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TEACCH Intervention for Autism

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1. Introduction

Education is one of the fundamental factors for development. It enriches people's understanding of themselves and the world. It improves quality of life and leads to broad social benefits to the people and society. Education raises people's productivity, creativity and promotes entrepreneurship and technological advances. No country can achieve sustainable economic development without investing in education. The ultimate goal of education is to help a person become responsible, independent, and contributing member of the community to which he or she belongs. For children with special educational needs, education aims to maximize their potential and help them become well adjusted individuals.

Autism is a developmental disorder that affects a child's perception of the world and how the child learns from his or her experiences. Even among the most complex disabilities, autism remains an enigma. Autism is the most frequently occurring form of a group of disorders known as Autism Spectrum Disorders (ASD). The Autism Society of America (2006) defines autism as a complex developmental disability that typically appears during the first three years of life and is the result of a neurological disorder that affects the normal functioning of the brain, impacting development in the areas of social interaction and communication skills. Both children and adults typically show difficulties in verbal and nonverbal communication, social interactions, and leisure or play activities. One should keep in mind however; that autism is a spectrum disorder and it affects each individual differently and at varying degrees. Autism affects essential human behaviors such as social interaction, ability to communicate ideas and feelings, imagination, and establishment of relationships with others (National Research Council, 2002). Children with autism may also show abnormal responses to sensory stimuli, such as touch, sounds and sights.

There are several goals for the education of children with autism. These goals emerge from the universal belief in education for all children and what can be taught to children with autism. Education provides opportunities for acquiring knowledge and abilities that enhance personal independence and socially responsible behaviour. In comparison with neurotypical children, a child with ASD may need to be taught different behaviours in order to manifest independence and responsible participation in the community.

Neurotypical children learn many behaviours without direct teaching, but this is not so with children who have autism. A young autistic child may have rote learned to count but may not be able to name things that he uses daily. As he grows older, he may be able to operate electronic equipment but not be able to dress appropriately. Hence, educational goals for

these students, as part of addressing independence and social responsibility, needs to address language, social, and adaptive goals that are not part of standard curricula. Education must foster acquisition of not only academic but also social adaptive skills, language and communication and reduction in problem behaviour in such children (Lal, 2005).

Studies show that children with autism respond well to structured educational program tailored to their specific needs. The severe challenges that some of them face is best addressed by an educational program that follows the behavioural approach, and is implemented in one to one or small group sessions (Vismara & Rogers, 2007; Lal & Lobo, 2007). Children with autism have difficulty with abstract, language-based, conceptual tasks that require sequencing and organization. Typical methods of teaching such as verbal explanation, demonstration and modelling may not be successful due to social, communication and limited imitative behaviours in the children. Conversely, tasks that are visual in nature and rely more on eye-hand integration, spatial, or motor capacities are better comprehended and enjoyable for them. It is possible to capitalize on these strengths while remediating the weaknesses. Thus, if tasks, even those that are verbal and conceptual in nature, are structured for the child so that both what is expected and how to achieve it is apparent from visual characteristics, teaching and learning the tasks is easier (Schopler et al, 1998). Structure in teaching and teaching environment addresses the unique features of autism. It enables to children to understand what is expected of them, encourages self control and enhances skills to cope with the ever changing and dynamic social situations. Structured teaching approaches provide familiar, predictable and structured environments that reduce anxiety, promote independence, increase flexibility and tolerance for change (Quill, 2000, as cited in Simpson & Smith Myles, 2008).

TEACCH (Treatment and Education of Autistic and related Communication handicapped CHildren) is a program designed to provide the structure and predictability that children with autism require to function successfully. This chapter presents the findings of a research study conducted in Mumbai, India, to determine the effect of TEACCH based intervention on development of independent work skills in children with autism.

2. TEACCH

TEACCH is an evidence-based service, training, and research program for individuals of all ages and skill levels with autism spectrum disorders. Established in the early 1970s by Eric Schopler and colleagues, the TEACCH program has worked with thousands of individuals with autism spectrum disorders and their families. The TEACCH approach includes a focus on the person with autism and the development of a program around the person's skills, interest, and needs. The TEACCH priorities centre on understanding autism, making necessary adaptations, and selecting strategies for intervention that utilize the person's existing skills and interests. The TEACCH program emphasizes individual assessment for understanding the person. It also believes in the 'culture of autism', suggesting that people with autism are part of a distinctive group with common characteristics that are different, but not necessarily inferior to others (Mesibov et al, 2004). Understanding the culture of autism requires understanding persons with autism as they are and to develop program to suit each person's functioning level.

By accepting the culture of autism TEACCH program works toward changing the structural norms to facilitate inclusion of persons with autism, rather than moulding them into an

existing normal model. Because some of the neurological issues that contribute to autism characteristics are irreversible, TEACCH intervention does not aim to 'normalize' a child with autism. In stead, the long term objective is to help the child develop into an adult who can function well in the environment.

Structured teaching is an important component of the TEACCH program. This is because structure suits the 'culture of autism' more than any other technique.

2.1 TEACCH principles

Given the cognitive and behavioural features of autism, the TEACCH program has developed ways to help children with autism function in the culture that surrounds them. The educational program recommended by TEACCH is founded on principles discussed below.

