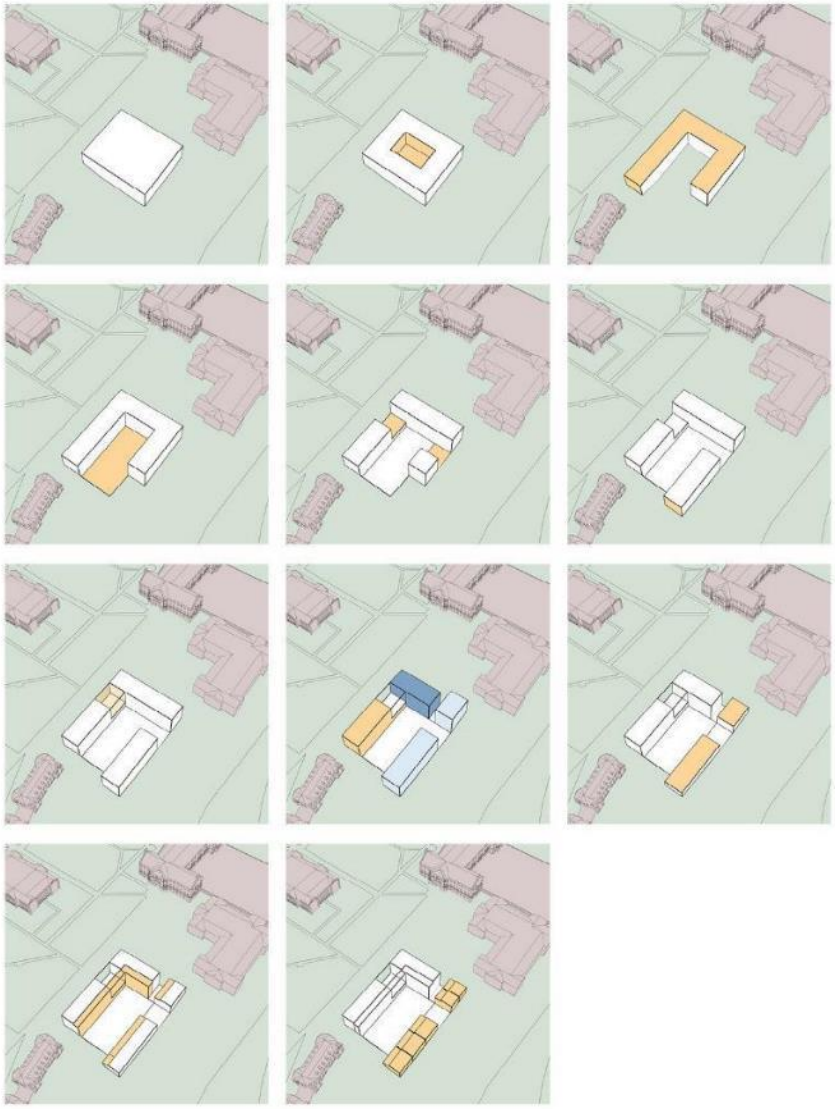


*Figure 7.32: Building response to campus (image by author)*

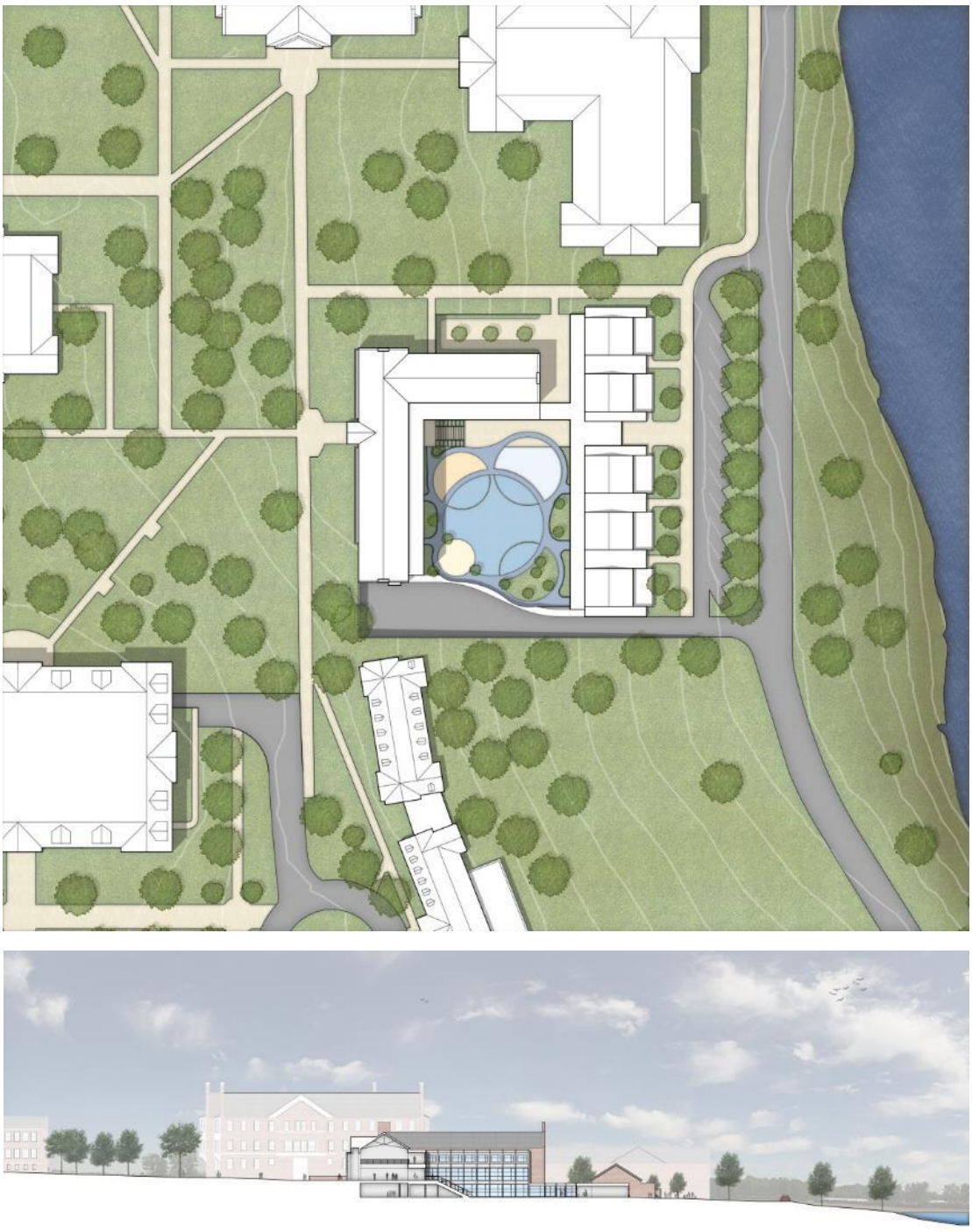


*Figure 7.33: Site plan and Section (image by author)*

The center relates in scale to the context around it and continues the regulating line created by the dorm to the south which allows it to mesh with the context of what already exists on campus.

