

## EDUCATIONAL SPACES FOR CHILDREN WITH AUTISM; DESIGN DEVELOPMENT PROCESS

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### **Abstract:**

*Autism is a complex developmental disability that affects communication, social abilities and imagination<sup>3</sup>. Apart from the triad of deficits there are associated differences in perception of senses that impairs the way of thinking and perceiving the world. This paper attempts to discuss the design development process, for educational spaces, to facilitate children with autism to respond more positively to teaching and therapies. The paper is derived from a larger study that consists of five parts (1) Establishing relation between environment and the needs of autistic children (2) Environmental design considerations to address educational and behavioural aspects (3) Design parameters that have a strong connection to autism (4) Measurement scale to evaluate design parameters (5) Design guidelines based on the evaluation of the parameters. The study has made it clear that although abilities and behavioral patterns exhibited by an individual child can vary enormously, there are considerations among most children that require special attention. These considerations provide a sensitive base, which has the ingredients to meet the needs and enhance learning. On the whole the study considers many design aspects such as observation, discussion and survey, the sole purpose of this paper is to build up a development methodology that is expected to guide environmental design for education of children with autism.*

*‘Reality to an autistic person is a confusing, interacting mass of events, people, places, sounds and sights. There seems to be no clear boundaries, order or meaning to anything. A large part of their life is spent just trying to work out the pattern behind everything.’ -A person with autism<sup>4</sup>*

### **1.0 Introduction**

‘Universal design has most commonly been applied in connection with physical or sensory impairments and thus, at least in practice, does not specifically address the needs of individuals with significant cognitive impairments. Yet there are increasing number of people who suffer from cognitive impairment who could also benefit from environments that are more usable.’ (Calkins, Sanford, Proffitt, 2001). Autism like other cognitive disabilities, because of its complex nature, has remained unrepresented in accessibility design guidelines in the past. Until recently it was considered as hopeless and incurable condition, but now with advancement in special education and understanding of enabling environments, it is clear that all people with autism can benefit from a timely diagnosis and access to appropriate

<sup>3</sup> <http://www.actionasd.org.uk/whatisautism.html>

<sup>4</sup> <http://www.autism.org.uk/nas/jsp/polopoly.jsp?d=1062>

environments, services and support. With increasing attention to autism and government funding, many researchers are studying the complex field of autism but the concerns for supportive learning environment for the children is still missing. This paper attempts to discuss a progression that would produce design guidelines for educational facilities and its scope is limited to the design development process and the development of design evaluation tools. While the overall procedure utilizes methods such as observation, discussion and survey, the primary intent of this paper is to inform the methodology that will direct environmental design of learning environments.

## **2.0 Background**

‘Autism is a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences.’<sup>5</sup>

The three main areas of difficulty which all people with autism share are sometimes known as the 'triad of impairments'. They are difficulty with social communication (difficulty with verbal and non-verbal communication like language, gestures, facial expressions or tone), difficulty with social interaction (difficulty with social relationships, for example appearing aloof and indifferent to other people), difficulty with social imagination (difficulty in the development of interpersonal play and imagination)<sup>6</sup>. Autism is known as a ‘spectrum disorder because the severity of symptoms ranges from a mild learning and social disability to a severe impairment and highly unusual behavior. Autism may also occur in association with other difficulties like mental retardation, sensory dysfunction, hyperactivity and seizure disorder. The most recent estimates of the prevalence of Autistic Spectrum Disorders have suggested a figure closer to 1% of the population in UK <sup>7</sup> where it has touched the lives of over 500,000 families. In USA, it is estimated that 1.5 million children<sup>8</sup> and adults have some or the other form of autism, and another 15 million (parents, health care professionals, loved ones etc) gets directly impacted by autism. Numerous studies have placed the occurrence of autism at a rate of approximately 1 in 500 people<sup>9</sup>. This means there are an estimated 2.0 million autistic persons in India and 2.65 million autistic persons in China, at their current population, assuming that there are no significant variations in this rate worldwide.