- Strengths and interests:
  All children have strengths and interests that can be used for teaching them. In case of autism, the child's attachment to certain colour, for example, may be made functional by marking the key aspects of his/her work in that colour. Preferred activities/objects can be used as rewards when the child completes or learns a task that is new or complex in nature. Similarly, a child's compulsion to complete tasks in a set sequence may be tapped for teaching him or how to use checklists for a range of activities such as, personal care, household chores and classroom routines etc.

- Ongoing assessment:
  All children have the potential to develop and learn. From the severely intellectually impaired nonverbal autistic child with issues in personal care and aggression, to the high functioning child with autism who can read, write and function satisfactorily in school, all of them have gaps in skills and have potential for progress. The TEACCH educational program is designed by observing children's approach to a variety of materials, directions, and activities, presented in different modalities and different amounts of structure. Special attention is paid to communication, self care, vocational and recreation skills (TEACCH Autism Program, 2011).

- Assistance in Understanding:
  Children with autism have difficulty in understanding the meaning of their experiences. This often is central to the problems faced by them. Teachers and caregivers cannot assume that the children would automatically understand why they have been asked to do certain things, or how the behaviours taught to them are related to what is being expected from them. Even the high functioning children are uncertain about expectations and customs in a particular social situation. The educational program supports and enables the children to deal with confusing and hard to interpret situations. This also reduces challenging or noncompliant behaviours that may emerge due to lack of understanding about expectations.

- Parent collaboration:
  Parents and family are important to the educational planning. The program is sensitive to the home environment. Hence, it includes the wishes and life styles of the child's family as significant elements. Parents are consulted with regard to specific ways to dressing, eating, or spending leisure time, and these are incorporated in the program as teaching goals for the child. This helps the children in functioning effectively in environments other than the classroom.

- Individualization:
  Providing for individual differences is a key element of TEACCH educational program. Children with autism often do not learn well in a group due to the differences in skills, difficulty in learning by imitation, and idiosyncrasies. Also, strength on one area may not correlate with performance in other areas. For example, good visual perception may not correspond with their ability to read facial expression. Similarly, expressive ability can mask significant receptive language deficits. Many children who are able to do grade level academic work may not know how to other functional tasks such as personal care and hygiene. On the other hand, some children with significant intellectual disability may have abilities (e.g. solving puzzles, painting, and singing etc.) that do not match with their cognitive functioning. A teacher using the program should know the children well and be prepared to teach them at different levels in different areas.

2.2 Structured teaching

Structured teaching is an approach in instructing children with autism. Structure, according to dictionary, is the action of building or constructing--arranging things in a definite pattern of organization. Structured teaching allows for implementation of a variety of instructional methods (e.g., visual support strategies, Picture Exchange Communication System – PECS, sensory integration strategies, discrete trials etc.). Structured teaching is based upon an understanding of the unique features and characteristics associated with the nature of autism. It describes the conditions under which a person should be taught rather than 'where' or 'what'. It is a system for organizing environments, developing appropriate activities, and helping people with autism comprehend what is expected of them. Structured teaching utilizes visual cues which help children with autism focus on the relevant information which can, at times, be difficult for the person with autism to distinguish from the non-relevant information.

Structured teaching addresses behavioral deficits in a proactive manner by creating appropriate and meaningful environments that reduce the stress, anxiety and frustration which may be experienced by children with autism. Deficits in behavior may occur, due to the following characteristics of autism:

- Language and communication difficulties:
  Autistic children have great difficulty in understanding spoken words. They have trouble understanding that words relate to objects and activities. Abstract words are extremely challenging because they are not linked to something tangible that can be inspected and pointed to. Without concrete visual connections to objects or activities, words are nearly impossible for them to understand. Processing language involves taking in speech sounds that one hears and converting them into patterns of understanding. Children with receptive language difficulties and language processing problems may not be attentive when someone is teaching and/or may not be able to follow long strands of directions. When given a task to complete, they may forget what they were asked to do or be able to complete only a few steps
  Several researchers have identified *joint attention* and *symbol use* as the core deficits in the area of language and communication (Sigman & Ruskin, 1999; Wetherby, et al., 1998; Jordan, 2003) for children with autism. Joint attention reflects the difficulty in coordinating attention between people and objects and is evident by deficits in

orienting and attending to a social partner; shifting gaze between people and objects; sharing feelings with another person etc. Symbol use reflects difficulty in learning conventional and shared meanings for symbols and is evident in deficits in using conventional gestures; learning conventional meanings for words; and using objects functionally and in symbolic play.