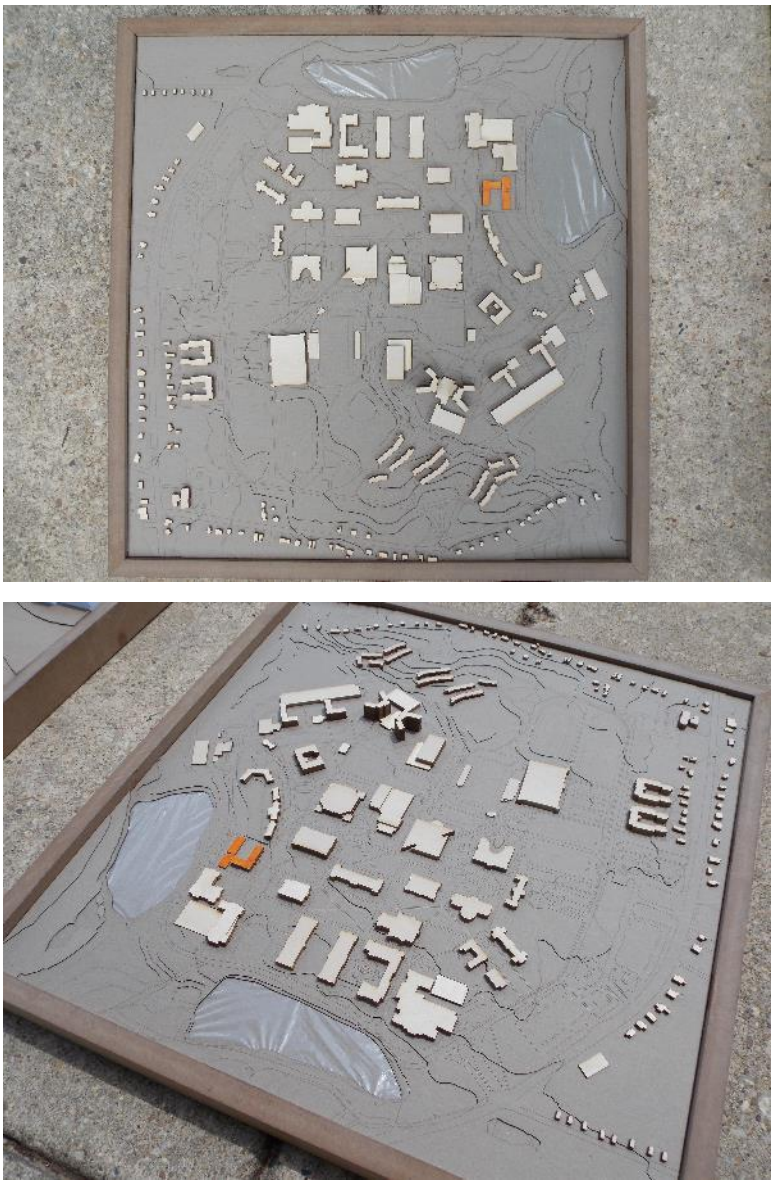


*Figure 7.34: Campus physical model (image by author)*

*Figure 7.35: Aerial view of building (image by author)*

### *Building Scale*

When designing for a group of students with the sensory challenges found predominantly in those with autism, the organization of functions in a building with respect to one another is of great importance. This functional organization, or zoning, has great impact on the comfort of the user and the transitions between the spaces needs to be design to allow the user to recognize when they are moving from one zone to the next. The center has been laid out according to the sensory quality of the space instead of the conventional functional programing.

*Figure 7.36: physical models exploring building form (image by author)*

The building is broken into three wings, each with a different sensory quality, the eastern wing has the lowest sensory quality, the north wing has a medium sensory quality and the western wing has the highest. All three wings are organized around a central courtyard which serves as the play space for the younger students. Within the building there is a circulation corridor which runs around the central courtyard and always allow students to know exactly where they are as it provides a consistent element of for them to reference.

When coupled with sensory zoning and transitions, the issue of conducive way finding and navigation may greatly aid the special needs user in gaining various skills and independence while freeing staff and faculty. Without appropriate way finding faculty and staff become responsible for guiding children throughout their day as they move from one activity to another and student lose their ability to learn independently to navigate spaces.

Predictable environments are the key to creating a cohesive circulation system. Visual aids such as color and pattern are employed in circulation areas to assist way finding. This is done discreetly to avoid visual over-stimulation. Signage is another important part of way finding and navigation. Autistic individuals are dependent primarily upon the written word and signage is a challenge for communication-disordered individuals. It has been found that individuals with autism, although sometimes unable to communicate with conventional language of the spoken and written word, can communicate well using pictures and symbols.

All lighting used in circulation is either natural or diffused up-lighting as to avoid the harsh flickers from direct florescent lights. Sunlight entering the spaces is design to avoid glare and silhouetting. The use of contrasting materials on the walls, floors, ceiling, and doors helps to visually separate the different elements of the corridor and clarify the visual quality.

*Figure 7.37: Ground floor (image by author)*

The ground floor of the center mostly houses the program for the school functions. There is a wing of classrooms located in the eastern wing which is broken up into the lower level students in the southern three classrooms and the upper level students in the northern two classrooms. The northern portion of the building contains the therapy rooms and additional service for the school including the nurse, speech therapy, occupation therapy, art and a group gathering space. The western wing houses the high stimulus program; the cafeteria and music rooms.

Each room is kept acoustically separated from the others using high quality wall systems. Lighting within the rooms whenever possible, is natural and indirect, from a source above eye-level to avoid visual distraction. Due to part of the ground level being underground English basements are used to get light into the sub-terrain levels. Fluorescent lighting, which emits a low hum and flickers, is avoided and replaced with diffused up lighting. When moving into the classroom, therapy rooms, or high stimulus rooms the student pass through a bar of poche space, which acts as both a sound barrier to protect from noise in the corridor as well as a space for storage in many of the rooms.

The central courtyard located on the ground floor is design as a sensory playground for the younger students. Like the building itself it also has multiple sensory zones. A high stimulus area is located in the north within the orange circle which house function such as water and music play. The central large circle contain the accessible playground and the lower green circle is a low stimulus area where students can go to escape from the noise of the classrooms or other children. There would also be outdoor seating near the cafeteria and space for growing gardens within the central courtyard. The circular design of the courtyard was designed as a whimsical contrast to the center which has very orthogonal form. The older student would have an outdoor space for their use located to the north of the center, which in opposition to the central courtyard which is closed off due to safety concerns, is open to the campus as these students would be more involved with campus activities.

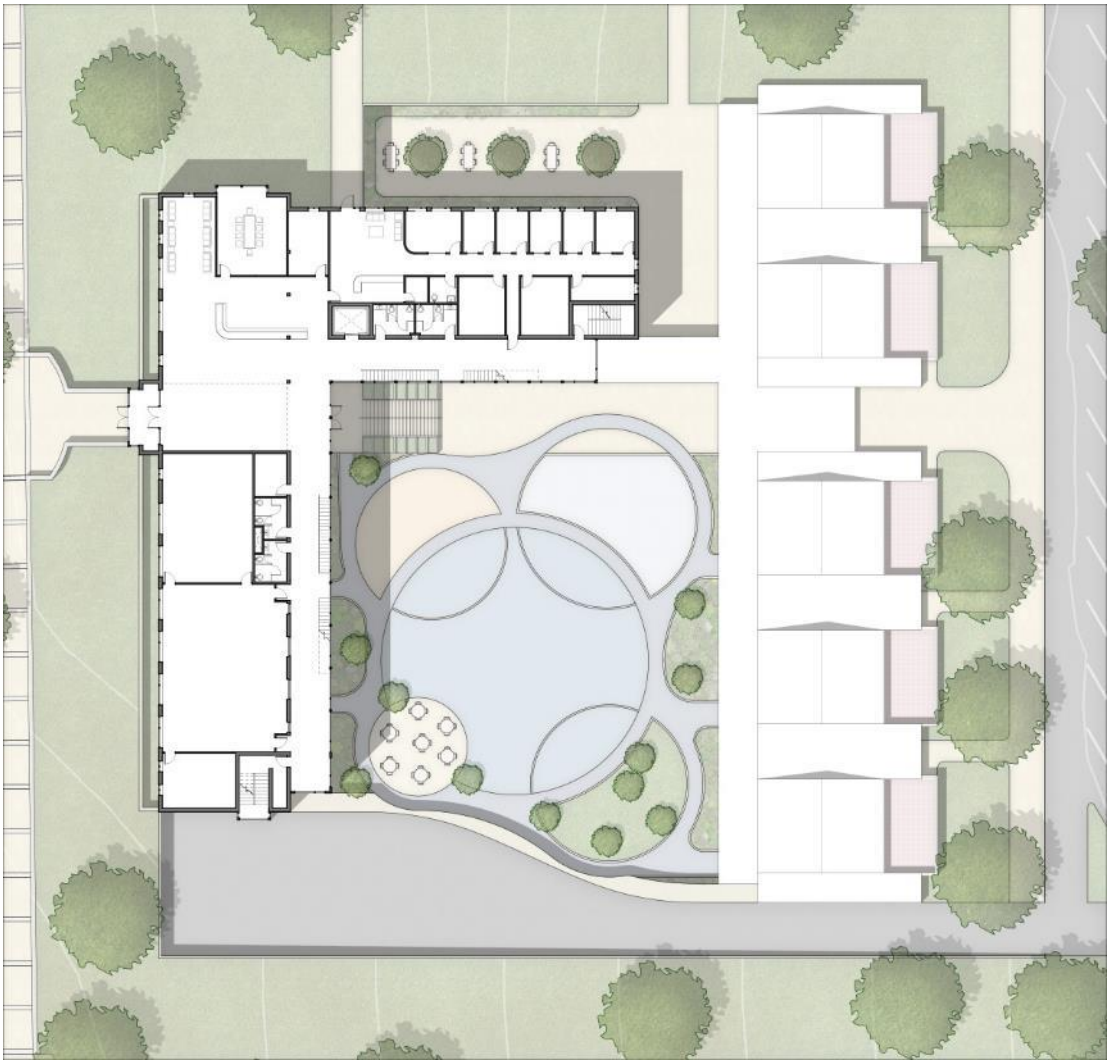


*Figure 7.38: First Floor (image by author)*

The second floor of the center houses the diagnostic center and the physical education portion of the school program. The second floor also acts as the main entrance from the campus into the center. The diagnostic center, located in the north wing houses the diagnostic center as well as the early intervention program and has its own entrance from the north. The gym, physical therapy rooms, and exercise rooms of the school are located within the western wing. The lobby space contains waiting areas and a conference room for school administrators and teachers to meet with parents

