



# Design Principles for a Special Education Center for Children on Autism Spectrum Disorder

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## Abstract

Autism Spectrum Disorder (ASD) expresses different usage of communication, application of language and stereotypic behavior. ASD continues lifelong. Therefore, good design quality and special education is essential for individuals who are diagnosed with ASD. The suitable design of special education center for ASD will help children on the spectrum to learn and gain communication skills in comfortable environments. However, design for autism is an overlooked topic by design researchers, interior architects. This research aims to fill the gap in the literature of design for ASD. The qualitative research is applied in the research to comprehend design problems and solve it by new understanding of design. In this study, 6 autism experts' idea were taken in the meetings to design better autism centers for individuals on the spectrum. Participants of the study shared their observation of autism centers and approach for better autism centers. Depending on the repetitive view of problems and solutions, some research codes were achieved to have common sense of autism design. Moreover, special education center in the USA was visited to analyze more deeply. Main problem of special education design is crowded classrooms which doesn't help students to self-regulate. Also being unaware of ASD and its relation to the design creates ignorance to design for ASD. Depending on the interviews and observation of autism center, solution for design problems are displayed. By this way, design set-up can be made to create autism friendly centers.

**Keywords:** *Autism spectrum disorder (ASD), Design for autism, Special education center design.*

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## INTRODUCTION

The place has an indirect way of communicating with people. People have this communication through the senses. As a result of the communication, place experience occurs. Place experience is gained through sensation, perception, and cognition. When the sensual ability is different, the experience of place can be distinct. Yi Tuan (1977) mentioned that blind people develop an acute sensitivity to sounds, they can use them and their reverberations to evaluate an environment's spatial character. Individuals' place experience depends not only on their physical abilities but also their mental or developmental orders. For instance, individuals who are diagnosed with Autism Spectrum Disorder (ASD) experience environments and places quite differently. Every person on the spectrum is not the same. Some can bear hyposensitive features of ASD, and some can bear hypersensitive features of ASD. Loud noises, bright lights, strong smells, and crowded spaces can trigger individuals who have hypersensitive ASD features. On the other hand, hyposensitive individuals can have inactive behaviors as a result of their experience of place. They may need rocking back and forth in a chair, spinning, and deep pressure to fulfill their sensory needs (Moller, 2024).

Autism Spectrum Disorder (ASD) was founded thanks to various scientific research in 1967 by Neil O'Connor and Beate Hermelin. According to scientific research, it was found that ASD sources from neurology (Rowland, 2020). Children on the spectrum don't orient to visual and auditory skills as much as their sense of touch. To understand ASD broadly, it expresses impaired social behaviors, differences in communication and application of language, and obsessive behaviors up to the individual's interest. ASD has typical symptoms that are related to social communication, restricted or repetitive behaviors, or interest (CDC, 2024):

Social communication:

- Avoids or does not keep eye contact.
- Does not show facial expressions when happy, sad, and angry.
- Does not share an interest with others by 15 months of age.
- Does not point to show you something interesting by 18 months of age.
- Does not notice when others are hurt or upset by 24 months (2 years) of age.
- Does not notice other children and join them in play by 36 months (3 years) of age.
- Does not pretend to be something else, like a teacher or superhero, during play by 48 months (4 years) of age.
- Does not sing, dance, or act for you by 60 months (5 years) of age.

Restricted or repetitive behaviors or interests:

- Lines up toys or other objects and gets upset when the order is changed.
- Repeats words or phrases over and over (called echolalia).

- Plays with toys the same way every time.
- Is focused on parts of objects (for example, wheels).
- Gets upset by minor changes.
- Has obsessive interests.
- Must follow certain routines.
- Flaps hands, rocks body, or spins self in circles.
- Has unusual reactions to the way things sound, smell, taste, look, or feel.

Other Characteristics:

- Delayed language skills.
- Delayed movement skills.
- Delayed cognitive or learning skills.
- Hyperactive, impulsive, and/or inattentive behavior.
- Epilepsy or seizure disorder.
- Unusual eating and sleeping habits.
- Gastrointestinal issues (for example, constipation).
- Unusual mood or emotional reactions.
- Anxiety, stress, or excessive worry.
- Lack of fear or more fear than expected.

The number of ASD is increasing day by day. It is stated that 1 in every 36 children is diagnosed with ASD (CDC, 2023). According to the Autism Turkey Platform's data in the previous years, there are 550,000 children with ASD, and around 150,000 children with ASD in the 0-14 age group. Considering the parents and close relatives of individuals on the spectrum, there are approximately 2 million people affected by ASD spread across all provinces in Turkey (ODFED, 2024). The growing number of people on the spectrum is a big threat. In comparison to statistics in 2000, now the number of individuals on the spectrum is % 241 higher than the baseline (Loftus, 2024). Moreover, boys are four times more likely to be diagnosed than girls. % 36.5 of ASD caregivers use Applied Behavior Analysis (ABA) (Loftus, 2024).