- Social relations difficulties:
  As they grow, babies learn how to be social and interactive by watching how others talk, play and relate to each other. They enjoy the give-and-take of social engagement and will initiate, maintain and respond to interactions with others. In fact, they seek out these interactions. Children with autism, however, often do not show the expected development of early social interaction skills. They seem not to have the same "drive" to interact socially as their peers do. These social impairments affect children's interactions with adults as well as with other children. They affect children's ability to initiate interactions with others as well as to respond to interactions that are initiated by others. Many children also show profound *empathy* deficits. They develop a limited appreciation or no appreciation at all, of other people's feelings and ideas. To the severely autistic children, their own feelings and ideas are the only feelings and ideas that appear to exist. Autistic children may have no reaction to another person's crying, for example. They may have no idea that their words and actions affect other people. Many autistic children are completely unaware of their surroundings and other people in their surroundings. It is impossible for some autistic children to take another person's perspective without deliberate training. For individuals with autism, it does not come naturally to consider other people's perspective. This makes it difficult for them to understand how others think and feel (Richard 2000). Clinicians and researchers call this inability to consider others' perspective as deficit in *theory of mind.* Theory of mind, the ability to attribute mental states to self and others in order to understand and predict behaviour, is an area of weakness among individuals on the autism spectrum. *Play* is considered a key social behavior. As children with autism have trouble in symbol use, joint attention and understanding others' perspective, participating in pretend play and using imitative skills are difficult for many of them.
- Sensory processing difficulties:
  Sensory processing is the way our central nervous system receives and understands the meaning of sensations (Miller, 2000). Children with autism tend to have extreme reactions to sensory stimulation. Their senses may become hypersensitive (over-sensitive) or hyposensitive (under-sensitive). *Hypersensitive* children find themselves overloaded with even moderate levels of sensation, and work to block out sensory inputs such as light, sound and touch. *Hyposensitive* children, on the other hand, are not stimulated enough by normal sensory inputs and typically seek out extra stimulation. Children who are hypersensitive to touch sensations may tantrum when they are touched, while hyposensitive children may crave and seek out strong hugs that provide deep pressure. Children with high pain tolerances may injure themselves quite significantly but carry on as though nothing has happened, while oversensitive children may find simple touches or textures to be intolerable.
- Resistance to change:
  Children with autism have a propensity to establish and enforce routines. A lack of completion of the activity in a routine can lead to distress and anxiety. Researches indicate that insistence on completing an activity in a particular way may be the child's

attempt to find patterns and look for rules and organization within environment (Baron-Cohen, 2002). Once a pattern has emerged it must be maintained. Thus, establishment of a routine ensures that there is no opportunity for change. Clinical evidence suggests that the routine becomes more dominant and elaborate when the person has recently experienced changes in the key people in their life, accommodation, daily routine and expectations or when they display signs of anxiety. The anxiety may be due to apprehension that they are unsure how to socialize and may make a mistake, and not knowing if there will be a change in routine or expectation. The students may resist the change by complaining or resist with their behaviour by becoming aggressive or defiant. They may tantrum or become agitated. Too many unexpected changes in the day may cause them to be overwhelmed and experience a 'melt-down.'As a person matures, the insistence on routine tends to diminish, but change is never easily tolerated.

- Organizational difficulties:
  Organization requires integration of several elements and arranging them so as to achieve a preset objective. Since children with autism experience problems in integration of information into a cohesive whole, they have poor organizational skills. It is difficult for them to focus on the immediate task and the desired outcome (Mesibov & Shea, 2003). Sequencing requires similar skills. Hence, it is not unusual for such children to perform a series of tasks in illogical order, and to be unaware of it. This shows that while they have learned the steps of a complex process, they do not understand the relationship among the steps or the importance of each step with regard to the final outcome.

- Distractibility:
  It is common for children with autism to experience problems in attending to specified stimuli such as, colours or shapes etc. Paying and sustaining attention to a task is difficult. Similarly, knowing what to attend to and shift attention from one stimulus to another when required is a challenge too. This is especially problematic when fast and multifaceted social exchanges take place (Simpson, et al., 2008). Distractibility is also caused by the inability to integrate sensory information. A child may pay attention to a teacher's hand rather than what he/she is showing him; or pay attention away from the task to a sound that is so soft that the teacher does not even hear. At times, need for repetitive behaviours also cause distractibility in such children. Whatever the source of distraction, the children have difficulty in prioritizing the importance of external stimulation or internal needs in the process of doing a task.

- Concrete thinking:
  Regardless of their cognitive level, children with autism experience problems with symbolic or abstract language concepts. Straightforward facts and descriptions are grasped better. They often do not understand that word meanings may change according to the situation in which they are used. Hence, it is difficult for them to follow the humour in jokes, criticism in sarcastic remarks, and the message in idioms and adages. A high functioning student with autism may explain the meaning of "a bird in hand is better than two in bush" as "it is easier to hold one bird in the hand. A bush is big, so it is not easy to hold birds while they are in the bush. Our hands are not so big"

- Difficulty with generalizations:
  Children with autism are often unable to apply to learned skill to different situation. For instance, a child who has learnt to put on socks may refuse to put them on if the

socks given are of different colour than the ones used during training. Similarly, the children may learn to wash plates, but do not understand that dirty trays can be washed in the same manner. They also often learn the literal wording of a rule, but not understand its underlying purpose, and so have problems applying the rule in different settings. A child who did not understand physical space, used to stand very close to people when talking to them. He was told to stop four feet away from them before speaking to them. He understood this, but became concerned with measuring how far he was from people than speaking with them. Also, he insisted on keeping this distance even while talking to his parents. He had obviously not understood the concept of physical space behind this rule, and that the rule did not apply to all situations in a similar manner.

2.2.1 Elements of structured teaching

The use of structured teaching has been central to TEACCH program since its inception more than four decades ago. The elements of structured teaching include physical organization, schedules, work systems, and task organization. A brief description of each is provided below.

