Universally Beneficial Educational Space Design for Children with Autism; the Research Progression

Rachna Khare, National Institute of Design, Ahmedabad, India, khare_rachna@hotmail.com
Abir Mullick, Georgia Institute of Technology, Atlanta, USA, abir.mullick@coa.gatech.edu

Abstract: With a growing trend towards people-centered and evidence-based design, most of the researches on designing for special groups, accessibility codes and design guidelines are based on the 'environment and behavior' studies. The present study employs a research method based on environment and behavior studies, to explore the effect of identified environment issues on children for universal access and application. The systematic study of behavioral features in autism in the present study has provided a wealth of understanding that is applied to the process of research and design. There are several stages to this; in initial stages, learning behaviors of children in educational spaces helped in defining the 'enabling environment' for autism, termed as 'environmental design parameters'. These eighteen design parameters are tested in the subsequent stages to provide evidence based body of knowledge to design autism friendly and inclusive educational spaces. Although the overall study considers many design aspects such as observation, survey and evaluation, the main purpose of this paper is to discuss the research process adopted to define and validate enabling aspects of educational environment for children with autism and present the results obtained in brief.

Key words: Autism, Design, Educational Spaces, Inclusive Environment, Environment and Behavior

1.0 Introduction

In educational space design, the accessibility standards address issues related to physical access but children with cognitive disabilities often remain unrepresented. Such disabilities are by and large overlooked by the architects and designers as conditions that influence building design and are excluded from building codes and design guidelines. Autism is one of these lifelong developmental disorders that affect communication and social abilities of an individual, other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements and unusual responses to sensory experiences (APA, 2000). Children with autism are found in all countries in the world of different cultural expectations, different attitudes to education and disability and very different levels of resources. The most recent estimates of the prevalence of Autistic Spectrum Disorders have suggested a figure closer to 1% of the population in UK where it has touched the lives of over 500,000 families (NAS, 2007). In USA, it is estimated that 1.5 million children (CDC, 2001) 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 (NICHCY, 2007). 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.

Until recently it was considered as an incurable condition, but now with advancement in special education, it is clear that all people with autism can benefit from a timely diagnosis and access to appropriate services and support. Today with dawn of inclusive education in the world, it has become vital to explore the scope of environmental design for autism. The present research study emphasizes the need for a fresh approach in designing educational spaces for a supportive environment and intends to develop a framework that will work as a tool for designing high performance autism friendly educational spaces beneficial for all.

2.0 Methodology

Largely, the aim of the study is to recognize the environmental aspects effecting performance of children with autism, measure their impact on learning and then develop a set of guidelines for architects and designers to design autism friendly educational settings. The study also makes an effort to explore the effect of the identified environmental aspects on able-bodied children to establish a base for Universal Design. The process followed in the current study mostly derives from Environment-Behavior research methods, discussed by Zeisel (2006), Preiser (2001), Steinfeld & Danford (1999) and Cherulnik (1993). It employs several research approaches; sequentially starting with a concept, it draws from accumulated knowledge, existing theories and preliminary field survey to formulate the hypothesis. The hypothesis is then tested to verify the concept for the purposes, those can be generalized.

The concept that propels the entire study is *'Performance of pupils with autism is enhanced in appropriate physical environment'*. This concept originates from author's experiences with children with autism, and the literature on autism. Acting as a reference for all future observations, it sets the objectives and raises the research questions. These research questions are systematically analyzed in five phases of the study (refer figure-1). These five phases are: (1) Establishing relation between environment and the needs of children with autism (2) Developing Environmental Design Considerations to address these needs (3)

Deriving Design Parameters from previous stages to present tangible and testable ideas (4) Conducting evaluations to validate identified Design Parameters (5) Preparing autism friendly Design Guidelines based on these evaluated Design Parameters.