ASD continues lifelong. Therefore, society need to be adapted to ASD. This adaptation can be done through social consciousness regarding ASD. Therefore, each discipline should take this global issue as a research problem in the scope of their discipline and try to put forward solutions. In this way, ASD will be on the agenda to create a livable and better world. It is beyond any doubt that people on the spectrum and their families make huge efforts to cope with the effects of ASD. The big role in coping with the effects of ASD is education. That is why, the learning environments of individuals with ASD are significant for their self-development.

Educational places, that are part of daily life where individuals on the spectrum spend their most of time, are crucial for the educational development of these individuals. The schools that are not designed for students with ASD and their education may cause discontinuous education. Hence, educational rights that is individuals' basic needs can

be affected negatively. The greatest support to be given to an individual with ASD is education. In the Autism Spectrum Disorder Handbook written by Tohum Autism Foundation, it is stated that uninterrupted, intensive, and one-to-one education in the early childhood period (before the age of 3, at most before the age of 5) is of great importance for the development of the individual (2019). While a special curriculum is applied in education, training is given with content that increases individuals' social interaction skills and attention.

The education of individuals with ASD becomes more open to development as they acquire certain skills. The education in early childhood which is also primary education is designed to improve communication, daily life skills, and motor skills (MEB Özel Eğitim ve Rehberlik Hizmetleri Genel Müdürlüğü, 2020). Education is a lifelong learning process that is realized in collaboration with families and teachers. Therefore, the review and experience of experts on the ASD have utmost importance when designing places for individuals on the spectrum. This study aims to understand the current design problems in autism centers and recommend new design principles for autism centers. Thus, it is expected to detect design problems and necessities in autism centers and recommend design solutions accordingly.

## LITERATURE

Architecture has a multidisciplinary structure that includes various disciplines such as sociology, archeology, humanities, and art. Therefore, architecture has multiple ways of seeing and thinking. ASD and architecture seem like they are not related at first glance. Maybe, that is why, it is an overlooked topic by many architects, designers, and researchers. As it mentioned previously, educational environments are significant for individuals' self-development. Therefore, educational places should be designed to support learning of all individuals. However, educational places for students with ASD, who are among special individuals, can only be designed by understanding the features of ASD and the lives of those individuals. Design means observing the life routine of individuals, recognizing their routine, and preparing the ground for the realization of the expected life. In this sense, when designing for people with special needs such as ASD, it should be essential to design with empathy.

Empathetic design provides equitable design solutions for its users. It is needed especially for people with special needs. "By assuming that the life experience of disabled people is unfamiliar to designers, such guides suggest that empathy-building offers a way for designers to step into the user's shoes." (Bennet and Rosner, 2019).

The pioneer design criteria for autism design were found by Dr. Magda Mostafa. Mostafa's ASD Design criteria were called ASPECTSS. ASPECTSS stands for Acoustics, Spatial Sequencing, Escape Space, Compartmentalization (Partitioning), Transition Space, Sensory Zoning, and Safety. These criteria are designated to apply to individuals with ASD.

ASPECTSS, the world's first experimental design method formula for ASD. This research; which is for children with special needs, was awarded with UNESCO/ Emir of Kuwait award. In the article titled Architecture for Autism: Built Environment Performance In accordance to the ASPECTSS Design Index, ASPECTSS features are explained as stated (2015):

- **Acoustics:** Acoustics criteria is one of the set of criteria that affects individuals on the spectrum the most. Acoustic comfort is provided by cavity walls, sound-insulated materials, and systems that minimize the echo. All the applications are for decreasing exterior and interior places-based noise.
- **Spatial Sequencing:** The organization of places is designed depending on the daily activities of the place user. This criterion is based on the sensory smoothness of the place transition. Therefore, there is a rational idea when connecting places. For instance, high-stimulus areas such as music rooms, and dance halls can be grouped, and focus-needed places such as study rooms, and classrooms can be grouped.
- **Escape Space:** This criterion is related to defining small descriptive areas that neutralize individuals on a spectrum in the environment. Escape space can be a playing area or even a swing in a classroom where focus is needed. Escape space aims to soothe anxiety and emotional hardship or help when individuals have disruptive sensory-based challenges. Disruptive sensory-based challenges can be disturbed by bright lights, some color, and noise. Escape spaces are places that individuals can use as a sensory shelter when in need. Moreover, they can be designed to recalibrate senses by using calming elements. For instance, the element of nature in an escape space.
- **Compartmentalization:** Compartmentalization aims to create a singular function in a section. In these sections few people and single activities took place. This criteria is against to universal open plan principle. Compartmentalization is related to setting a boundary through furniture, divider, or separator. Also, compartmentalization can be made through the application of different colors or materials on the floor. By this way, the sensory and social load of individuals on the spectrum aims to be decreased.
- **Transitions:** The design of transitions function in cooperation with the criteria of sensory zoning and spatial sequencing. Through transitions, the sensory level is arranged when passing from a high stimulus area to a low stimulus area. In other words, transitional spaces are preparatory areas for passing from one function to another.
- **Sensory Zoning:** Sensory zoning is provided to group similar sensory places together. This can be applied to defining sensory features of functions. After that, placing low stimulus places closer provides transitions to high or middle stimulus places.
- **Safety:** Individuals on the spectrum have some altered perception of the spatial organization and depth. In addition to the altered perception, they may need safety sensors or stimulators especially if they are hypo-sensitive. These stimulators may remove hazardous factors to prevent