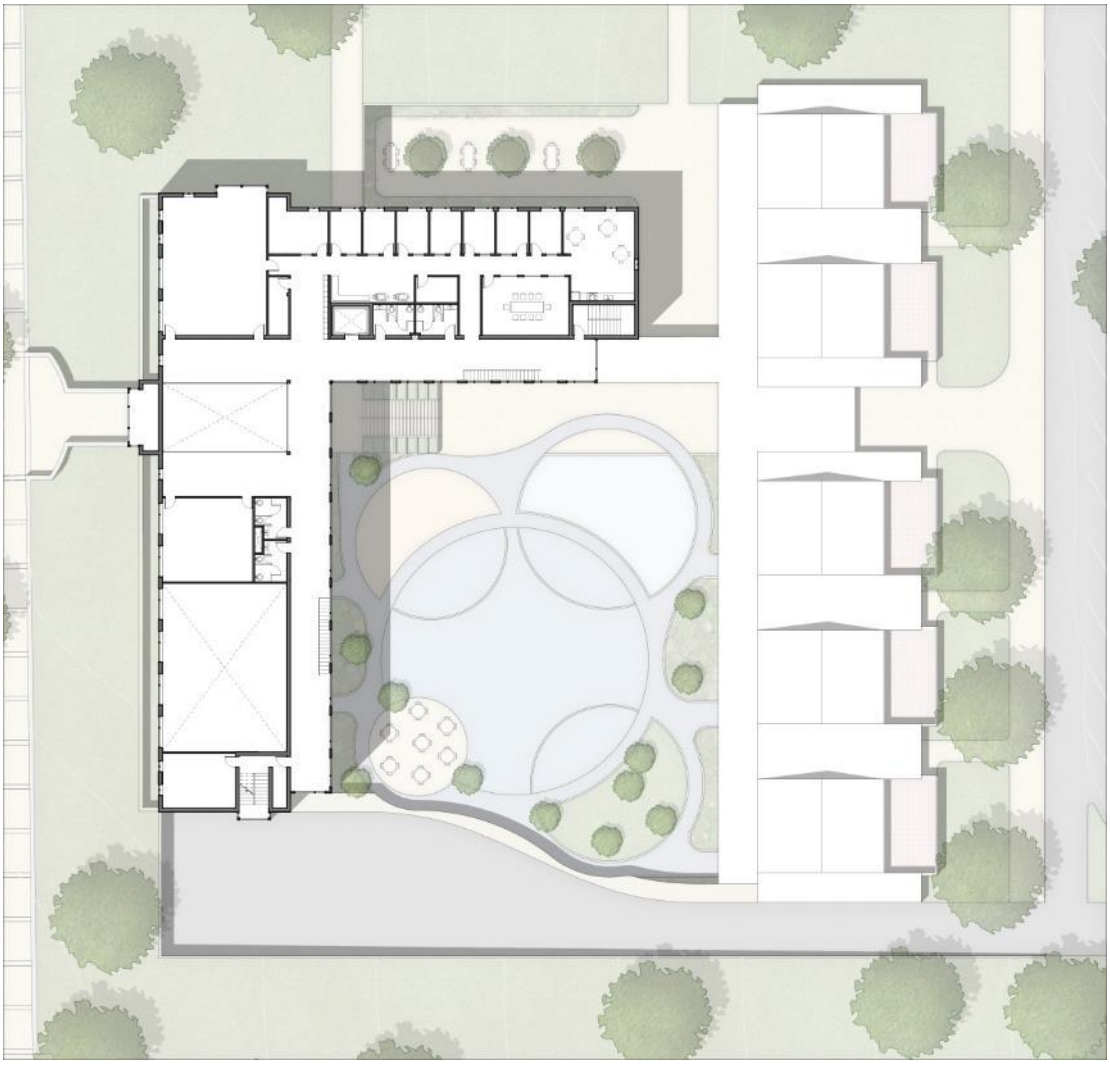


*Figure 7.39: Second Floor (image by author)*

The third floor of the center houses the parent education program and the administration for the school. The administration is house in the north wing and consist of various offices and meeting spaces. The parent education program is split between two rooms on either side of the mezzanine, they include a classroom and group meeting space. The group meeting space would also serve other functions such as conference space when not in use for parent education.

