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Chapter 10

Autism and Functional Language Development – An Experiment with AAC Intervention

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Additional information is available at the end of the chapter

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1. Introduction

Communication is the base of human interaction. It is a process of sharing ideas, feeling, needs and desires through spoken and written word, signal, sounds, gestures, signs, pictures, symbols, music and body language Communication lends to the social and cognitive development of human beings. It helps in building relationships, acquiring knowledge, and taking decisions. Communication is a powerful tool, an eloquent weapon, a manipulative agent, a distinctive attribute and as recognisable as appearance of an individual.. From the most primitive to the most modern human being, communication as seen as the means to gain control over one's environment and to take one's personal and social needs forward. The ability to communicate and the selection of mode of communication varies from person to person. The most advanced the ability, the greater the learning capacity, and vice versa. Deficits in communication skills can prevent people from realizing their potentials. A communication deficit or disorder is reflected in the inability to receive and process or interpret and use concepts of linguistic symbol systems.

Autism is a developmental disability that affects the way a child's perceives the world and learns from his or her life experiences. Even among the most complex disabilities, autism remains an enigma [1]. It is the frequently occurring form of a group of disorders known as Autism Spectrum Disorders (ASD). The Autism Society of America [2] has defined it 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. Persons with autism have deficits in verbal and nonverbal communication, social interactions, and leisure or play activities. However, as autism is a spectrum disorder, its effects may vary from person to person. Some may be severely affected and others less so. Occurrence of autism in

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a child may affect such core human behaviours as social interaction, ability to communicate ideas and feelings, imagination, and establishment of relationships with others [3]. Children with autism often are self-absorbed and appear lost in their own world. They are unable to successfully communicate and interact with others. They may have difficulty developing both receptive and expressive language skills. They also may have difficulty in using and understanding nonverbal communication as body posture, hand gestures, eye contact, and facial expressions [4]

2. Autism and the language pattern

In typically growing children, communication and language emerge as an outcome of a neural integrity that helps them function in early social exchanges with parents or caregivers. These interactive behaviours are essential for the cognitive, affective and social growth that lead to development of communication and language skills. In case of children with autism there may be a relationship between atypical central nervous system functioning and impairments in communication and language [5]. The functional differences between typical children and those with autism may contribute to learning styles and strategies that interfere with acquisition of communication and language skills. Language pattern in autism may be understood well in the context of how nonverbal and verbal communication emerge in children with autism

- Nonverbal communication: Typically growing children use non-symbolic strategies for communicating in early infancy. A child may try to get a toy while looking at it and the parent who can help the child get the toy. This intentional communication is the result of infant and parent social exchange and the parent's ability to understand the infant's signals. These signals are manifest in infant's gestures (e.g. pointing and waving) and vocalizations. Children with autism use gestures and vocalization less frequently and with less sophistication than typically growing children. Their gestures often involve contact with people or objects such as leading people by hand or touching the object. Joint attention and pointing are rarely seen. While preverbal children with autism compare favourably to children with developmental delays with respect to production of syllables with consonants, they tend to produce more atypical vocal behaviours such as squeals and yells [6]. Additionally, aberrant or self-injurious behaviours are often used for communication by nonverbal children with autism. These excess behaviours serve a range of functions such as seeking attention, requesting, escaping and showing displeasure and protest. With respect to rate and reciprocity of communication, it is reported that children with autism compare well with typical children in terms of the rate of communication, although their communication is more primitive. However, respondent acts of communication are significantly lesser than initiated communications. This may be due to a limited ability for turn taking in communicative interactions [7].

- Productive speech and language: In verbal children with autism the articulatory and phonological abilities are better in comparison to the overall communication and language

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skills. However, many may suffer with dysprosody, and voice impairments as pitch and volume. These result in monotonous and staid speech patterns. With respect to language, the morphological and syntactical abilities develop slowly but in typical manner. The major difficulties faced by children are in encoding meaning relevant to conversation, meaningful interpretation of verbal messages, semantic confusion specific to temporal sequencing, and poor sensing of semantic relationships.

With the variety of language and communication issues discussed above, children with autism require appropriate and systematic intervention in this area. An intervention is deemed appropriate if it provides improvement in the child's functional communicative abilities. Over the years, development of language and communication skills has become the core of autism intervention efforts. Several methods and strategies have been used. Among such methods is Augmentative and Alternative Communication (AAC) system.