In the *first phase* of the study, an extensive preliminary diagnostic exploration is carried out to deepen the understanding of the concept. This elaborate research stage in the present study derives from available literature on previous works on design and developmental disabilities, the literature on autism and strategies used for teaching (Siegel, 1998, Jordan, 1997, Maurice, Green & Luce, 1996, Schopler, 1983), and the existing theories of environment-behavior research and disability studies (Steinfeld and Danford, 1999), to further develop unfocussed ideas about the users' needs. These ideas are further refined through preliminary field investigations carried out in different countries of Europe, USA, and India. The field investigation technique in natural settings adopted to establish the educational needs of children with autism is unobtrusive and described as the most suitable method for the population that cannot be interviewed and is sensitive to the researcher's presence, by John Zeisel (2006).

The *second phase* of the study leads to the development of detailed environmental design considerations those are enabling for pupils with autism. These environmental design considerations are based on the elaborate diagnostic exploration carried out in first phase of the study to take care of the deficits and conditions in autism. To present the ideas tangibly, the identified enabling design considerations are summarized as 'eighteen environmental design parameters' (refer figure-2). These design parameters help to organize and simplify the extensive information generated during preliminary diagnostic exploration. This is the *third phase* and it sets the descriptive hypothesis in the present research study.

The descriptive hypothesis or design parameters are tested in the *fourth phase* subsequently, to have empirical evidence in favor of the concept. Empirical testing is carried out to quantify the qualitative ideas; it contributes to the precision of knowledge and makes the research findings more convincing. Multiple sets of tools developed in the present research are environmental assessment (EA), performance measurement scale for pupil with autism (PMPA) and design parameter rating scale (DPRS). The above mentioned design parameters are tested in existing educational setups based on the post occupancy evaluation in environment-behavior studies as discussed by Zeisel (2006) and Preiser (2001).