- Physical Structure:

  Physical structure refers to the actual layout or surroundings of a person's environment, such as classroom, play room, home etc. Children with autism have difficulty differentiating between dissimilar events and seeing how distinct activities relate to one another. The physical boundaries are clearly defined with activity labels like music, work, play, snacks. The use of consistent, visually clear areas and boundaries for specific activities enables children with autism to better understand their environments and relationships between events. The teacher should consider classroom goals for the child and then allocate specific areas for major activities. Planning physical structure depends on curricular goals and child's individual needs. Since children with autism have difficulty differentiating between dissimilar events and seeing how distinct activities relate to one another, a clearly organized classroom helps in learning important concepts. It also teaches independence and alleviates anxiety caused by ambiguity and transition. Physical structure is essential for a number of reasons: Physical structure provides environmental organization for children with autism; clear physical and visual boundaries help the person to understand where each area begins and ends; and the physical structure minimizes visual and auditory distractions. The amount of physical structure needed is dependent on the level of self-control demonstrated by the child, not his cognitive functioning level. As children learn to function more independently, the physical structure can be gradually lessened.

- Schedules:

  Schedules are important aspect of structured teaching. They are visual cues that tell the children what to expect through the day. They explain the sequence of activities that would occur during the day. Like the physical structure schedules help the children in comprehending the difference between events and how each event relates with another. Visual schedules are beneficial for children with autism in improving the sequential memory, receptive language, and attention problems. Schedules help children in predicting daily or weekly events. They aid in transitions which are often very difficult for autistic children. Schedules can motivate children to complete a task that they do not want to do because they can see a favorite activity follows soon after the less

preferred tasks. Visual schedules can be presented in written (for more capable children) and pictorial (for non readers) forms. Those children who need a high degree of concrete structure may use object schedules.

- Work Systems:
  Physical structure and schedules enable children with autism to understand where to go and what to expect during the day, work systems tell them what they should do in their assigned physical areas. Work systems are essential for teaching independent work behavior. Through work systems children know the behavior expected of them in work activities. Systems help in organization and completion of tasks. Work systems provide four types of information: work that is to be done; how much work to be done; indication of when the work is completed, and what happens after a given is done. Work systems can be made to suit the needs of children on individual basis. Like schedules, work systems can be presented in written as well as pictorial forms. This is helpful as the visually clear task components with predetermined number of material and defined end points enable children to understand how to start and complete the tasks. This organization facilitates independent work behavior.

- Visual Structure:
  Children with autism are visual learners (Lal & Bali, 2008). They do their work better when instructions are presented visually. Visual structure refers to visual organization, clarification and instruction pertaining to tasks. When a task is presented in clear visual form it is easier for the children to identify its features. Since visual information is concrete and less dynamic, children learn the task easily. Similarly, visual organization also facilitates information processing. Task elements can be so organized that sensory overload is avoided. Visual instructions are graphic representation of task steps. Visual instructions are also helpful in explaining the daily routine to the children.

2.3 TEACCH teaching method

The TEACCH instructional method is broadly based on the principles of applied behavioural analysis. It recommends breaking the learning task into small steps that must be taught with prompts and the learning behaviour to be shaped with use of reinforcers

- *Instructions*: They consist of directions given to a child regarding the task that has to be done. Instructions may be verbal or nonverbal. The mode is instruction is selected to suit the functional level of the child. If instructions are verbal, the teacher should avoid using too many words or long and complex sentences. Use of phrases and telegraphic language help the child focus on key element of the instruction. For example, in stead of saying 'I want you to go to the wash room and clean your hands well before sitting down for lunch' the teacher may instruct a child to 'wash hands, and then eat'. This telegraphic statement will be understood better by the child than the earlier long sentence. When instructions are given nonverbally they are accompanied by contextual and visual cues. Providing only the materials that the child needs to use for a specific task and presenting them sequentially enable the child to understand not only their relevance for each step of the task, but also learn to work independently. For example, if paper, paint brushes and colours are kept on the work table, it is easy for the child to understand that the teacher expects him/her to paint.

- *Prompts*: A teacher uses prompts to shape a child's behaviour to the desired level. Prompts help a child to complete a new task. Different types of prompts may be used.

Physical prompts are used to give manual assistance in task completion; verbal prompts are reminders for a task; gestural prompts are signs or actions that point to or demonstrate the task; and visual prompts may use pictures/symbols/colour cards to cue the child to the task. Prompts should be used systematically. They must be offered before the child responds incorrectly. Decision regarding the prompt level depends on the child's functioning. It is important for the teacher to ensure that unintentional prompts are not given (e.g. slight movement of head, eyes or hand may amount to gestural prompt when such a prompt is not planned). It is as important to withdraw the prompts when the child learns to do the task in order to prevent prompt dependence in the children.

- *Reinforcement*: Behaviours that are reinforced positively are likely to be repeated. Typically growing children are motivated to work because of the praise they may receive from others, intrinsic satisfaction of working and a sense of achievement when the task is completed well. Children with autism may not be motivated by any of these. However, there are items and activities that do motivate these children. The teacher needs to determine what interests and motivates a child. Some children may like a particular toy, a book, an object, or a food item where as others may find activities more interesting. An important aspect of reinforcement is that it should be given immediately after the child emits a correct response. Praise and social rewards should accompany tangible reinforcers. This pairing increases the desirability of personal contact for the children with autism and makes people greater sources of reinforcement in the future.