Educating children with autism is a challenge for both parents and teachers. These children have unique strengths and weaknesses (Hodgdon1995). Academic goals are tailored to that individual's functioning level. Educational programming for students with autism often addresses a wide range of skill development including academics, communication and

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<sup>5</sup> Individuals with Disabilities Education Act (IDEA), United States of America, the federal legislation under which children and youth with disabilities receive special education and related services.

<sup>6</sup> National Autistic Society, United Kingdom, <http://www.nas.org.uk>

<sup>7</sup> National Autistic Society, United Kingdom, <http://www.nas.org.uk>

<sup>8</sup> Based on the autism prevalence rate of 2 to 6 per 1,000 (Centers for Disease Control and Prevention, 2001) and 2000 U.S. Census figure of 280 million Americans.

<sup>9</sup> Disability fact sheet on Autism (NICHCY: 1.800.695.0285), No.1, April 2007, A publication of the National Dissemination Center for Children with Disabilities, USA, pp3& [http://www.autism-india.org/afa\\_aboutautism.html](http://www.autism-india.org/afa_aboutautism.html)

language skills, social skills, self-help skills, leisure skills and behavioral issues (Schopler, Lansing & Waters, 1983; Maurice, Green & Luce, 1996).

### **3.0 The Study**

According to the literature on environment and behavior relations, how a person behaves in a particular situation does not reflect either the person alone or that person's environment but rather, the interaction between the two (Mead, 1934; Cronberg, 1975). This perspective on the nature of person-behavior-environment is the defining characteristic of a transactional perspective (Moore, 1976 Wandersman; Murday & Wadsworth, 1979; Stokols, 1981, 1987; Altman & Rogoff, 1987). A term used to characterize the appropriateness of a particular person-behavior-environment transaction is "congruence" or "fit". Fit is a state of equilibrium where an individual's capabilities are in balance with the demands of the environment. Equilibrium may not be a specific pivot point but rather “zones of adaptation” within which individuals are sufficiently challenged yet not so challenged or deprived that they are under pathological stress. Perception of users plays a role in "fit." Enabling environments, designed to achieve the best fit, should be congruent with the functional requirements of users.

The study is carried out based on the belief that ‘Performance of pupils with autism is enhanced in appropriate physical environment’. The objective is to identify the enabling aspects of educational environments, measure their affects on educational performance and develop design guidelines that will lead to the development of effective educational spaces for autistic children. The present study is intended to create a developmental framework for designing educational facilities and it will offer a tool for architects, designers and facility managers to design high performance educational spaces.

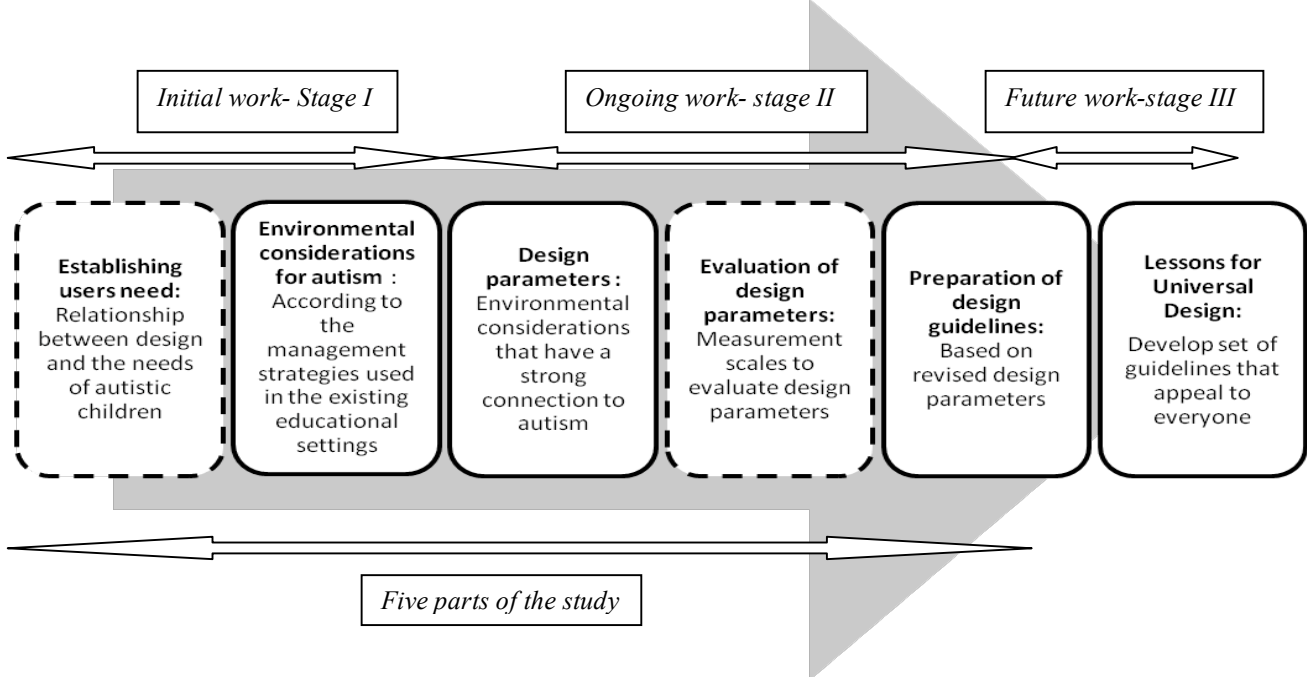
The study is carried out in two stages. In the first stage, a set of environmental design considerations to aid children with autism to respond more positively to teaching were developed based on the management strategies (Schopler, Lansing & Waters, 1983; Maurice, Green & Luce, 1996) used in the existing educational settings. These environmental considerations produced autism-friendly environments and they were based on the initial study<sup>10</sup> that reviewed eleven educational facilities including eight field studies at Germany & India and three literature studies at USA & UK with children with autism. The facilities chosen represent most restrictive to least restrictive educational settings for children with autism.