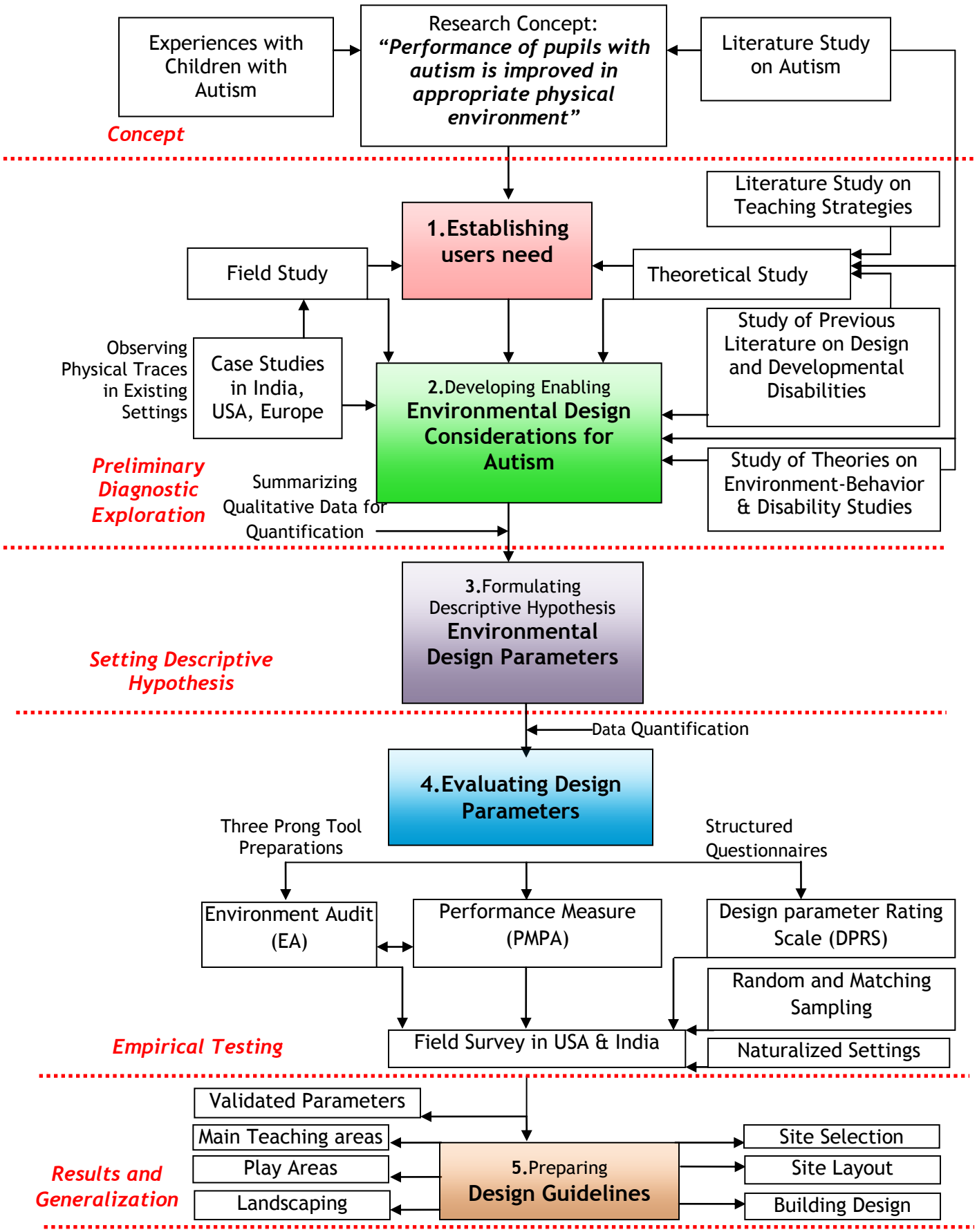

Figure 1.Five Phase Research Process adopted in the Study

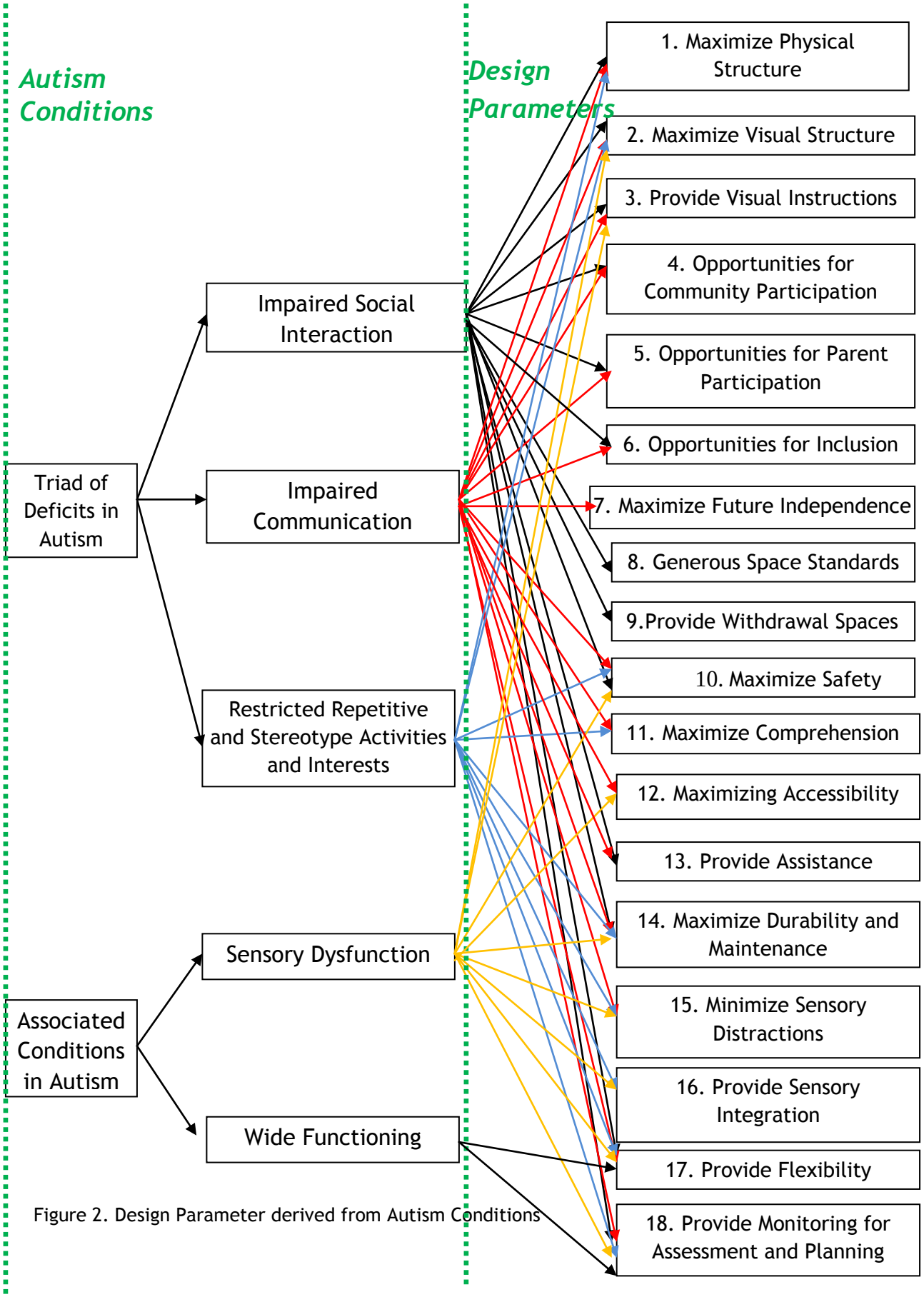

Figure 2. Design Parameter derived from Autism Conditions

An extensive survey is carried out in the fourth stage of research and EA and PMPA data are collected from sixteen educational spaces in USA and six in India. DPRS data is collected from eighteen experts working with low functioning children with autism and also from fourteen regular education experts. The data is collected from teachers and therapists working with the children with autism, in a naturalized setting that is familiar and comfortable for children. The samples although selected randomly, represent all age groups, elementary, middle and primary; different type of educations settings, inclusive and specialized; different education experts, autism and regular education and different countries- developed and developing. The empirical data is then structured, compared and analyzed both intimately and distantly at the same time. Manifest and latent inferences from observations are drawn to answer the research questions formulated in the beginning of research.

To present a successful research, Reizenstein (1975) and Cherulnik (1993) expresses the need to fill the 'gap' between environment-behavior research, and design and planning practice. The *fifth and final stage* addresses that gap and the presents the research findings in a way, which can be used in applied design situation. It presents highly rated universally applicable parameters for children with autism those are also beneficial for able-bodied children in the form of architectural design guidelines. The guidelines are prepared for site selection, site layout, building design, main teaching areas, play areas and landscaping. These guidelines provide a framework, for architects, and designers, to design high performance educational spaces for children with autism. The guidelines are expected to be universally beneficial and supplement existing design standards for schools to provide equal educational opportunity for everyone.

3.0 Results and Discussions

The data collected from elementary, middle and high schools for autism shows strong correlation between educational environment and performance. Both environment and performance are assessed relating to the identified design parameters and their interdependence is clearly visible in figure-3. Some variations in the slope of the graph profile portray that although environment plays an important role, the performance is not solely dependent on it and there are several other impacting factors.