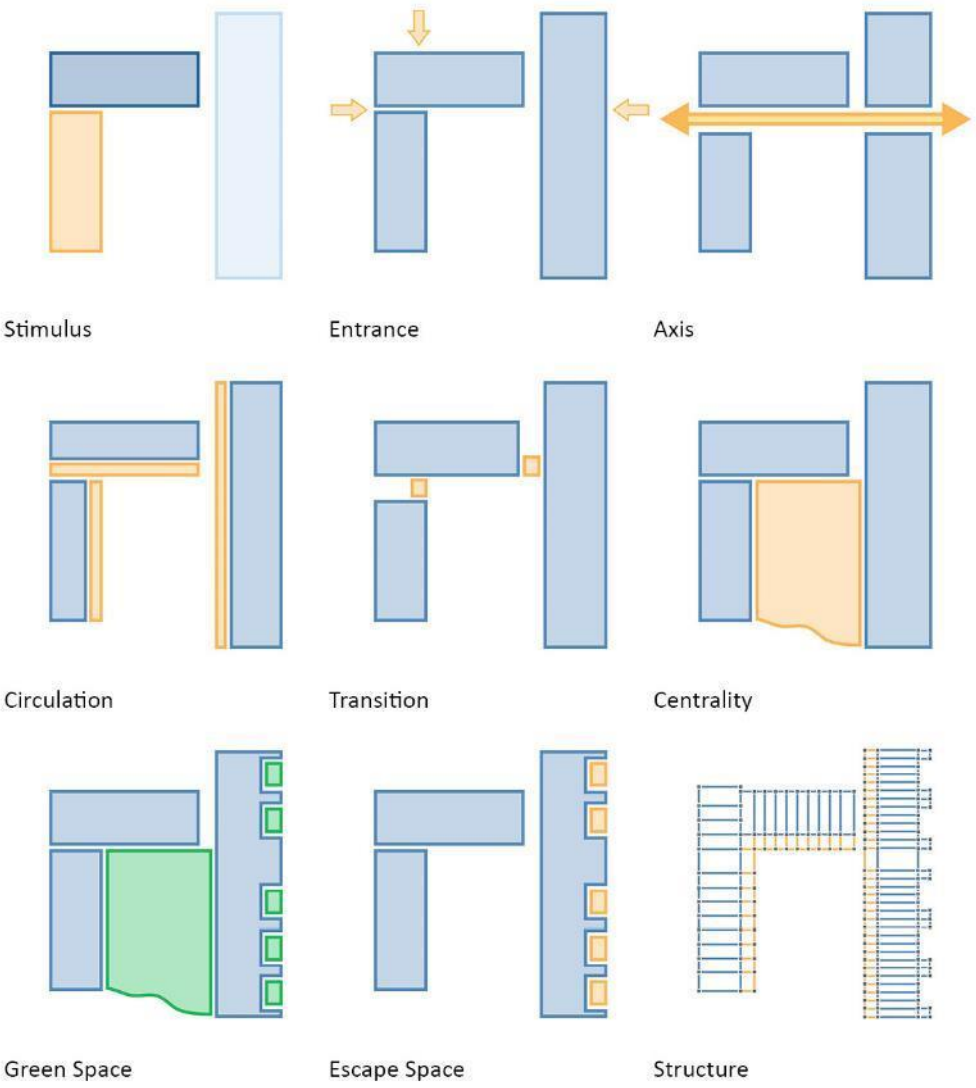



*Figure 7.40: Diagrams of building (image by author)*

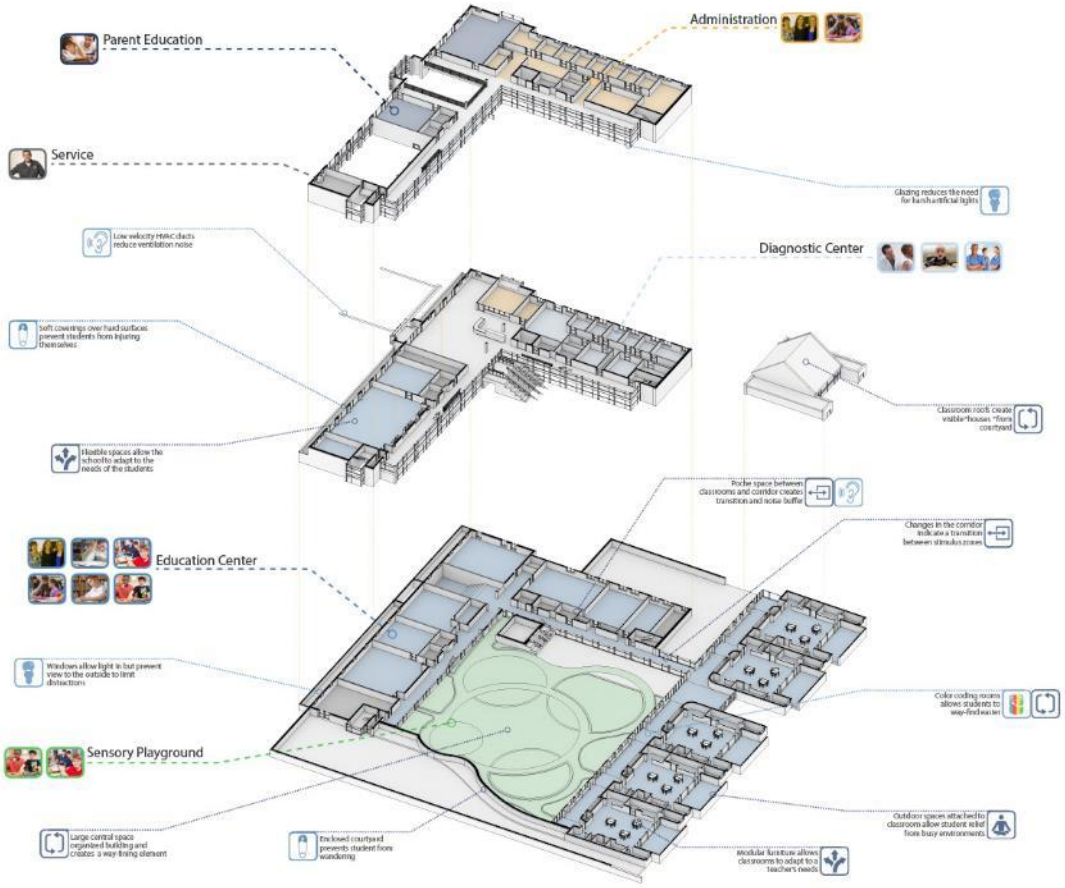



*Figure 7.41: Application of principles to building (image by author):*

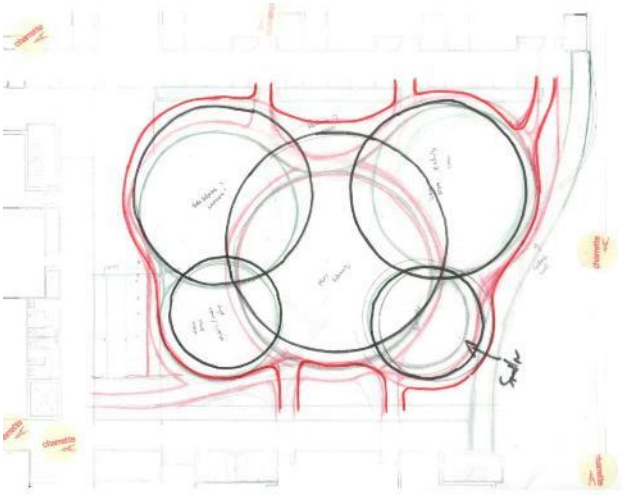


*Figure 7.42: initial design of sensory playground (image by author):*

*Figure 7.43: View of sensory playground (image by author):*

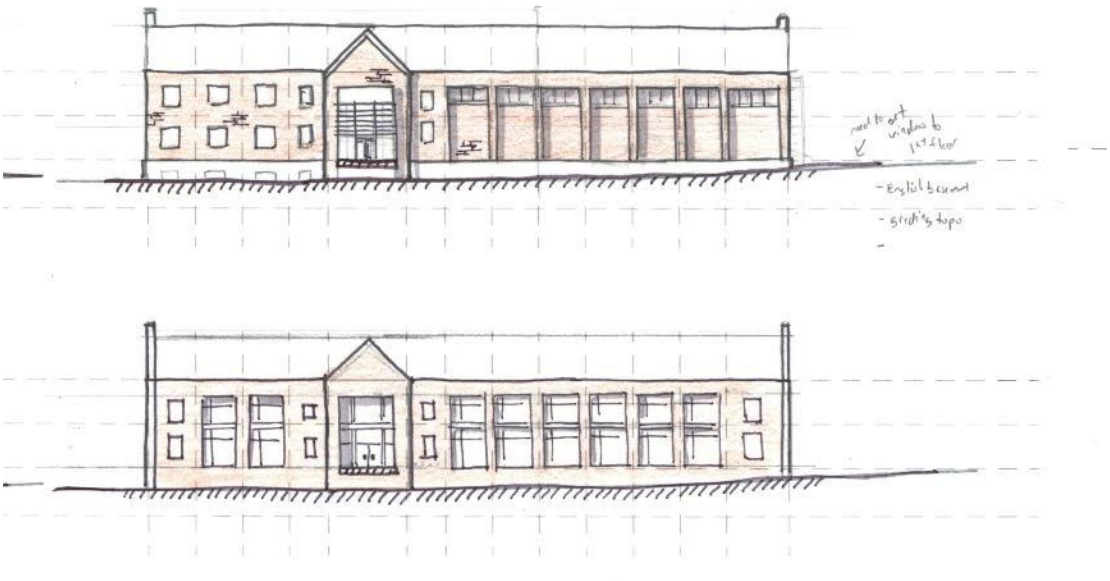


*Figure 7.44: Initial facade studies (image by author):*

*Figure 7.45: Approach to the center (image by author):*

*Figure 7.46: Physical model of the center (image by author):*

### *Room Scale*

Due to the building being divided up in terms of stimulus there is a need for different types of learning spaces which response to different levels of stimulus based on the activity that happens in those spaces. A classroom design was explored as a low stimulus learning spaces and a gym was explored as a high stimulus learning space.