Based on the expert's interviews in the educational facilities, environmental interventions adopted by therapists and available literature (BB-77 1992; BB-94 2001; Stokes 2001; Harker & King 2002; Humphreys 2005), autism friendly environmental design considerations were developed. These environmental considerations were expected to improve educational performance of pupils with autism. The environmental considerations included detailed description of the autism friendly environmental requirements at both macro (location, site planning, landscaping etc.) and micro (building design, services, furniture, fittings, building materials etc.) level. Design parameters were developed to evaluate the enabling aspects of educational environment. They are concise versions of the environmental considerations that had a strong connection to autism. These parameters have a tripodic relationship between deficits, conditions and spectrum and summarize the environmental requirements for children

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<sup>10</sup> Initial part of the study was carried out under Research & Development project sponsored by All India Council of Technical Education, India

with autism. They acted as a ‘measurable quantity’ during evaluation and will be used to determine the result of the study in the form of design guidelines.



**Figure 1** The design development process

In next stage, the study is extended<sup>11</sup> to develop three testing tools to evaluate the design parameters. To be explained later, these tools are the environmental audit, performance measurement scale and design parameter rating scale. The environmental audit is a checklist of design parameters derived from the environmental design considerations for autism and their presence is expected to improve educational performance. The performance measurement scale is derived to test the performance aspects of the parameters. To understand how environment impacts educational performance, the measure scale will be used by teachers to obtain information about children’s performance and the role the environment plays in education. Design parameter rating scale is developed to assess the importance of the parameters and the extent to which the environment is important for education. Teachers will employ the scale to rate the role of environment in education. This paper uses the design parameters to lay ground for the tool development in the new study. The design parameters and tool development work have been included in the paper. The larger study will conclude with a set of design guidelines based on evaluated design parameters to develop a framework that architects, designers and facility managers can employ to design educational facilities for children with autism.

**4.0 Tools:**

**4.1 Environmental Audit (EA)**

The environmental considerations for educational spaces for children with autism are developed for all the aspects of building design. They are prepared as per the literature on

<sup>11</sup> Ongoing part of the study is done under Fulbright program in College of Architecture at Georgia Tech, Atlanta, 2007-08

autism and observations in existing school facilities for autistic children. The eighteen design parameters summarizing environmental considerations form the basis of environmental audit checklist.