individuals from any accidents. In this way, when they display stereotypic behaviors such as spinning they will be under protection. Safety precautions can be provided by building systems, material selections, safety barriers, and usage of correct furniture and fittings. By taking safety precautions, accessible and safe places can be created for all types of different abilities, disabilities, and age groups.

ASPECTSS covers various perspectives of autism design. Each criterion is highly significant in developing a sustainable living environment for individuals on the spectrum. There are some studies in the world which are related to different aspects of design such as acoustics, color, and material (Kanakri, S., 2017; Grandgeorge, M., Masataka, N., 2016). On the other hand in Turkey, there is only one PhD thesis (Designing the interior of educational environments to provide physical and psychological comfort for children with autism who are between the age of 5-11) in the Interior Architecture and Environmental Design discipline<sup>1</sup> (Kavaz, 2022). It demonstrates a gap in the Interior Architecture and Environmental Design literature. Some studies are gathered under aspects of design such as color, and acoustic as explained below.

<sup>1</sup> Yök Tez Merkezi, 2024.

**Acoustic:** The reaction to sound depends on the hypersensitivity and hyposensitivity features of ASD. Hyposensitive and hypersensitive ASD people perceive sound as follows (Crampton, 2018):

Individuals with ASD with Hyposensitive Features:

- They can hear noises by one ear, another ear may partially hear or not.
- They can't define some sounds
- They like to slam doors, bang objects together, or use high tones of voice so they can feel it.

Individuals with ASD who have hypersensitivity characteristics:

- They can hear distant conversations.
- They have difficulty isolating background sounds and as a result, they may not be able to focus.
- Sounds are perceived as louder than they are.
- Sounds are perceived as in altered form.

There is another research related to acoustic and autism studied by Dr. Shireen Kanakri (2017). She observed the repetitive behavior of children on the spectrum under the acoustical design of classrooms. Depending on the research above the 70 dB sound level there were repetitive behaviors triggered such as repetitive movement and speech, closing ears, hitting, blinking eyes, making loud noises, and complaining. This research shows the relationship between environmental stimulators such as loud noises affect attention and behavior. Also, loud places trigger repetitive behavior (Kanakri, 2017). Acoustic insulation is essential when designing for autism. Therefore, sound-absorbing materials such as acoustic foams, fabric, and fiberglass can be applied. Acoustic panels are effective for sound insulation as well. Acoustic panels can be in any form and material which is suitable for ceilings and walls.



**Color:** Individuals on the spectrum perceive colors differently because of their altered vision. There are some chemical imbalances and neurological disorders in the retinas of individuals with ASD (Autism Key, 2011). According to color studies, % 85 of individuals on the spectrum perceive color as more intense and bright than typically developed individuals. % 10 of individuals on the spectrum perceive color as typically developed individuals. % 5 of individuals on the spectrum perceive color as more blurry (Autism Key, 2011). Color preference and its perception is an ongoing research topic. Kingston University has a research project about the perception of children on the spectrum in cooperation with GA Architects. Depending on the study, 20 different colors were found suitable for individuals on the spectrum who are between 15 to 19 years old. In general, blue and green tones of colors are preferable amongst the age group (GA Architects, n.d). In addition to the recommended colors; single colors, low stimulus colors, and less toxic colors should be selected.

Another research is on the light color's effect on 13 children on the spectrum. 6 different colors (yellow, white, red, blue, green, pink) of light effect are observed on 6 different typical behaviors (playfulness, eye contact, repetitive body movement, repetitive speech, aggression, refusal of task) of children on the spectrum (Kavaz, 2022). Depending on the observation, playfulness was most in the color of light such as yellow. Eye contact was observed mostly on yellow and green light. Moreover, refusal of tasks and aggressive behavior were mostly observed under the white light. Repetitive speech was observed mostly under the red and blue light. Repetitive body movement seems most under yellow and red light (Kavaz, 2022).