3. Research support for TEACCH

As an intervention approach for autism, TEACCH program has been well researched. Several empirical studies, conducted across countries have established the program's efficacy for children with autism and other severe developmental disabilities. In a longitudinal study, Tsang and colleagues (2007) evaluated the usefulness of TEACCH program on 34 children from a pre-school in Hong Kong. This experimental research provided TEACCH intervention to 18 children while 16 control children continued with the regular training. The study lasted for 12 months. Children's cognitive, social adaptive functioning and developmental abilities were measured prior to intervention, during intervention and post intervention. The intervention group children showed better outcomes at post test. They also showed progress in developmental domains during intervention. Hume, et al (2009) examined the effects of work system on independent work and play skills of students with autism. A Single subject 'withdrawal of treatment' design, with replications across three participants, was used to assess the effect of intervention over on task behaviour and work completion skills of the students in classroom and employment settings. Observational data indicated that all students showed increases in on task behaviour and in the number of task completed or play material used, and reduction in teacher prompts. Siaperas & Beadle-Brown (2006) report the outcomes of a study conducted by the Greek Society for the Protection of Autistic People in which 12 autistic residents in an institution were taught using the structured teaching approach. After the 6 month intervention period the subjects showed significant improvement in personal independence, social abilities, and functional communication abilities. Kusmeirski & Henckel (2002) determined the effectiveness of TEACCH program on reduction of maladaptive behaviour and enhancement of independence in functional activities. Four children with autism, of 8 to

13 years, residing in a residential institute were studied. Baseline data were collected for 30 days followed by 30 days of intervention to two children. Results indicated that use of TEACCH schedule decreased maladaptive behaviour in one child, while the other child improved on the ability to independently complete functional tasks.

Some studies have assessed the benefits of TEACCH program in family environment. Hungelmann (2001) evaluated a home program in which parents of children with autism were taught how to implement structured teaching in the home. The study included baseline sessions, treatment sessions, home visits and follow up sessions. Results indicated that children demonstrated significant gains in task mastery as they progressed through the TEACCH program. Parents who participated perceived the program as an effective means to remediate their child's deficits. Similarly, Malhotra, et al. (2002) published the results of a study conducted with parents of children with autism. The treatment methods were drawn from TEACCH protocol. The parents were taught how to use behavioural strategies for enhancing eye contact, reduction of maladaptive behaviour, structuring time, activities, and physical environment. Parents were trained in using the techniques, educated about the nature of their children's disorder, and counselled to deal with the emotional fall out of the diagnosis. Subsequently, 5 children were given TEACCH based intervention for 3 to 6 sessions of 45 to 60 minutes each. Results showed that the parents found the intervention helpful for the children and themselves.

4. Method

The study employed a one group - pre test - post test experimental design, and was conducted on children with autism enrolled in schools in Mumbai.

4.1 Subjects

Children enrolled in four schools were considered for the study. As per the school records a total 27 children manifested autistic features. Administration of DSM –IV and Childhood Autism Rating Scale identified 21 of the 27 children as having autism. A random selection of 12 children was made from this group. The selected children were within the age range of 8 to 12 years.

4.2 Instruments

The Scale of Independent Work Skills (SIWS) and TEACCH based intervention program were the main instruments used in the study. They were developed for the purpose of the research. A brief description of both is given below.

- *Scale of Independent Work Skills*: SIWS was used as a measure at pre and post tests. The instrument measured behaviour under four main domains, namely conceptual skills, daily living skills, pre-vocational skills and self engagement activities. Each domain consisted of items stated in behavioural terms. The authors used the following steps in the development of SIWS: (a) *generation of item pool* was effected by reviewing instructional goals and objectives of educational programs followed in inclusive schools in Mumbai. In addition, observation of classroom work and social behaviours, and discussion with teachers contributed to the process of item generation; (b) *review of items* was done by experienced teachers and domain experts. This was done for determining the content validity of the instrument. Items that were accepted by all reviewers were

retained; (c) The draft was subsequently *pilot tested* on children with autism. This resulted in addition, deletion or modification of some items. Two items were changed within the daily living domain; a few more were added to the pre-vocational domain. The SIWS consisted of several items based on educational goals pre set for the children. Hence, the ability to sort and arrange objects according to shapes, colours, sizes and patterns were assessed under conceptual skills; daily living skills were measured by manifestation of such behaviours as self care, cleaning and washing of items of daily use; pre-vocational skills included the ability to fold, cut, insert, string and staple etc., and finally solving puzzles and completing given task on worksheet comprised the activities of self engagement. The SIWS used a 5-point scale to measure children's response on the basis of the level of prompts required by them. The rating was given as per independent response, symbol prompt, picture prompt, gesture prompt, and physical prompt, with independent response earning 5 points and physical prompt 1 point respectively. The SIWS had a total of 34 items, with a maximum attainable score of 170. The scale had a test – retest reliability coefficient of 0.82.

- *TEACCH based intervention program*: The program was premised on the principles of structured teaching. Though structured teaching has several components such as physical organization, schedules, work systems and visual structure and information, the study used only two components, namely work systems and visual structure. Since the children were selected from different educational settings and were available only for intervention sessions, it was not possible to accommodate changes in either physical organization or daily schedules of the respective settings. The intervention consisted of teaching of independent work behaviours. For each child at least 5 activities were selected with at least an activity each from what could be included under conceptual, daily living, pre-vocational and self engagement skills. A child's functioning level also determined the selection of activities for him/her. For example, making of sets (as per a given number) was not chosen as an activity for a child who had not learned counting. Each child was given 15 sessions of structured teaching. A session was of 30 minute's duration. The first two sessions were used for demonstration of skills to be learned. Task material was presented in boxes/trays (refer to figures 1,2,3,4,&5) that provided definite boundaries. Boxes/trays had visual cues, and the material within were so arranged that activity moved from left to right. Generally, a task had a 'finished' symbol placed at the extreme right to indicate completion of the task. Reinforcement was chosen as per individual preferences of the children