3. Augmentative and Alternative Communication (AAC)

AAC has Alternative and augmentative communication (AAC) includes a variety of methods which support or replace oral language. AAC refers to any attempt to improve communication success through unaided methods such as natural gestures, sign language, and vocalization or through use of such aids as pictures, communication boards, and speech generating devices. According to the American Speech-Language-Hearing Association [8] AAC is as an area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders (i.e., the severely speech-language and writing impaired). It incorporates the individual's full communication abilities. AAC includes the use of visual language modes such as signs, pictures and visual icons representing specific linguistic units. These capitalize on strong visual processing of children with autism. Visual supports are reported to be useful in educational program for children with autism who experience difficulties in acquisition of functional speech or in processing and understanding spoken language & social interaction [9]. Since information provided through visual modes is predictable, static or less transient than words, it improves the autistic child's ability to recognise language input and generate language output [10]. Inability to communicate is often a major factor for emergence of challenging behaviours in children with autism. Training in AAC provides a simple way to communicate basic needs and may lead to a significant reduction in inappropriate behaviour events that hinder learning of social interaction skills [11].

Children diagnosed with autism are unable to verbally express feelings, thoughts and needs. Their struggle to communicate even the most basic needs through nonverbal or verbal modes can be frustrating to them and their caregivers. The lack of adequate communicative behaviour often hampers learning and literacy and creates significant obstacles to social and emotional development and independence. Use of an AAC system can serve as a bridge from a life where thoughts, feelings and needs are held in silence, to a life where interaction, expression and learning are possible. Additionally, use of AAC for children with autism may stimulate brain

development; facilitate access to social information and literacy experiences; reduce the need to communicate through aberrant behaviours, and enhance self-concept [12].

3.1. Types of AAC

While AAC has been categorized as aided and unaided [13], most AAC users and practitioners classify the system as given below.

- Natural communication methods: These include hand pointing, gestures, facial expressions and body language that people commonly use while communicating in spoken language. These natural methods augment what is being spoken.
- Sign language: Traditionally used by people with hearing impairments, sign language consists of manual symbols for linguistic units. Signing is useful for helping children with autism understand language. Signs provide information in visual form. They are also less dynamic than spoken words which helps processing of information. Signing can be used as a means of expression with other people who know the signs.
- Object symbols: Miniatures, models and parts of objects are used as symbols for real objects. Toy cars, doll's clothes, models of fruits etc. may be employed for comprehension and expression of language. At times an object may be used to denote an activity for example car keys may denote going for a drive.
- Photos and pictures: Photos, pictures and line drawings of real objects are commonly used as AAC system for children with autism. They are preferred for children with autism as they provide information in visual mode, are easy to handle and are low cost aids.
- Communication boards: They are introduced to children once they are familiar with a number of words, and are able to group them in categories, and use them with some syntactical structure. Communication boards consist of photos, pictures and/or words denoting people, objects and activities.
- Speech generating devices: These mechanical aids similar to communication boards. When the user presses a button, the machine speaks out the word or the sentence.

3.2. Guidelines for AAC use

Before introducing AAC to a child, his or her communication goals should be determined and discussed by professionals and parents. Assessments may be conducted to decide on the suitability of a specific method of AAC. The following general guidelines [14] may provide some direction for planning strategies for a child who uses an AAC system.

- **Restructure physical environment**: One must ensure that an appropriate technical or non-technical AAC system is easily available for the child. Additionally, a child should be seated or positioned so that he or she can access the AAC system independently.
- **Provide communication opportunities**: Communication is important for learning and development. All children need opportunities to communicate their ideas in order to learn from the environment. Unlike typically developing children, those who use AAC systems

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may not be able to start a conversation, get attention, or interrupt others, even if they wish to say something. Communication situations should be structured with a shared focus of attention, to enable children who use AAC systems have many opportunities to communicate and interact. By including communication opportunities in daily routines, the child who uses AAC will have frequent chances to interact.

- **Train communication partners**: Children with cerebral palsy and other physical disabilities often need extra support in order to get access to communication partners and to get involved in motivating activities. Their communication partners must be made aware of this. The communication partners should be taught how to talk to, understand, and respond to the child using an AAC system. They would then be able to find creative and rewarding ways for the child using AAC to participate in activities.

- **Positive expectation from an AAC user**: Communication is a two-way process. While having a conversation with someone, we expect interaction and responses. There should be same expectations for the children who use AAC systems. Expectation is a critical component of a successful communication partnership. If communicating partner expects an AAC using child to respond, the chances are that the child would. Expectation of participation, increases the possibility of its occurrence.