*Figure 7.47: Section showing high stim and low stim space (image by author):*

*Low stimulus learning space*

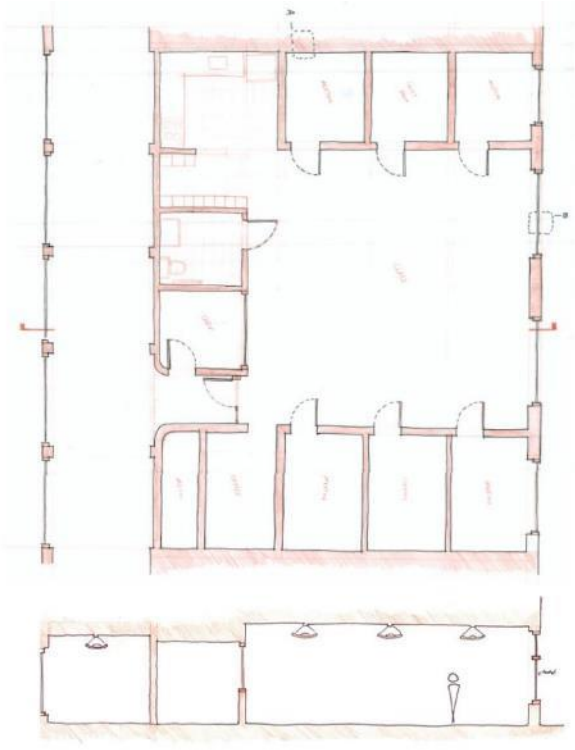


*Figure 7.48: Initial classroom design (image by author)*

*Figure 7.49: Process schemes of classroom (image by author)*

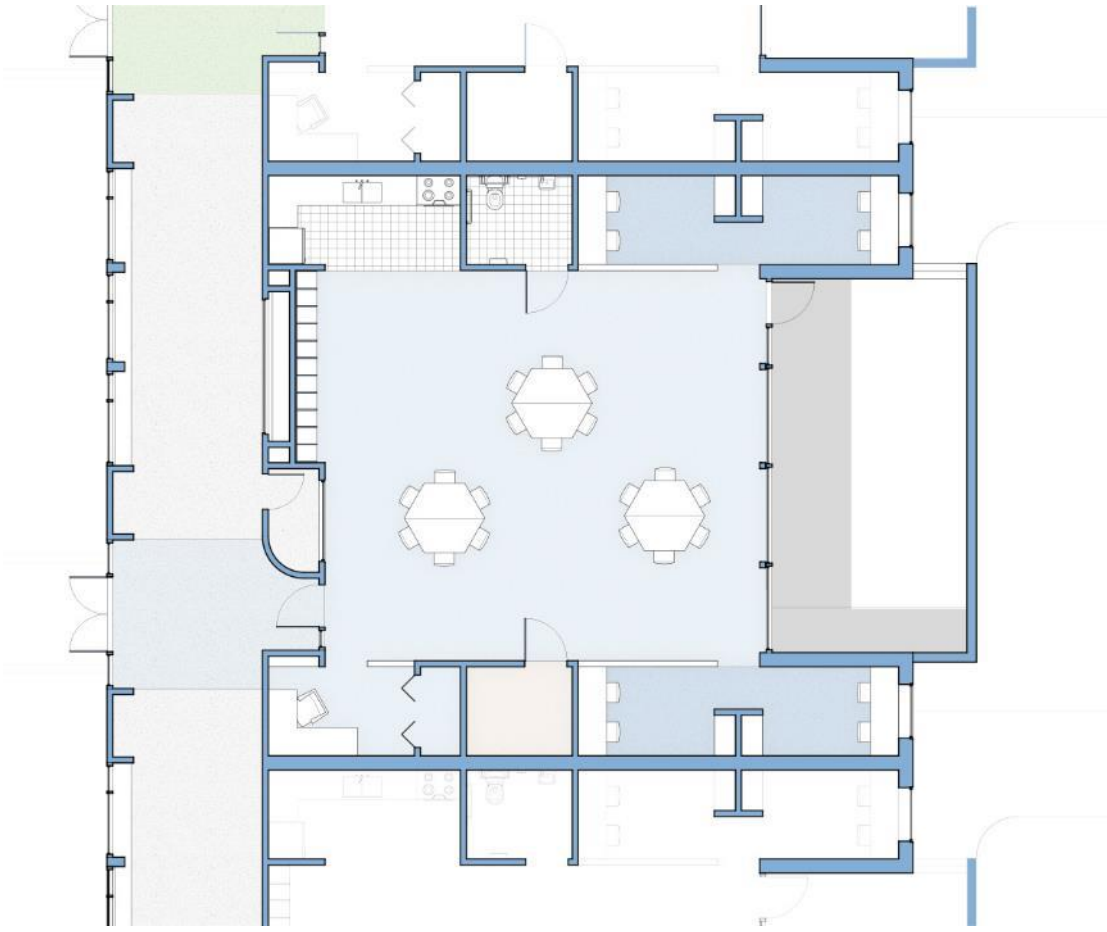


*Figure 7.50: Floor plan of classroom (image by author)*

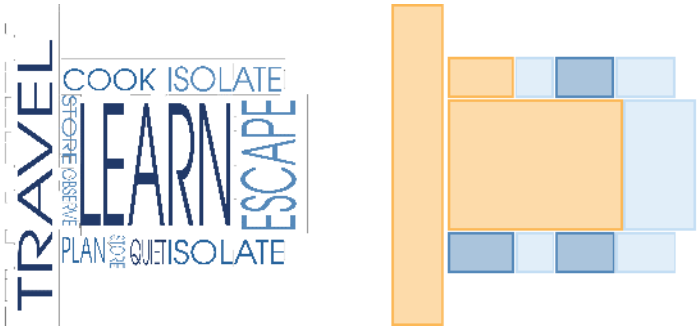



*Figure 7.51: Diagrams of the classroom showing program and stimulus (image by author)*

The classroom houses a variety of different programs and is organized similarly to the building, with a large central area that organizes the additional program located along the edges. Each function or activity is allocated to a different area which can be physically and visually separated from the remainder of the classroom by low partitions, celling heights, or different flooring materials and colors. The additional program within the classroom consist of a kitchen, bathroom, office, quite room, outdoor garden, observation room, and individual work areas.

Natural lighting is introduced into the room, but has sun shades at eye level and below to prevent distracting views to the outside and to block out direct glare. The artificial lighting within the room is up lighting that reflects off the acoustical baffles hanging from the ceiling to create a soft diffused lighting. Acoustically the classroom used heavily insulated walls to prevent noise from the outside from reaching the interior as well as fabric acoustical panels in the ceiling to reduce the echo within the room and lower the reverberation time in the classroom.

The external garden space attached to each classroom serves as an escape space for the students as well as an area for teachers to hold outdoor activities such as sand

play. A contain outdoor space also limits view to the outside at student are only able to see the outdoor space and not the busy environment of the campus.

The classroom is designed to be a modular element that can be repeated throughout the school and modified specifically for age groups contained within each class.