**Material:** Due to the stereotypical behavior of individuals on the spectrum, they are prone to accidents more than typically developed individuals. For that reason, correct materials in interiors must be selected. Low slip surfaces and waterproof flooring materials will allow users to move safely. Moreover, plain surfaces will be better not to cause any confusion for individuals with ASD. Material selection should be based on tactility, with neutral textural qualities (Almaz and Mohamed, 2023). Maintenance is another factor of materials when considering sustainability. That is why easy maintenance needs to be considered. For instance, instead of using wall-to-wall carpet, carpet tiles will be maintained more easily. Natural materials which don't include any VOC are autism-friendly. Natural materials can be wood, stone, or fabric-based materials. Seating and furniture are significant, especially in educational environments. Therefore, table edges needed to be beveled to not harm any individual on the spectrum. Also variety of seating in consideration of the sensory needs of students needed to be taught. A selection of bouncy, rocking, hammock, cushioned, balance, and spinning chairs will meet their variety of needs (Almaz and Mohamed, 2023).

**Lighting:** Lighting has a big role in the discipline of architecture. It also serves people of all ages and features. ASD is a group with different

sensory needs that must be considered when designing light. Individuals on the spectrum may not have only sensory sensitivities, they may have sensitivities on vision as well. It also depends on the hyposensitivity and hypersensitivity features of ASD. For instance, hypersensitive ASD individuals realize each detail in their surroundings, while hyposensitive individuals exclude details about their surroundings. Bourne and Kleibrink (2016) describe the visual perception of hyposensitive and hypersensitive individuals on the spectrum as follows

Hypersensitive Individuals' Visual Perception:

- They avoid bright light.
- They avoid sunlight
- They follow each movement in the room by their eyes.

Hypersensitive Individuals' Visual Perception:

- They can't easily differentiate between background and object.
- They can lose vision when objects or people move.
- They can't easily place objects.

To reduce light sensitivity, indirect natural incandescent lighting should replace fluorescent lighting (Bullock, 2018). Due to fluorescent lighting's flickering nature, it can be perceived as an environmental stressor for individuals on the spectrum. Places need to be maintained with dim lights. Also, indirect lighting reduces flickering, intensity, and brightness, helping ASD individuals cope with their light sensitivity (Gaines KS et al., 2014).

## DESIGN OF SPECIAL EDUCATION CENTERS

The design of the special education centers should fulfill the needs of children. There are some regulations for designing special education centers in different countries. According to regulations of the US General Services Administration:

**Entry and Circulation:** The entry includes the transition space, vestibule, and reception area where parents, teachers, children, and visitors enter the facility. The main circulation provides pathways between discreet functional spaces.

**Staff Area:** Staff areas include the director's office, assistant or secretary workspace, staff lounge and work area, staff toilet, parent/teacher conference area, and central resource storage

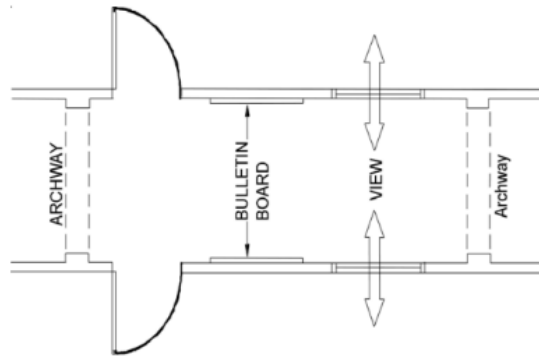
**Classrooms:** Architecturally defined spaces within classrooms include the entrance, cubby storage, classroom and teacher storage, diapering station and storage, toileting and hand washing, sleeping, nursing, and food preparation. The classroom should have an art sink, raised areas, and loft areas (though these level changes need not be built in), and must have open, architecturally unrestricted areas.

**Common Areas:** The center may also include a multiple-purpose space. The multiple purpose space may be used as a meeting or gathering area and as an activity area. If adequate outdoor play yard space is not available, or if the climate in which the center is located is not conducive to outdoor play during significant portions of the year, an indoor large-



motor activity area must be provided. If lofts are to be located in this room, applicable protective surfacing must be provided for the highest unprotected deck of the loft or climber, whether portable or permanent.

**Main Circulation:** There are two types of circulation paths in a center: the main circulation connecting the various classrooms and major spaces of the center, and the internal circulation patterns within those spaces. The main circulation serves as a community space as well as a pathway. Especially in child care centers, the circulation space should never be simply utilitarian. Instead, it should be conceived as a street or a gallery with stopping and cueing areas along the way.