4.3 Procedure

The intervention began after the children were pre tested on SIWS. A typical intervention session proceeded in the following manner:

- Work table was prepared in advance with only task material set on the table
- Teacher sat next to the child and gave telegraphic instructions, e.g. 'sort beads'
- Each task had a visual symbol that denoted the activity, e.g. sorting task had coloured symbols, matching with that of the beads, near the bowls where sorted beads would be kept
- The child was prompted (pictorial, gestural or physical) to comply with the instruction.
- Rewards were presented after the child had reached 'finished' symbol

Fig. 1. Colour Sorting Task

Fig. 2. Shape Sorting Task

Fig. 3. Paper Stapling Task

Fig. 4. Daily Living Task

Fig. 5. Bead Stringing Task

Each activity was done twice during a session. The intervention focussed on teaching the skills measured by SIWS. However, the activities selected for intervention were different from those in SIWS. As the children learned the activities, they were asked to do the activity once with the task tray and then without the task tray during a session. A record of behaviour was maintained for each child. At the completion of 15 sessions, SIWS was administered again.

5. Results

The study aimed to determine the effect of TEACCH intervention on independent work behaviour of 12 children with autism selected as subject. At the end of intervention period the authors could see the change in the children's ability to understand and perform selected tasks independently. This general observation was supported by the data from SIWS re administration. The use of t-test was justified as the children were selected randomly. The SIWS measured behaviour on four subareas consisting of conceptual skills, daily living skills, pre-vocational skills and self engagement activities. An analysis of the composite mean score on SIWS at pre and post tests along with the scores on each subarea is presented below.

MEAN	N	df	t-value	Significance
113.17	12	11	8.4	P<0.001
129.67	12			

Table 1. Comparison of Composite Mean Scores on SIWS at Pre and Post Tests

The composite mean score on SIWS at pre test was compared with that at post test (refer Table 1.). The post test mean (129.67) was significantly higher than mean (113.17) at pre test as shown by the resultant t-value (8.4, df=11, p<0.001). In Figure 6, a detail comparison of each child's performance shows the positive effect of TEACCH intervention.
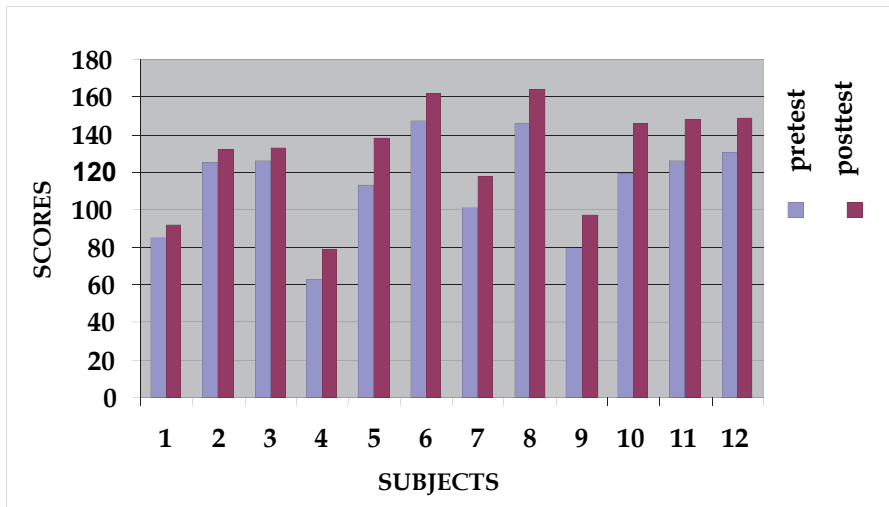
Fig. 6. Children's Composite Scores on SIWS at Pre and Post Tests

As seen in Figure 6, TEACCH intervention enhanced the independent work skills of all children. Each of the 12 children improved their performance, though some gained more than the others. This variance in gain could be due to the initial differences in their functioning levels.
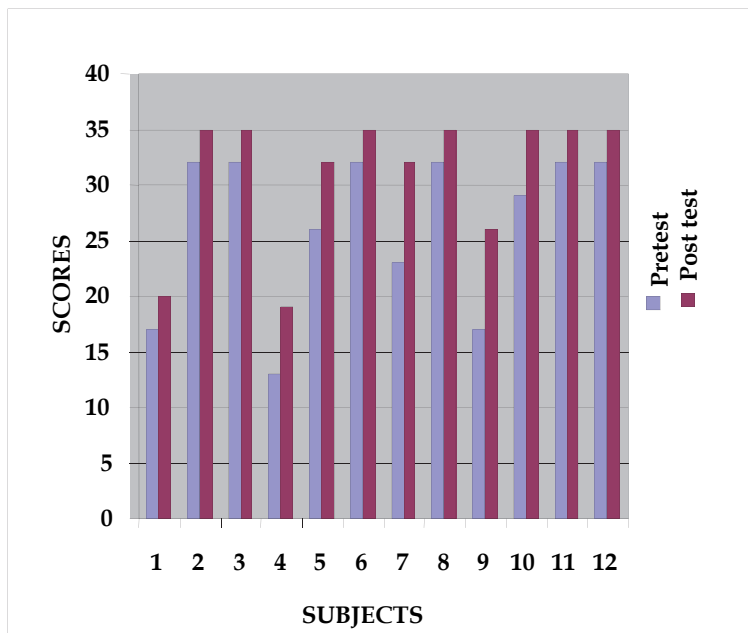

Fig. 7. Children's Scores on Conceptual Skills at Pre and Post Tests

The children's scores on selected component skills of independent work behaviour were analysed to assess the effect of intervention across all components. On conceptual skills, the pre test mean score of 26.42 was significantly lower than their mean score of 31.17 post intervention as evident from the derived t- value (6.92, $p<0.001$). A description of how each child performed on conceptual skills at pre and post tests may be seen in Figure 7.