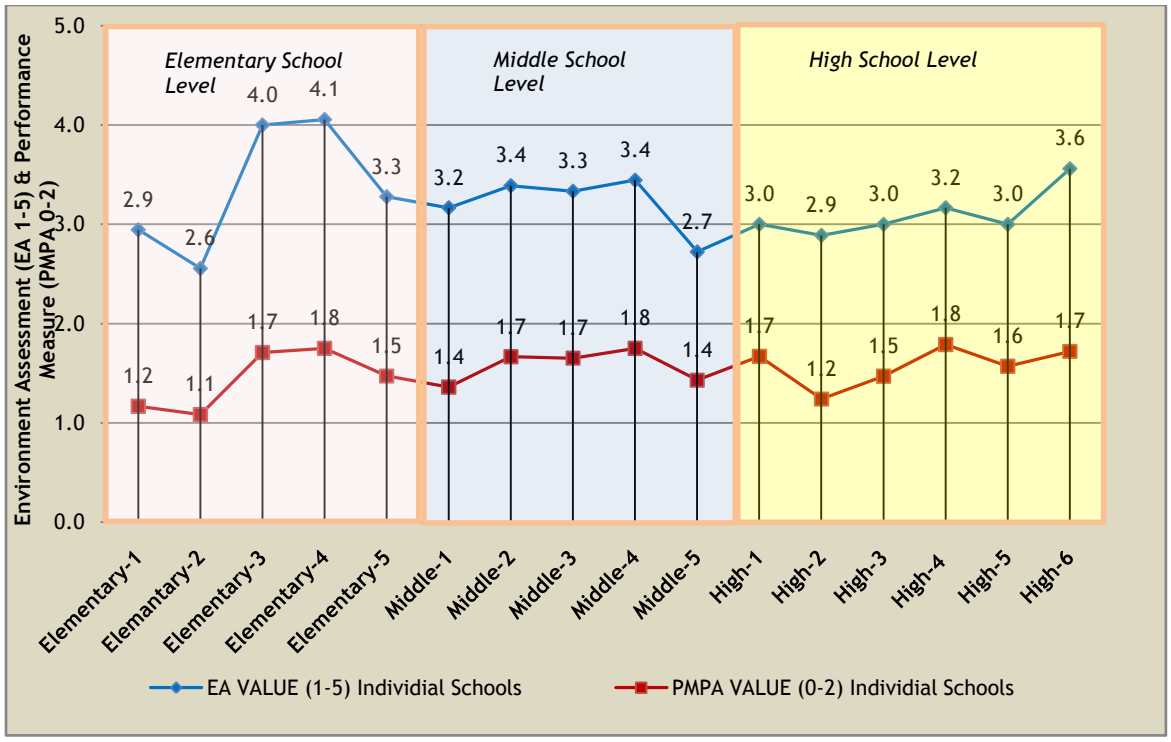

Figure 3. Graphical Representation of Environment Assessment (EA) and Performance Measure (PMPA) Data in Primary, Middle and Secondary School