**Figure 1.** Corridor

According to Ministry of Education (MEB) Kindergarten for 8 children Special Education Requirement Program determines the spatial needs as in below:

**Table 1.** . Ministry of Education (MEB) Kindergarten for 8 Children Special Education Requirement Program

Room Type	Features	Room Number	Student Number	M <sup>2</sup>	Total M <sup>2</sup>
<b>Waiting Room</b>	It is designed for parents of students to wait and meet their needs. It should include seating units, TV, Wi-Fi, and kitchenette. It must be located on the ground floor	1	-	24	24

<b>Infirmary</b>	It should be located on the ground floor and have 2 rooms connected. In one room examination, injection, and medical dressing can be done. In another room, two patients can stay. Also, it should include separated male and female WC.	1	2	16	16
<b>Activity Room</b>	It is suitable for 37 to 66-month-old kids, and children can sit around an oval table. Floor and wall materials should be soft. TV, Wi-Fi, and toys should be provided in the room.	8	8	24	192
<b>Sleeping Room</b>	It should be connected to activity room. Therefore, children can rest on beds.	4		24	96
<b>Playing Room</b>	Floor and wall materials must be suitable for playing. Ball pit, and trampoline can take place in the playing room.	1	8	48	48
<b>Individual Education Room</b>	It can be designed in connection to the activity room.	4	1	12	48
<b>Language and Speaking Therapy Room</b>	Preferably it should be located on the first floor.	1	3	16	16

## RESEARCH METHOD

In this research qualitative research method was applied. Qualitative research helps to create a solution for a problem through observation, interview, and document analysis. In this way, known or unnoticed problems can be perceived (Seale, 1999). After the data collection process, an analysis of the data is done. There are some qualitative analysis methods such as descriptive, rhetorical, and content analysis. In

this research content analysis is applied. The content analysis reviews data in detail and explains notions, themes, and categories. Content analysis focuses on the data. Repetitive and emphasized notions are detected from the data set and codes are identified. Through codes, categories, and themes are specified. Shortly, the detected similar and related data (codes) are interpreted and brought together within the framework of certain concepts (categories) and themes (Baltacı, 2019).

It is possible to classify data as primary and secondary. If data is collected for the first time, it can be called primary data. If data previously collected for another purpose will be used, such data is called secondary data. Quantitative research is related to numeric data such as kg, height, and measurement (Açık Ders, 2024). Qualitative research is related to abstract notions such as attitudes, behaviors, and ideas. In this research idea of experts who focus on ASD in their discipline was the target group to collect primary data. The consent form and purpose of the research were shared with experts.

There are 6 experts in ASD joined to the meeting. All experts are specialized in the topic of ASD and observed children between the ages of 3 to 18. One of the experts is a psychologist in an Autism Center in Turkey. One of the experts is a licensed counselor and play therapist in the USA, and actively works with children on the spectrum. Another expert and participant is a special education teacher of autistic individuals in the USA. 2 experts are academicians in Turkey who specialize in education for ASD. 6<sup>th</sup> expert is an architect who has various experiences in autism design. Experts' names and work names are not shared due to confidential concerns. The experts were found through the review of related departments in universities and autism centers. Participants are reached through email and visit to autism center. 4 meetings were in person. 2 meetings were online. The meeting took approximately 30 minutes. Another part of the research is the visit to the Behavior Associates Autism Center in Muncie, Indiana, USA. The consent form and purpose of the research were shared with the head of the center. After validation of the research visit was realized.

### INTERVIEW FINDING

There are specific questions asked to the participants of the meeting. However, in some meetings, more information was taken from the different experiences of the participants.

The main questions asked of each interviewee are as in following lines:

First Question: What are the main problems you observed in the learning environments?, Second Question: Is there any design element that affects individuals on the spectrum the most?, Third Question: How can the design of learning environments be developed?, Fourth Question: Is there any suggestion for interior architects?

6 participants' answer was given in Tables 2 to 7. 1st interviewee is a Licensed Professional Clinical Counselor and Play Therapist in Chicago.

She expressed that ASD is a mysterious field before. However, now it is embraced more. She said “ASD is a neurological diversity, it is not an illness. Therefore there is not a cure for it. Our responsibility is to help children navigate their world. Navigation starts with the language that we speak. As a society, we should embrace autistic individuals' identity firstly by the language that we use for them. As I said, ASD is not an illness. So, autism is not an accessory that we call a ‘person with autism’. When we call like that, we indirectly convey that one group is superior to another. Now, language has changed a lot. We should use neuro-diverse language. It is a good idea to ask autistic individuals what they want to be called”.