- **Provide sufficient time for communication**: People with verbal communication abilities can communicate at a faster pace. They can often carry on conversations, interrupt and interject with ease and great speed. Children who use AAC systems may process language inputs slowly, and thus communicate at a much slower rate. They must be allowed time for communication messages to be sent and received.

- **Respond to communication attempts**: It is essential that communication partners respond to the child's communicative attempts, confirm the intended message and/or clarify meaning. If required a communication partner may use the child's AAC system to participate in conversations, showing the child how to say specific messages and use appropriate interaction strategies, such as turn taking or asking questions. In case a child's communication is unclear, the partner should try different problem solving strategies to comprehend what the child is trying to communicate. A partner may look for gestures, eye pointing, or other body movements that might indicate a person or object related to the message.

- **Provide training for AAC usage**: Children need to be formally taught to use the AAC system and need frequent opportunities to practice using it in day to day situations. Instructors must set aside time to teach vocabulary, strategies for communication and interaction, and the skills for operating a technical AAC system. Instructions should be broken into small steps with well stated objectives built on previous learning. Systematic recording and monitoring of the child's progress and skill development helps in long-term planning for further learning.

- **Using of Speech generating devices**: If a speech generating device is being used the messages in the AAC system should be updated regularly to ensure that they meet the child's communication needs and are appropriate for the current environment. Review the

AAC system regularly to ensure that it continues to be the most effective communication tool for the child.

- **Include AAC in educational plan**: Every school going child with special needs has an Individual Education Plan (IEP). If a child is need of using an AAC system, it is important that training in AAC usage be included in the IEP. However, the AAC inclusion should not be as a separate area. Rather, it should be listed as a strategy or technique that a student will use to complete educational goals.
- **Develop community care plan**: The child requires a community care plan when it is time to leave the school. The plan should include needed revisions to the AAC system as the AAC user prepares for a major life transition. The AAC inclusion in the community care plan should be of similar nature as that in the IEP.

4. Picture exchange communication system

For children with autism who have severe speech and language delay, the goal of intervention should focus on developing their functional communication. Teachers and caregivers may enable a child to communicate functionally by selecting to teach those words/forms concepts that are meaningful and relevant to the child's environment; teaching the child to use the words/forms in functional manner, and preparing communication partners in the environment to respond to words/forms used by the child in functional manner. Given the importance communication has as a predictor of future social and educational development and later quality of life, it is imperative that intervention program for children with autism stress on alternative means of communication. These alternatives means consisting of visual icons, symbols and manual signs, capitalize on strong visual processing ability in many children with autism [1]. Picture Exchange Communication System or PECS, as it is commonly known, is an AAC system that primarily uses pictures to teach functional communication skills. Developed at the Delaware Autism Program by Bondy and Frost [15], PECS provides children with communication deficits a method to communicate in social settings. According to the designers of PECS, the rationale for PECS emerged from the failure of traditional techniques such as speech imitations, signing, and picture point systems. These techniques relied only on the teacher to initiate communication and did not enhance children's capacity to initiate social interaction. According to Bondy and Frost, PECS has several advantages over other communicative interventions for young children with autism. Speech training is very slow and leaves children no way to communicate in the interval until they can speak some words, if they acquire the ability at all. AACs using speech or sign also require children to have the ability to share a point of focus with an adult and to imitate actions that they see the adult do, both behaviours that children with autism have difficulty with. Finally, according to Bondy and Frost, typically developing children learn language in part because of the associated social rewards for doing so. Their social deficits mean that children with autism are generally not sensitive to such social rewards. Thus, they have little incentive to learn language. The protocol used in PECS provides material rewards for communication in the context of the communi-

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cative exchange, giving children with autism better reason to learn to communicate without artificial reinforcement. PECS allows children with autism who have little or no communication abilities, a means of communicating non-verbally. Children using PECS are taught to approach another person and give them a picture of a desired item in exchange for that item. By doing so, the child is able to initiate communication. The child with autism can use PECS to communicate a request, a thought, or anything that can reasonably be displayed or symbolized on a picture card. PECS works well in the home or in the classroom [16]. PECS is a low-tech AAC system. It does not require any electronic devices. It uses laminated line drawings and a phase-wise implementation protocol.

4.1. PECS phases

PECS is introduced by teaching a child to give a picture of a desired item to a "communicative partner", who immediately responds to the request by giving the desired item. With time the child learns discrimination of pictures and how to put them together in sentences. In the more advanced phases, the children are taught to answer questions and to comment. The PECS program has six phases of teaching.