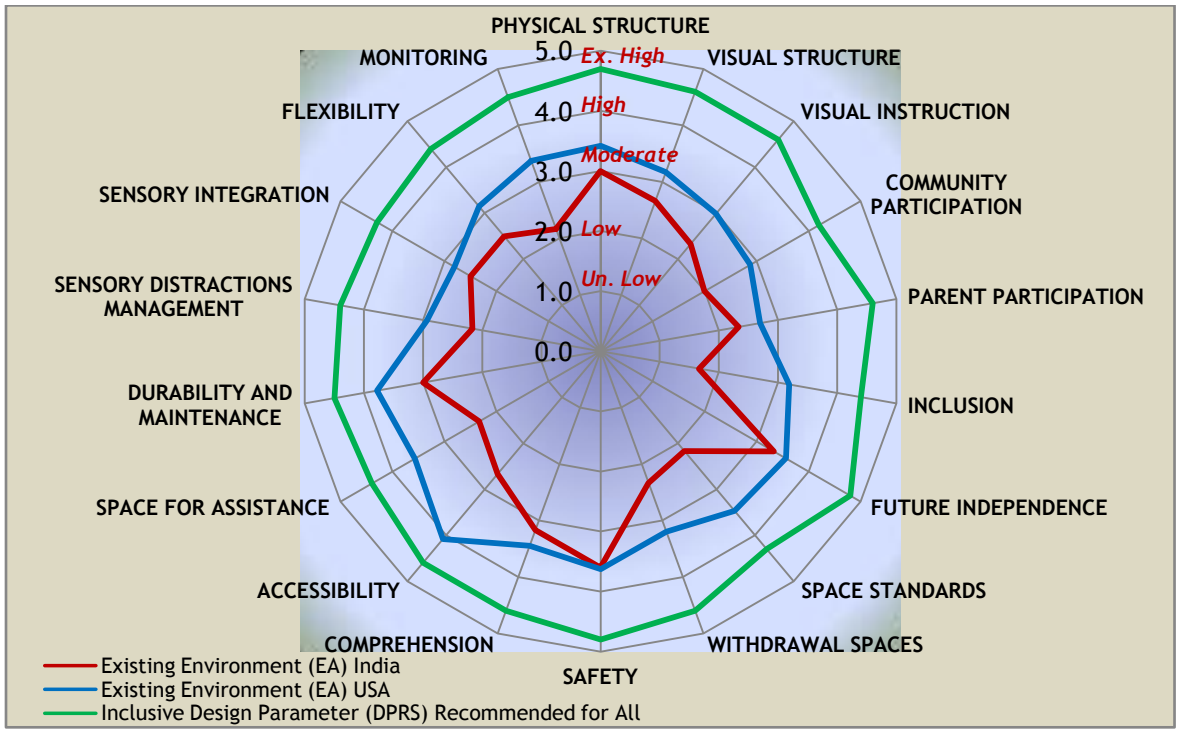

Figure 4. Graphical Representation of Comparative Analysis of Existing Environment in India, in the USA and Recommended Inclusive Environment for Children with Autism

The environmental design parameters are ranked high by educational experts who work with children with autism, as well as able-bodied children using 'design parameter rating scale'. 95.3% autism experts and 86.3% regular education experts rated the design parameters as highly recommended on a five point scale. This confirms that the design issues are not only favorable for kids with autism but are also beneficial for all school children. Universal consequence of the design parameters to the educational environments is furthermore defined by the mean values of 'design parameter rating' by autism and regular education experts, that establishes equilibrium between environment and the demand of all users with and without autism. Figure-4 illustrates this mean value as universally beneficial, inclusive, autism friendly, recommended value for design for all.

When compared with existing environment in India and the USA, it is observed that existing schools comply with the recommended value up to 56% in India and 71% in the USA. This shows cross-cultural validity of the parameters. Teachers in both countries feel that the environment is important for children with autism, and have arranged their class room according to the knowledge and resources available to them. This is encouraging, but unfortunately most of the other areas in the school buildings designed by architects do not show sensitivity to the needs of children with autism.

4.0 Conclusions

Behavior of every child with developmental disability is impacted differently, but all children are at first the learners and at second the disabled and their education in inclusive environment, should be based on what they can do and not on what they cannot, to make it a successful experience (Mullick & Khare, 2008). The present multidisciplinary, multistage research uses pre-established multilayered environment-behavior research methods, to generate new evidence based knowledge to design autism friendly inclusive educational spaces. It explores the effects of physical environment on functional performance of children with autism that could be extended in various directions in future, to better understand the relationship.

The research has studied the overall impact of eighteen parameters in improving performance, future studies could further elaborate by studying effect of every individual parameter, on behavior of children with autism. The findings could be further strengthened by doing environmental interventions to study the impact of enabling environment on

performance of children with autism. For developing countries, economic implications of the environmental design parameters could also be explored in future studies. Low cost and simple universal design solutions could be developed to help pupils with autism, using available resources, indigenous material, technology and skills.

The research process adopted present study is expected to have a strong acceptability in wider audience. This is because the study provides an evidence based argument for universal application for children with autism as well as able-bodied children. Similar research process may be adopted to explore potential of design for children with other cognitive disabilities and identify universally beneficial enabling features for them in educational spaces. It could also be applied to the other areas in environment design, like furniture design, product design or other types of buildings, like residential care buildings or rehabilitation centers.

The research process adopted in the present study employs multi-disciplinary, multi-stage multiple research approaches in orderly way, to achieve the research objectives. The sequential progression in the study stands on accumulated body of knowledge, to produce enabling environment for children with autism. The research process adopted may be useful for those studies that aim to generate new evidence based knowledge, to design supportive, accessible and inclusive environment that teaches all children that they are valued members of our society and their contributions are important.

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