**Table 2.** First Participant's Answer

Participants	1.Design Problems	2. Prominent Design Element	3.How to develop Learning environments?	4. Expectations from designers?
<b>1<sup>st</sup> Participant</b>	<p>Crowded classrooms. (Participant declared that there are 30-40 kids in each classroom)</p> <p>Places are not designed for their sensory needs (self-regulation tools such as rocking chairs and blankets can help to self-regulate). A sensory path is needed in transitional spaces.</p>	<p>Lighting, noise, and odor overlook the sensory sensitivity. For instance, the wrong selection of lighting triggers headaches.</p>	<p>Playful environments are needed. Playing provides self-regulation and connection. U shape or circular seating system creates more connection. Relaxation areas are needed. The application of warm and neutral colors is preferable</p>	<p>The learning needs of autistic students are essential. Avoiding too bright light and noise is beneficial for them. Sensory rooms and relaxation places are essential. Autism is not an illness. It is neurodiversity. So, forcing people to do what they want is not okay. We need to accept autistic people as they are.</p>

**Table 3.** Second Participant's Answer

Participants	1. Design Problems	2. Prominent Design Element	3. How to develop Learning environments	4. Expectations from designers?
<b>2<sup>nd</sup> Participant</b>	<p>Noise problem. Design should include all types of autism since it is a spectrum disorder. Visual overload so visual should be less in school environments. Classrooms are so crowded.</p>	<p>Design for sensory sensitivity.</p> <p>Sudden noises such as bell sounds to announce break time disturb kids.</p>	<p>Sensory rooms and some of the features or tools of sensory rooms can be copied in playing areas.</p> <p>The design language needs to be simple and plain.</p>	<p>Pursuing sensory needs for the creation of places to support senses, special education, playing, and sports.</p>

2nd interviewee is a psychologist in Ankara who worked in inclusive and special education schools. His answers are analyzed in Table 3. 3rd interviewee is based in the USA, in the field of special education for students on the spectrum. In the Table 4, 3rd interviewee's answers can be observed.

**Table 4.** Third Participant's Answer

Participants	1. Design Problems	2. Prominent Design Element	3. How to develop Learning environments	4. Expectations from designers?
3 <sup>rd</sup> Participant	Safety is the principal. property disruption may occur when there are not any appropriate materials used for autistic kids. Due to the disruption of property, wall floor materials can be soft.	There are design-based safety issues. For instance, designers can prefer designing room positions to not directly towards to exit and block the exit if it is possible.	The environment should be free from stimuli to prevent distractions, especially in learning environments.	Adaptable places for each type of user are needed.  Attaining access to all types of spectrum is crucial in the design. For instance, if a student has disruption or anger problems, so there shouldn't be a bunch of furniture.

4th participant is an architect based in Turkey and has various experiences with ASD and design. Analysis details can be seen from Table 5.

**Table 5.** Fourth Participant's Answer

Participants	1. Design Problems	2. Prominent Design Element	3. How to develop Learning environments	4. Expectations from designers?
4 <sup>th</sup> Participant	There are no or very limited relaxation areas. They need classrooms with a certain number of students and personal places.	Limited studies regarding autism design. No consideration of environmental factors. Very limited or not have personal/relaxation spaces.	Variety in size while designing classrooms. For instance, small spaces for relaxation and big spaces for movement. Flexibility in design is a necessity.	Designers need to extinguish uncertainty in the design. Uncertainty cause anxiety and aggression for students on the spectrum.

5th participant works as an academician in the field of special education in Turkey. He has expertise in ASD. Table 6 displays analysis of the 5th participant.

**Table 6.** Fifth Participant's Answer

Participants	1. Design Problems	2. Prominent Design Element	3. How to develop Learning environments	4. Expectations from designers?
<b>5<sup>th</sup> Participant</b>	Places need to be designed for socialization. Seating design and public places can be designed for the social atmosphere.	Lighting and safety.	Autism centers or educational places need to be multifunctional. Arts and sports places must be added. One-way circulation must be designed.	Designers should avoid applying complex textures and colors. Having enough natural light is essential in learning environments. Safety precautions must be taken. For instance, fixed furniture and apparatus to not open windows can be added.

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6th participant is an academician in the field of special education in Turkey. She has various educational experiences with children on the spectrum. Analysis of 6th participant's answer is given in the Table 7.

**Table 7.** Sixth Participant's Answer

Participants	1. Design Problems	2. Prominent Design Element	3. How to develop Learning environments	4. Expectations from designers?
<b>6<sup>th</sup> Participant</b>	Color in the interior is not suitable for children on the spectrum. Bright colors shouldn't be used in places.	The most prominent feature of the autism design is the sociability of functions. Therefore the set of individual and common areas is significant in autism centers.	Materials and textures need to be researched more. For instance, hard textures are not very good with students on the spectrum. If there will be a renovation in design students need to be informed. Since they like certainty and familiarity.	Creating a playful environment for students is expected from a designer. Playing is a way of learning and connecting with others.



## OBSERVATION FINDING

To support research and observe design for ASD, Behavior Associates in Muncie, Indiana, USA visited and photographs in the center were taken. Behavior Associates founded in 2013 has 3 centers in Indiana, USA. In Behavior Associates ABA (Applied Behavior Analysis) is applied. ABA focuses on improving behaviors, social skills, academics, reading, and communication. ABA Therapy breaks down complex behavior into smaller tasks and rewards individuals when they complete tasks (Behavior Associates, 2024). In addition to ABA therapy, speech therapy, and mock classroom accommodate the needs of students from elementary to high school.