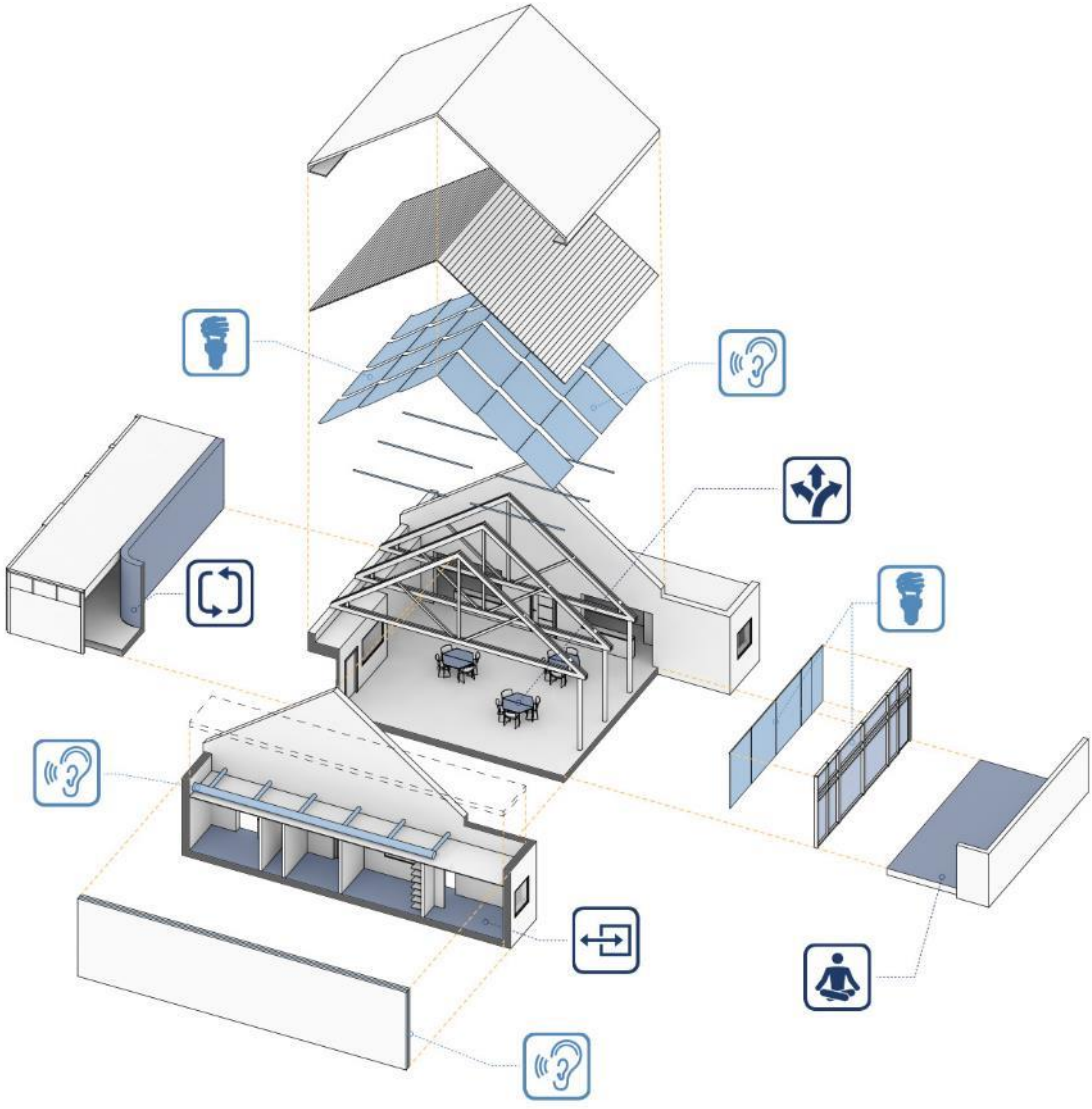


*Figure 7.52 Application of principles in the classroom (image by author)*

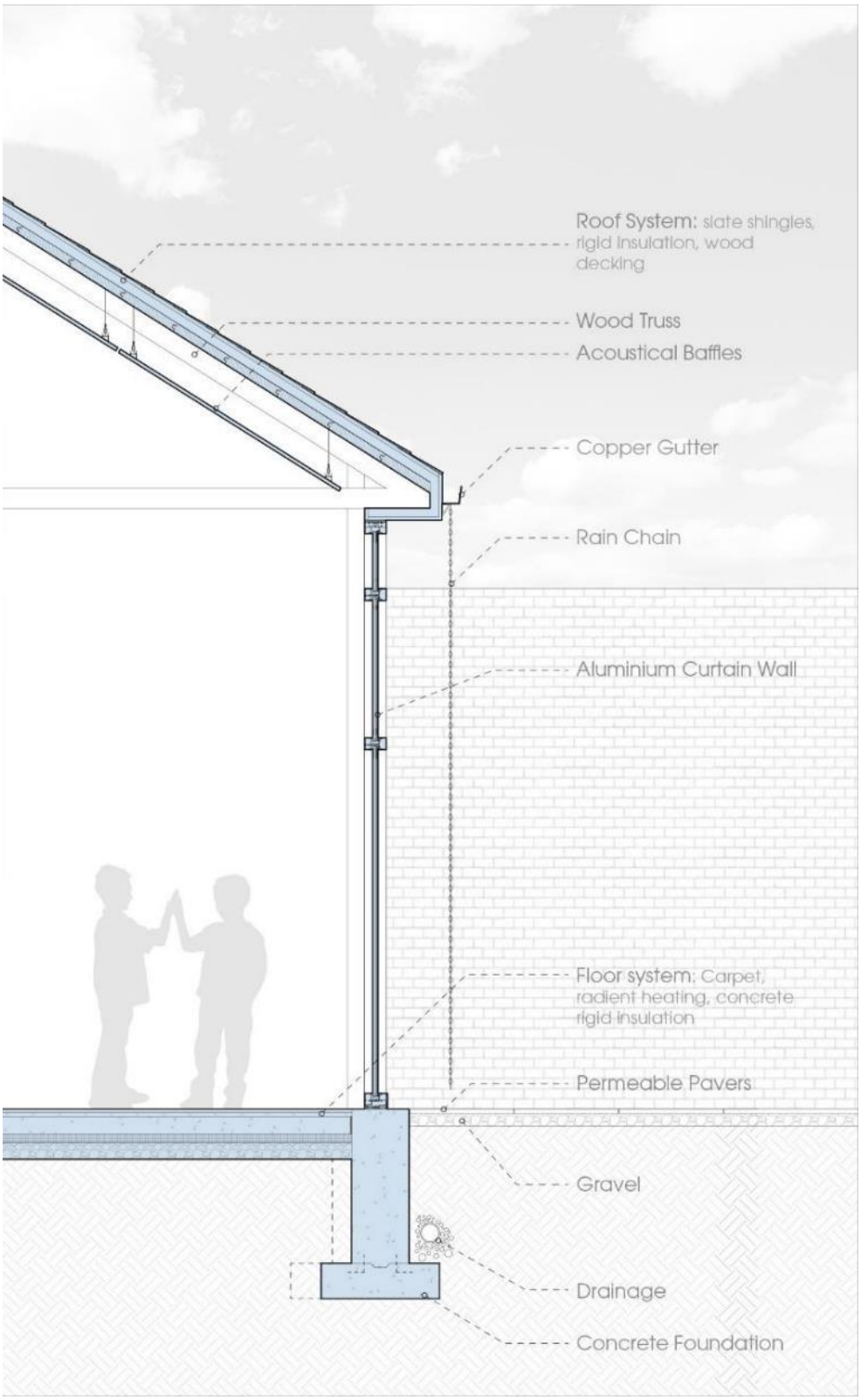



*Figure 7.53: Wall section through classroom (image by author)*

*Figure 7.54: Classroom corridor (image by author)*

*Figure 7.55: Classroom (image by author)*

*High stimulus learning space*

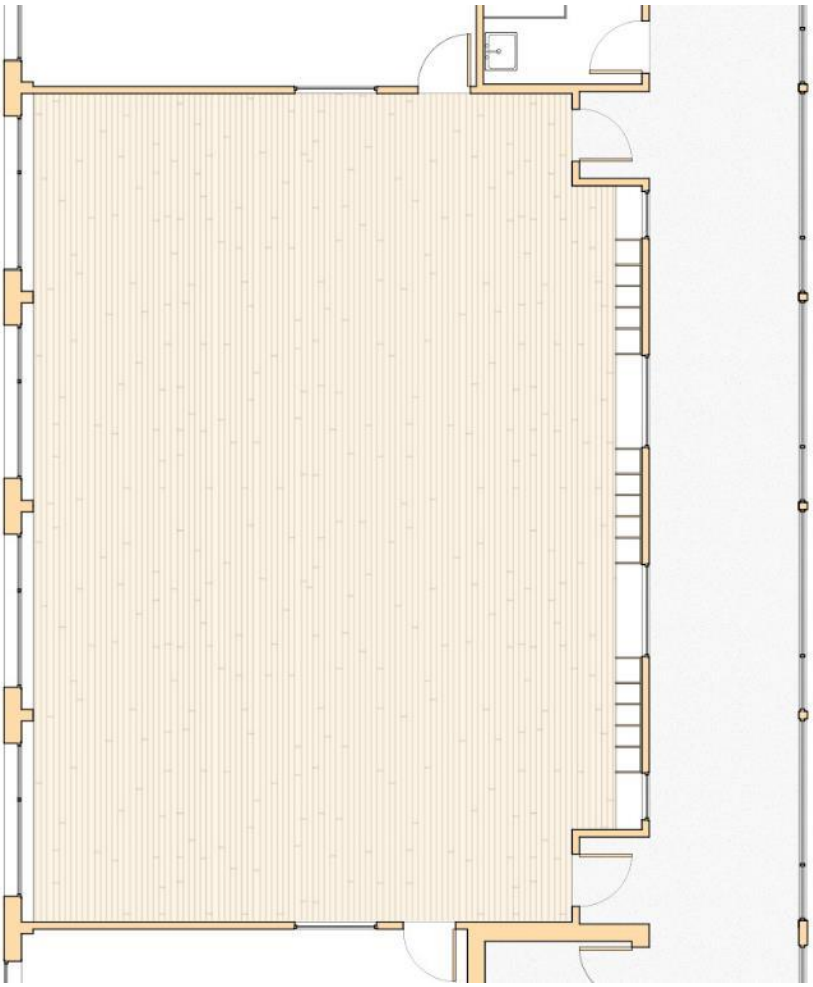


*Figure 7.56: Floor plan of the gym (image by author)*

The gym, in contrast to the classroom is a higher stimulus environment. It would require different materials and organization due to this. The materials of the gym would need to handle the abuse it would receive from students. The gym is organized as an adaptable volume which could serve many different need associated with physical activity. The gym contains storage and seating along one end of it to hold all the resources needed for the different activates as well as provide a space for student to relax from the activities