A positive change in conceptual ability was seen in all children. For some children the gain conceptual skills were higher in ratio to their composite scores (ref. Fig 6). Subject 1 and subject 9 showed a marked improvement (increments of 3 and 9 points respectively) in this area in comparison to their overall gain on SIWS. Similarly, subject 4 and subject 7 also showed considerable change from pre to post test.

Further analysis of SIWS data revealed an improvement in daily living skills too. The children showed a gain in mean score of more than 4 points from 36.25 (pre test) to 40.33 (post test). This gain was found to be statistically significant (t value= 2.56; $p<.05$). Analysis of individual raw scores at pre and post tests brought out a gain pattern different from that for conceptual skills. Figure 8 represents this gain graphically.
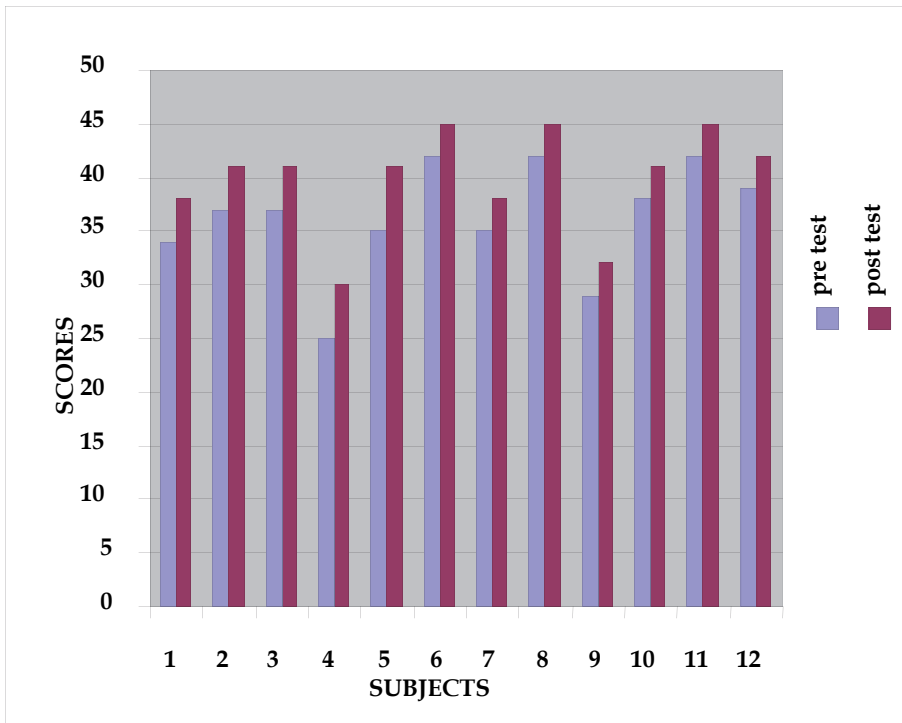
Fig. 8. Children's Score on Daily Living Skills at Pre and Post Tests

As can be seen from Fig.8 the gain in daily living skills was almost uniform. Though all children improved their score post intervention, the difference between the pre and post test score was not as much as seen in other areas.

With reference to pre vocational and self engagement activities too, the children showed an overall gain. Individual performance of each child on pre vocational activities is presented in Figure 9.
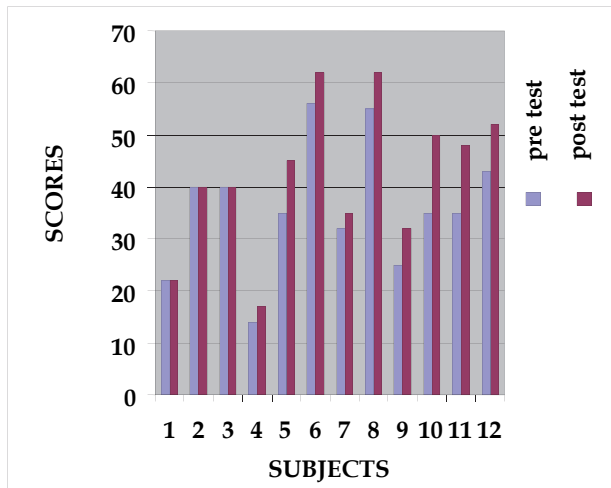