**Figure 2.** Façade View of Behavior Associate



**Figure 3.** Garden & Playground



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**Figure 4.** Special Education for Individuals



**Figure 5.** Special Education for Individuals





**Figure 6.** Communal Education Room

**Figure 7.** Transitional Place



**Figure 8.** Daily Life Teaching Place

**Figure 9.** Daily Life Teaching Place



**Figure 10.** Individual Area

**Figure 11.** Communal Education Room

Behavior Associates Muncie is located in an area where there is a connection to nature and children on the spectrum can spend time in nature and play games (Figure 2 and 3). It has various sizes and functions of place in the center. Individual and common classrooms offer personal and communal education. In Figure 4, it seems that the design language of the room is plain. The floor has carpet covering which is safe for students on the spectrum. Individual rooms are spacious and it takes only 2 students for the education (Figure 5). The wall color is also very light blue which doesn't disturb children. Figure 6 is photographed to display communal education areas. As it can seem, tables have a beveled corner that protects students from any accident. Also, no furniture or design distracts students' attention. Fixed furniture is preferred which is a safe way of mobile design for children on the spectrum (Figure 6).

In the transitional place perception of contrast is made by the dark color of the flooring and walls. In this way, it directs students to the other functions. Another positive approach is to create places to adapt students to housework. In Figures 8 and 9 kitchen is designed to teach students how to prepare food and clean it. On the dishwasher dirty label is placed to notify kids (Figure 9). Also in the cupboards, all items' names are written. There is an also individual area for children in high school (Figure 10). Wood and carpet are applied to design a home-like environment. The break area and study area are designed together. The teaching area is separated by a partition wall (Figure 11).

## DISCUSSION

Depending on interviews with 6 experts who are from different backgrounds and have experiences in ASD shared their ideas regarding to main design problems and various ways of suggestion to design for autism. When answers to 1<sup>st</sup> question (What are the main problems that you observed in the learning environments?) are analyzed, it is noticed that the main problem in the learning environment is having crowded classrooms. Therefore, the size of classrooms can be proportioned for effective learning. Moreover, another problem is that learning places don't help individuals on ASD to self-regulate. It can be provided by the existence of relaxation areas, soothing colors, and design language. 2<sup>nd</sup> question (Is there any design element that affects individuals on the spectrum the most?) is related to the most effective elements of design.

There are some common answers are highlighted depending on the interviews. For instance, the safety of places and the approach of sensory design are the most effective design elements for ASD.

3<sup>rd</sup> question's answer includes various strategies to develop the design of educational environments for individuals on the spectrum. Firstly, children on the spectrum can be sensitive to environmental stimuli such as noise, bright light, or color. Therefore, design should address this sensitivity. On the other hand, some groups of children can be hyposensitive. Therefore, for them, places could stimulus. For instance,

rocking chairs and sensory paths (Figure 12) can be applied in the educational environment for children on the spectrum.

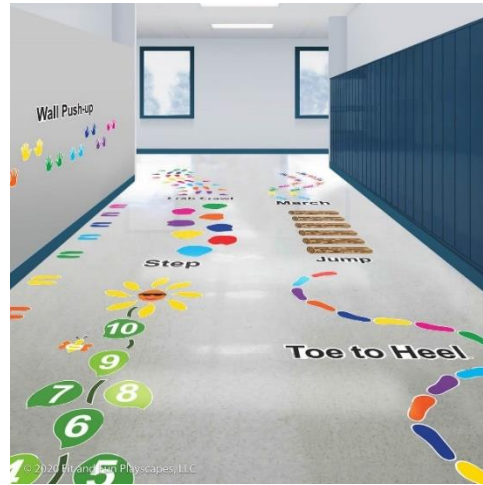


Figure 12. Sensory Path

Places should create various options for all types of spectrum. In general, design language could be plain. However, for stimulation, some individual rooms or seating could be designed for those in need. Another idea is creating a playful environment that helps children to socially engage and communicate. Also, the seating design should be arranged to increase communication. One expert suggested U-shaped seating.

According to the 4<sup>th</sup> question (Is there any suggestion for interior architects?) analysis, it is expected to create flexible places that include all types of spectrum. To include, a set of sensory features which is self-soothing, and stimulating design elements should be applied. Extreme environmental stimuli such as noise, bright light, and colors are avoided. The design of the educational place should encourage children to move and communicate. Place variation should be provided for students to be alone in relaxation or individual rooms/areas also communal areas should take place in the educational environments. Lastly, each case and person is unique. Therefore, asking what user prefers in the place should be the main concern for interior architects. In Figure 13, design problem and design solution analysis depending on interview can be seen. By this way, necessities of centers and their problems can clearly be perceived. Appropriate design solutions can easily be provided to the children on the spectrum.