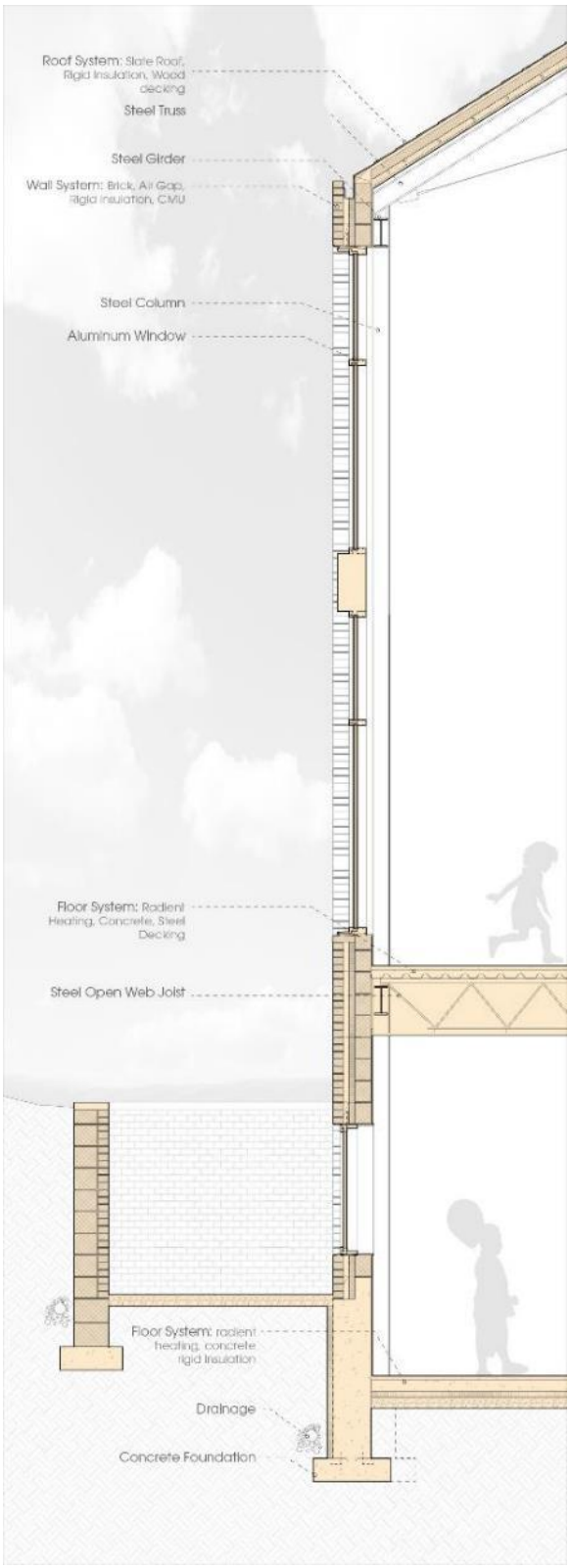



*Figure 7.57: Walls section through the gym (image by author)*

*Figure 7.58: Entrance to the Center (image by author)*


*Figure 7.59: Gym (image by author)*

# 9. Conclusions

During the thesis defense presentation the jurors commended the thesis for its explanation of how an autistic individual is effected by the built environment. The difficulty in understanding how the user experiences space is one of the hardest parts of designing for an autistic user as it is impossible for architects to place themselves in their shoes. By presenting the sensory perception issue of autism in a way that was visual and easy to understand to the jurors, it made it easier to comprehend the way the autistic individual sees space.

Beyond this thesis presentation it was suggested that a greater look into the details of how the building was put together be explored. The quality of the interior spaces and the exact materials used are incredibly important to the autistic user. Every detail of the building needs to be designed and thought through from the way a corridor is created to the material used on the ceiling of a classroom.

The goal of this thesis was to present and a series of principles to aid in the design of a school for students with autism. At the core of that are the principles of design. This thesis was not just about a school or education, it was about giving architects the tools to create a better built environment for those with autism. These principles are designed to be applied to any number of buildings in any degree. Something as simple as changing a light switch to a dimmer or adding more insulation between rooms to reduce noise could make the built environment more accommodating of the needs of individuals with autism

Designing for autism seems to be an impossible task. How do you design for someone whose senses you cannot understand? How do you design for a student whose sense can change throughout the day? How do you design for two students in the same room who perceive space differently from each other? These are all questions that need to be answered. This topic of designing for autism is relatively new in the world of architecture. There needs to be a reevaluation of what universal design is. It needs to incorporate individuals with disabilities outside of the physical realm such as those individuals with autism.

The biggest take away I would have from this thesis exploration would be the need to take into considerations the view point of others and to not assume that you truly understand their needs. An aspect of research in architecture needs to be included in every project. Many things that I would have considered good design would have been detrimental to an autistic individual and only though research can we fully understand who we are designing for.

It is the hope that this thesis would encourage a movement to listen more to the way that different individuals perceive space and motivate architects to develop the knowledge and resources to begin designing appropriate architecture for such individuals.

# Appendix

## *Interviews*

**Name:** Lindsay Hilsen
**Biography:** Lindsay is a Board Certified Behavior Analyst who has dedicated her career to working with children on the Autism Spectrum. She is a qualified elementary level and special education teacher with master's degrees in both special education and education. She has worked as an ABA teacher and is currently the Autism Clinical Educator for Sunny Days Early Childhood Developmental Services, New Jersey. She is a published international author of two autism curriculum books. Lindsay is a frequent presenter and lecturer on Autism and ABA topics.

**What features of the built environment have a strong impact on students?**
The biggest features that impact are the lighting and acoustics.

**Is your current classroom an optimal environment to teach autistic individuals? Have you had to make any changes to it?**
I'm not currently teaching. But I've had to put tennis balls on the chairs, dim the lights, and have a space for calm down time.

**How does teaching for autistic students differ than teaching typical students?**
It differs in that a lot of these kids have sensory needs so you always need to keep that it mind. They have trouble with change and spur of the moment items. Everything has to be broken down into achievable steps.

**What is the biggest challenge to teaching those with autism?**
Each child with autism is so different. They all have such different needs. They all need different supports.

**Are there certain places in your school that your students with autism have problems adjusting to?**
Assemblies and the cafeteria.

**Are there certain places in your school that your students with autism prefer?**
The sensory gym

**What recommendations would you provide to an architect or designer who is buildings an inclusive school with a focus on autism?**
Acoustics need to be considered. The lighting should be on dimmers. Have individual spaces in the room
.

**Name:** Jill Leestma

**Biography:** Jill has a masters in special education from the College of New Jersey with an Elementary Certification and a Nursery School Endorsement. She has over 30 years of experience teaching special education. She has work with student with multiple disabilities at Mercer County Special Services School District including 2 years with preschools students with autism. She worked for the last 10 years at Hopewell Valley Regional School District in the Class for Children with Autism. She has worked in both autism specific class rooms and inclusion class rooms.

**What features of the built environment have a strong impact on students?**
Anything that impacts attention, auditory input, visual input, movement in and out, and around the classroom, access to learning, access to reinforcement. I believe that natural light is better than florescent lighting. Windows can be calming if they look out over a garden or greenery, but they can also be distracting if they overlook a busy scene such as a roadway, the parking lot, or a school entrance. Autistic students can elope (walk/run away), so having some sort of sensor on a door to let you know it was opened would be helpful. An observation room so that parents, staff, etc can observe students without disrupting the classroom would be helpful. It would work much better is the observation window was not reflective on the classroom side as this is distracting for some students as they like to look at themselves. Divided areas are useful. Sometimes students with autism need to work one-on-one in an "intensive teaching" situation, so build in smaller area that can hold a table and the needed materials would be much nicer than using movable dividers. Build in area would also be quieter than movable dividers and having a place to store the teaching materials, the reinforcing items, and data collection materials would make working with the students easier. A bathroom in the classroom as well as a sink outside the bathroom for cleaning up after messing play or snack/lunch is helpful.