These eighteen items on the checklist are intended to prompt inspection so that their extent of presence in the environment can be recorded on a five point scale from exceptionally high to unusually low level (Table-1). Designers surveying a facility will be asked to check the building features that matches with the checklist in the environment. These are the assessment criteria and they depend upon extent of their presence in the environment. For example for exceptionally high level they have to be strongly present in all areas, for high level they have to be strongly present in some areas, for moderate level they have to be somewhat present in classroom and so on.

ENVIRONMENTAL AUDIT						
ENVIRONMENTAL FEATURES	Exceptionally high level	High level	Moderate level	Low level	Unusually low level	Comments
Physical structure						
Visual structure						
Visual instruction						
Opportunities for community participation						
Opportunities for parent participation						
Opportunities for inclusion						
Opportunities for future independence						
Space standards						
Withdrawal spaces						
Safety						
Comprehension						
Accessibility						
Space for assistance						
Durability and maintenance						
Sensory distraction management						
Opportunities for sensory integration						
Flexibility						
Monitoring for assessment and planning						

**Table 1** Environmental Audit

#### 4.2 Performance Measure for Pupils with Autism (PMPA)

There is usually a list of misfit situations between the building and the occupants that can only be discovered in an occupied facility (White 1991). Performance Measure for Pupils with Autism is a sequential evaluation process that measures performance of the pupils in an existing educational environment that has already undergone environmental audit.

Since design parameters and performance measures are related, the questions to assess the performance were derived from the design parameter. Teachers will be asked to respond to a questionnaire (Table-2) about the educational performance of children that is related with their interaction with the environment.

Performance Measure for Pupils with Autism		Yes	Some	No	Comments
1	Most pupils are able to locate themselves in the school environment?				
2	Most pupils know the purpose of different spaces in the building (like instructional areas, work areas, leisure areas, dining areas and others)?				
3	Most pupils are able to perform activities more independently in the areas that uses color coding, picture coding and number coding?				
4	Most pupils are able to perform activities more independently in the areas with visual instructions?				
5	Most pupils are able to perform different type of learning activities (academic, self-help, vocational, leisure, social, community and others) in the school environment?				
6	Storage in teaching areas is usable by most pupils independently?				
7	Most pupils require parent’s involvement in educational planning?				
8	Most pupils get the opportunities to interact with same age peers?				
9	Most pupils are comfortable in common areas (like cafeteria, group teaching areas)?				
10	Most pupils use planned/unplanned spaces for unique needs such as furniture and corners for withdrawal purposes?				
11	Most pupils are safe in the school environment (escapes, railings, heights, sharp edges, non-slippery surfaces, electrical outlets, breakable items, non toxic materials and others)?				
12	Most of them understand safety signs and emergency exits in the school environment?				
13	School building offer independent access to most pupils?				
14	Most pupils need assistance while learning new activities?				
15	Most pupils use the school building (materials, finishes, fittings, hardware and equipments) for intended purposes?				
16	The use of building and equipment by pupil demand				

	frequent maintenance?				
17	Most pupils can deal with visual distractions (like escape routes, windows, lights, shadows, patterns) in the school environment?				
18	Most pupils can deal with auditory distractions (like classroom noise, sound and vibrations from equipments) in the school environment?				
19	Most pupils can handle tactile distractions (like different textures of the building materials, furniture) in the school environment?				
20	Most pupils can manage olfactory distractions (like smell from kitchen and dining areas) in the school environment?				
21	Most pupils benefit from multisensory stimulations (like opportunities for rolling, jumping, spinning, vibrations, music, different smells and tactile experiences) in the school environment?				
22	Does reorganization of spaces helps implementing different instructional method and new therapy to most pupils?				
23	Is monitoring method effective and does not distract most pupils?				

**Table 2 Performance Measure for Pupils with Autism**

#### 4.3 Design Parameter Rating Scale (DPRS)

Children with autism vary widely in abilities, intelligence, and behaviors<sup>12</sup>. This was clear after observing children with autism, listening to the staff, discussing their behavioral characteristics, visiting autism schools and learning about autistic spectrum disorders. Everyone is impacted differently by autism though for most people, the environment forms the basis for their response. As a result, some people who are highly functioning individuals can be taught in classrooms with able-bodied children, whereas others have more unique needs and their classroom requires to be present in specialized schools. But for all of them, the environment serves as an important teaching tool and their education is enhanced by well designed environment and negatively affected by ill conceived spaces.