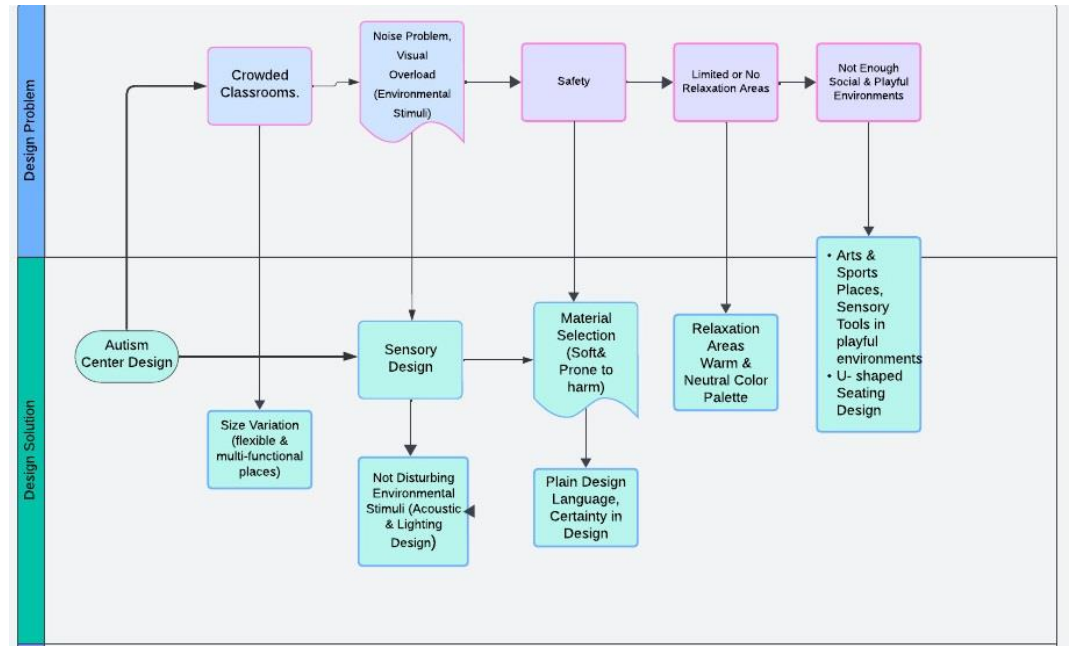


Figure 13. Analysis of Interview

## CONCLUSION

This research aims to find design principles for autism centers for a more comfortable and healthy environment. During the research, several design problems were identified and demonstrated solutions by enquiring particular questions to the participants who are experts on ASD. Depending on the surveys there are several design problems such as having crowded classrooms, overlooking sensory needs in design, noise problems, safety issues, visual overload, and not enough relaxation and social places. Also not including all types of autism is another design problem for the user.

In light of the research following design solutions can be recommended:

- The number of students needs to be arranged according to the physical capacity of the places in the centers.
- Safety in the design must be provided when designing places for ASD. For instance, due to aggression of children on spectrum property disruption may occur. Therefore, hard materials on surfaces or sharp edges of furniture can harm children on spectrum and also the designed environment. That is why, the material choice should be made accordingly.
- There is not only one type of ASD. Some people are hypersensitive and hyposensitive. Environmental stimuli such as bright light and sudden noises can mostly affect hypersensitive individuals (Gaines, K. et.al., 2016). Therefore, complex design language and too intense stimulation should be avoided in these places.
- Certainty and familiarity are sought by children on the spectrum. So, if there is a design change in the place students on the spectrum are needed to be informed before.

- Size variation in places should be provided. For instance, big size of places encourages movement and small sized places enable students to relax.
- Self-regulation is essential for students on the spectrum. Therefore, relaxation areas needed to be provided.
- Social and playful environments are significant in the self-development of children on the spectrum. Sensory tools can be added to these playful environments. Moreover, functions for art and sports could take place in autism centers.

Future research into sensory design elements for ASD will give a more detailed approach to ASD design. Therefore, educational places that have a big role in children's self-development will be appropriate for their needs.

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## Resume

Merve KAVAZ is an interior architect, researcher, and university lecturer. In 2014, she received her bachelor's degree from Bilkent University, Ankara Turkey. In 2015 she graduated from Coventry University, United Kingdom. She is one of two Turkish recipient who received Commonwealth Scholarship in 2015. In 2022 she received her PhD from Hacettepe University. During her PhD education she researched in Health and Environment Lab at Ball State University for 6 months. Research is supported by TÜBİTAK scholarship which is for PhD dissertation. She has various articles related to inclusive design. She is still working on the topics of design for all. Also teaching in design studios and carrying out elective courses.