**Is your current classroom an optimal environment to teach autistic individuals? Have you had to make any changes to it?**
No, it is quite small and noisy. It does have panels on the ceiling to absorb some of the sound. When I had students with autism in my current classroom (trailer) I used furniture to divide up the classroom into areas. I had an independent working area and 2 other tables that also served as individual or dual (2 student) direction instruction areas, with one of those tables also serving as a whole group instruction areas. I also had an area with toys and games for indoor play time. I did not have enough storage and had to get some movable cabinets. I also had to get a coat rack and cubbies unit into the classroom

**How does teaching for autistic students differ than teaching typical students?**
Students with autism are often sensitive to sensory input, much more so that typically developing students. Students with autism also need much more direct instruction as they do not learn as easily as typically developing students. Students with autism benefit from error-less learning (using prompting to help them get the correct answer and then fading the prompting), as well as much repetition and review. They also benefit from learning tasks that have been broken down into their smaller step by step

components (Task analysis). Applied Behavior Analysis is a proven technique in working with students with autism.

**What is the biggest challenge to teaching those with autism?**
Language and communication skills are a major area of deficit. Social skills are also a major deficit. Students with autism are diagnosed using a "checklist" and they must get enough checks in enough area to get the diagnosis- thus they can be very different.

**Are there certain places in your school that your students with autism have problems adjusting to?**
Noisy, busy places- the Cafeteria, The Gym, All School Meetings in the Gym

**Are there certain places in your school that your students with autism prefer?**
Outside on the swings or in the spinning cups, one of my students always wanted to go on the elevator at Stony Brook, sitting on a bean bag chair in the quiet reading corner of the classroom

**What recommendations would you provide to an architect or designer who is buildings an inclusive school with a focus on autism?**
Check out the state guideline for class size, student to staff ratio, age spans to get an idea of what amount of area you might need for a classroom. Check to see how the teachers and therapists would work in the targeted district- will they work collaboratively- then you might need to provide extra space for the therapists to work in the classrooms if they will be in there frequently. Check to see what the philosophy of the school will be- what strategies and techniques will they be using:
TEACCH (will need individual work station with area for work materials, structured teaching), Verbal Behavior- will need intensive teaching area for direct instruction as well as a natural environment area for less structured and more student directed learning. Discrete Trial Instruction- will need small area for individual instruction.

**Do you have any more comments or information you believe is relevant in relation to designing spaces for autistic individuals?**
Teachers and therapists will need a wide variety of materials and equipment, so storage space is important. Exercise is important- so an area where student can run, walk, and/or play outdoors and maybe indoors in important.

**Name**: Anonymous Teacher from St. Coletta #1

**What features of the built environment have a strong impact on students?**

The House structure provides students with the feeling of being in a smaller school environment within the larger school building as the "House" is more self-contained and consists of only 5 classrooms. The structure of the building provides consistency as each House is similar in size and structure. We also have a large common space that allows for transitions of many students at one time. The sensory room, art, horticulture and music studios provide an opportunity for students with autism to receive sensory input as appropriate. The large gym provides a space for motor movement and use of sensory swings.

**Is your current classroom an optimal environment to teach autistic individuals? Have you had to make any changes to it?**
The classroom environment provides structure to our students. Classrooms contain learning labs that allow students a quieter, distraction free space to work on new skills, and the physical structure of furniture in the classroom allows students to participate in large group, small group or individual work as appropriate. Changes are made to the physical structure of the furniture in the classroom as appropriate to the individual needs of each student.

**How does teaching for autistic students differ than teaching typical students?**
Teaching students with autism differs from teaching typical students as the educator must create highly individualized programming that addresses each student's communication, sensory and social/emotional/behavioral needs.

**What is the biggest challenge to teaching those with autism?**
No student with autism is alike and each has their own unique talents and strengths which require differentiated and individualized programming.

**Are there certain places in your school that your students with autism have problems adjusting to?**
Spaces that are noisier or more crowded, such as the cafeteria at certain times of the day can prove more challenging for some students. The gym can be a challenge if a student has issues with loud noises or if it is being used for a different purpose, such as a school celebration as the student may expect to participate in adapted physical education activities in that space as it is what is typically done.

**Are there certain places in your school that your students with autism prefer to be?**

Many of our students enjoy art, music and sensory, however, each student is different and while one student may enjoy music another may find the noise or the expectations unpleasant.

**What recommendations would you provide to an architect or designer who is buildings an inclusive school with a focus on autism?**
I would recommend that the architect research autism and have a good understanding of the sensory, communication and behavioral needs children with autism may have. Routine and consistency in the environment is important.

**Do you have any more comments?**
Space is important so that physical environment can be structured. Storage is important because each child may have a variety of different instructional, sensory and behavior materials.

**Name**: Anonymous Teacher from St. Coletta #2

**What features of the built environment have a strong impact on students?**

The layout of the building makes it easy for them to navigate such as recognizing their "house" by its color. The studio's and outside learning spaces provide areas of learning that allow for movement and exploration.

**Is your current classroom an optimal environment to teach autistic individuals? Have you had to make any changes to it?**
The classroom environment is set up based on student need, and the foundation itself is adequate to support appropriate design to meet our student's needs in most cases. Many classrooms have adjacent learning labs for more distraction free instructional space that can be shared with students from other classrooms as needed.

**How does teaching for autistic students differ than teaching typical students?**
The classroom environment is very important for students with autism. A typical classroom is often too distracting and not organized in a fashion that allows a person with autism to be independent. Creating different areas that signify a specific activity allows for them to understand what is expected of them as they move through their schedule for the day.

**What is the biggest challenge to teaching those with autism?**
As all students with autism are different, there is no one way to teach all students with autism. While one method may prove beneficial and effective for one student, it may not for another. Identifying their learning style and creating an instructional environment to best meet their needs is the biggest challenge.

**Are there certain places in your school that your students with autism have problems adjusting to?**
The "Village Green" during dismissal tends to be loud and crowded which students often have difficulties with. For others the cafeteria proves challenging as it can also be crowded and have many sensory factors (smells, space, etc).

**Are there certain places in your school that your students with autism prefer to be?**
Students with autism do well with routines, so once they are familiar with the different areas they expect to be there on certain days/times. Some students prefer being in the PE room on the swings, other's prefer being in the quiet of the classroom.

**What recommendations would you provide to an architect or designer who is buildings an inclusive school with a focus on autism?**

Be very aware of expansive space (can create cavernous type sound, echo's) and too many "nooks and crannies". Have smaller instructional spaces along with larger spaces for movement and exploration.

**Name**: Anonymous Teacher from St. Coletta #3

**What features of the built environment have a strong impact on students?**
Various options for use of space for instruction, leisure, sensory support, movement-

**Is your current classroom an optimal environment to teach autistic individuals? Have you had to make any changes to it?**
It depends upon the student. At times more individual spaces have to be created to teach specific skills.

**How does teaching for autistic students differ than teaching typical students?**
One has to account for student specific learning styles for individuals with autism. They are each unique. Typical students can adjust to day-to-day changes, larger groups and noise levels. Students with autism may not easily adjust or may adjust on some days and not others.

**What is the biggest challenge to teaching those with autism?**
The student must be seen as an individual needing a highly individualized program plan. The challenge is to make sure that supports are in place for each student to be successful.

**Are there certain places in your school that your students with autism have problems adjusting to?**
It depends upon the student. Some students like more open spaces, some like smaller spaces. OR, at certain times students may prefer one or the other.

**Are there certain places in your school that your students with autism prefer to be?**
See number 5. I would say in general, familiar spaces that are quieter, such as our learning labs for instruction and for movement some students enjoy our larger outdoor spaces, music and gym areas.

**What recommendations would you provide to an architect or designer who is building an inclusive school with a focus on autism?**
Have options for students with autism which include smaller quieter spaces in which to work on individual skills with a plan then for increasing their tolerance to be with larger groups-gradually. There is a famous Australian (Melbourne?) architect who has developed and planned a school such as you are describing-the state is sponsoring the building of the school. I cannot remember his name.

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