Fig. 9. Children's Score on Pre Vocational Activities at Pre and Post Tests

The pre test mean score (36.00) on pre vocational activities was lower than the mean (42.08) post intervention. Though some children did not show any change in their performance post treatment, the overall gain was statistically significant (t value=4.16; p<.002). On self engagement activities too improvement in behaviour was evident. However, this was not found statistically significant. Individual performance is presented in Figure 10.
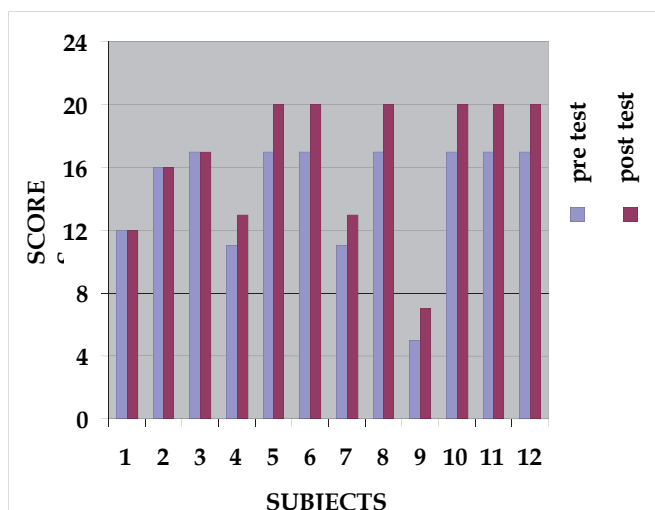
Fig. 10. Children's Score on Self Engagement Activities at Pre and Post Tests

6. Discussion

There are behaviours that neurotypical children learn on their own, but children with autism require to be taught. Increased independence and the ability to manage one's own behaviour and task performance continue to be areas of concern for children with developmental disabilities. Development of work skills, positive work attitude and acceptable work behaviour is one of the educational aims for students with special educational needs. Students with autism have difficulty independently initiating work; continue working and seeking new work when a given task is completed. Independent work behaviour does not persist without supervision. Hence, early development of independent functioning skill is considered important for children with autism.

An effective classroom for such children provides a physical structure that facilitates learning, and teaching methods that help language acquisition, social and academic skills and behaviour management. Educational strategies that provide structure and predictability to the learning process, allowing children to anticipate task requirements and set expectations, and teach a variety of skills across content areas in the natural environment are useful for children with autism (Earles-Vollrath, et al. 2008).

Children with autism are visual learners. Environmental supports that include use of labels, boundary settings, visual schedules, behaviour based communication tools and activity completion signals enable them to respond more appropriately in day to day activities by increasing independence and conceptual understanding. The specific learning characteristics of children with autism, namely, distractibility, difficulty in organization, sequencing and generalization, require that intervention be designed around specific strengths (e.g. visual-spatial organization) and needs (e.g. structure and predictability) of such children (Mesibov, et al. 2003). Work systems and visual structure, the two elements of TEACCH approach used by the authors in this study, are premised on these strengths. Effective work systems visually present information so that the child understands what is expected to be done. The authors used pictures, symbols, colours and objects to indicate the task at hand. For a shape sorting task, each shape would be placed in a separate bowl. This would make the task visually clear to the child who when given a collection of shapes, would know what was expected of him/her. Similarly, tasks were visually clear, organized and wherever required included visual instructions. This visual structure enhanced independent work behaviour. Sorting tasks had visually clear shapes or beads that improved visual discrimination easier. Use of trays and bowls (refer fig1 and 2) for keeping the materials rather than spreading materials out on table, helped visual organization. Task instructions were often given through jigs. Jigs are visual representation of how a task is to be carried out. They are helpful because they provide instructions in the way that is easiest for children with autism to understand. As can be seen in Figure 3, the bead stringing task visual instructions included a partial model of the activity to be done and a picture cue for the pattern to be followed. Visually presented stimuli enable the children to process information more efficiently (Lal, 2010). The significant difference between the children's pre and post test scores on SIWS may be attributed to these factors. According to some researches, children with autism experience central coherence deficits (Frith, 1996, Jarrold et al., 2000). The inability to hold information in mind in order to use it later in other tasks is what causes the autistic children to lack central coherence. They cannot hold one piece of

information in mind while manipulating the next step in a sequence (Grandin, 1995). This affects their ability to form concepts. Visually organized and systematic presentation of simple tasks aids development of conceptual skills as the children are able to process information better. Evidence of significant gain in conceptual skills indicated the positive effect of work systems and visual structure used in this research. Oral instructions augmented by visual cues strengthen cooperation and understanding of daily living activities. Pre teaching of such tasks is useful. Pre teaching consists of providing clear reminders to the learner before the skill is to be used (Wheeler, 2007). The authors used picture cards and symbols to denote steps of selected daily living activities. These were pre taught and later used as recall aids when children were asked to do the activities. This visual support enhanced memory and improved independence in task performance. Similarly, work systems, visual clarity, visual organization and visual instructions contributed to the positive change in children's score from pre to post test in pre vocational and self engagement activities. Independent functioning in the four sub variables was evident as children maintained the performance level even when the prompts were gradually faded.

7. Conclusion

Cultivating strengths and interests, rather than emphasizing on deficits is an important aspect of person centred teaching. In case of autism, it is central to intervention. TEACCH based teaching subscribes to this. It respects the "culture of autism" and recognizes that the difference between children with autism and others may work in favour of the former. Their basic strengths in visual skills, recognition of details, and memory, among other areas, can serve as a foundation for independent functioning in adulthood. Drawing on children's interests, however peculiar they may appear to most people, helps increase their understanding and motivation for tasks (Mesibov & Shea, 2003). The results of this study support the above findings. TEACCH based intervention was effective in enhancing independent work behaviour in children with autism. The results of this research may be useful for parents and teachers who are in need of evidence based and suitable intervention for children with autism.

8. Acknowledgment

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