The children with autism need structure, clarity, predictability and safety in their surroundings to improve their performance. To address this, teachers will be asked to review the eighteen environmental design parameters and rate them for their importance in education and development (Table-3).

<sup>12</sup> Disability fact sheet on Autism (*NICHCY: 1.800.695.0285*), No.1, April 2007, A publication of the National Dissemination Center for Children with Disabilities, USA, pp 3.

Design Parameter Rating Scale						
	Highly recommended	Recommended	Recommended with reservation	Not sure	Not recommended	Comments
Environmental Features						
Provide Physical Structure- organize physical environment through clear physical and visual boundaries to establish context of activity associated with a physical space.						
Maximize Visual Structure-organize visual environment through concrete visual cues and visual importance by incorporating color coding, numbers, symbols, labeling, illuminated sign boards, highlighters etc.						
Provide Visual Instruction- give sequence of steps to follow an activity (in the spaces where activities are to be performed) in the form of written instructions, pictures, visual schedules etc.						
Opportunities for Community Participation- involve pupils in the community activities in every day works such as shopping or using public transport.						
Opportunities for Parent Participation- involve parent in schools activities to address pupil’s individual educational needs.						
Opportunities for Inclusion - present an environment to the children with autism to interact with able bodied peers.						
Maximize Future Independence- provide environment for learning life skills and vocational skills that makes them independent in future.						
Generous Space Standards- help pupil with autism to deal with social demands as they are sensitive to loss of personal space and threatened by crowding.						
Provide Withdrawal Spaces- quiet areas that allow pupils with autism to withdraw to avoid unnecessary stress and anxiety in socially demanding spaces.						
Maximize Safety- minimize threats to pupil due to their own condition, unawareness or any disaster.						
Maximize Comprehension- clear layout, direct routes, clear zoning, simple forms, and no visual clutter assist pupil with autism to perceive the school environment easily.						
Maximizing Accessibility- poor coordination and balance, epilepsy, poor attention span in autism may require building to be made physically accessible.						



Provide Assistance- space needed to help pupil doing learning activities in classroom, toilet, dining areas and others						
Maximize Durability and Maintenance- durability and maintenance of equipment, hardware, furnishing, fitting, furniture etc from damage and misuse by pupil.						
Minimize Sensory Distractions- least distracting settings that are away from any visual, auditory, tactile distractions.						
Provide Sensory Integration-includes multisensory stimulations in the environment like opportunities for Rolling, jumping, spinning, vibrations, music, different visual experiences etc.						
Provide Flexibility- relating to broad spectrum of functional skills and diverse teaching models.						
Provide Monitoring for Assessment and Planning- monitoring pupil with minimal distraction for assessment, safety and activity planning.						

**Table 3** Design Parameter Rating Scale

### 5.0 Conclusion:

In rehabilitation practice, the environment provides a prosthetic support for functional performance. Standards and codes establish the importance of the environment and the need for appropriate interventions to match individual capabilities. The prevailing view that one environment for everyone may not provide the needed support that many children with autism require, triggers the idea of individualized learning opportunities that best enhances education and development.

Autism is thought to put people in a difficult position surrounded by uncertainty and unpredictability, which can be unnerving. Although designing physical environment for autism requires a good understanding of autism and the need of individual requirements, some design principles can be applied to improve their responses to teaching and therapies. The present study attempts to identify environmental issues of importance for educating children with autism. Then, the study employs teachers and therapists to measures their impact on education. Finally, the environmental issues will be tested to determine the design guidelines to facilitate children with autism in educational spaces.

The future course of study plans to establish a connection with universal design principles. The environmental design aspects of the study will be compared with school design guidelines to highlight compatibility and contradictions. This will help to develop a set of guidelines of appeal to everyone. We do not expect to come up with uniform set recommendations for everyone, but rather a flexible set of directives that will allow creating many different types of educational environments within the larger environmental concept so places can be personalized to meet the needs of all children. Universal design for educational facility will be inclusive, and it will provide equal educational opportunity for everyone.

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