- *The Physical Exchange*. In this phase, the child is taught to pick up a picture, put it into the hand of an adult, and release the picture upon seeing that the adult has an item that the child wants. Only one picture at a time with a corresponding item is introduced so that the task is simple and the child can learn the exchange of picture with desired item. For some children who require physical prompts it may be necessary to have two adults in the teaching session. While the first adult responds to the child's request for exchange, the second adult prompts the child to go through the motion of picking up the picture card and exchanging it for the item desired. The second adult may slowly reduce the support as the child learns to perform the exchange independently. The sessions occur while the child is seated at a desk with the adult.

- *Expanding Spontaneity*: This phase requires the child to be more actively involved in getting the desired item. The child is no longer working from the desk, instead he/she is expected to fetch the picture from the communication board and bring it to the adult for an exchange with the desired item. The communication board may be placed somewhere in the room.

- *Picture Discrimination*: Now the child is expected to understand that different pictures denote different objects in the real world. The training in this phase begins with just two pictures, one of a desired item and one of a non-preferred item. If the child is unable to discriminate between the pictures, he/she may pick up the picture of the non-preferred object for exchange, and result gets that corresponding object. This is done with the purpose of making the child focus on the selected picture. Prompts are provided to help a child discriminate between the pictures and select the right one. In this case a blank card serves as a distractor. On the other hand if the child can discriminate between pictures easily, number of distractor pictures are increased. As the child progresses, the adult may introduce abstract pictures or symbols denoting the desired items.

- *Sentence Structure*: Now the child is taught to use two pictures/symbols in combination. One symbol for the phrase 'I want' and the second for the desired item. At this stage, the child is given about 20-25 pictures on a communication board and a Velcro sentence strip on which to fix the appropriate cards. Initially the symbol for 'Í want' is fixed on the strip before it is given to the child, and the child is expected to select the desired item's symbol from the collection of symbols, fix it the adult for getting the item. Mastery of this phase occurs when the student can successfully add the symbols for both "I want" and the desired item to the sentence strip and exchange the sentence strip with a communicative partner without any prompts on 80% of trials.
- *Responding to 'What do you want?'*: In this phase, skill to responding to a question is taught. A desired item and 'Í want' symbol are available. The adult points to the 'Í want' symbol and asks 'What do you want?'. The child is expected to put the "I want" and the desired object's picture/symbol on a sentence strip and give it to the adult for exchange. As the child learns the skill, the adult slowly increases the time gap between asking the question and pointing to the "I want" symbol in order to help the child understand that the exchange can take place only when the "I want" symbol is placed before the symbol of the desired object. The child now picks up the skills of forming phrases to express his/her needs.
- *Responsive and Spontaneous Commenting*: In the sixth and the last phase the child learns to answer/comment to questions similar to 'what do you want?' The communication board now may contain a symbol for "I see" below the 'Í want" symbol along with several symbols that do not represent highly desired items. The adult shows one of the less desirable objects, the symbols for which is one the board, and asks the child 'What do you see?". The child is slowly led to place "I see" symbol on the sentence strip before the corresponding symbol for the object shown. The training follows the same process of prompting and rewarding correct response as in the previous phases. When the child gives the correct response, the adult reinforces it by saying "yes, you see a ___", and provides a reward of child's choice. The child is taught to answer several questions of similar nature such as "what do you have? What do you hear?, and what is this?" following the same procedure. In order to ensure that responses are generalized, the questions are asked by at least two different adults after the child demonstrates skill acquisition.

5. Research support for AAC and PECS

A variety of AAC methods have been used with people with autism who are either nonverbal or cannot speak intelligibly. Many of them have been investigated through single subject research protocols. In a meta-analytical research study [17] twenty-four single-case studies were analyzed via an effect size measure, the Improvement Rate Difference (IRD). Three research questions were investigated concerning the overall impact of AAC interventions on targeted behavioural outcomes, effects of AAC interventions on individual targeted behavioural outcomes, and effects of three types of AAC interventions. Results indicated that, overall, aided AAC interventions had large effects on targeted behavioural outcomes in

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individuals with ASD. AAC interventions had positive effects on all of the targeted behavioural outcome; however, effects were greater for communication skills than other categories of skills. Effects of the Picture Exchange Communication System and speech-generating devices were larger than those for other picture-based systems, though picture-based systems did have small effects. AAC is a multisensory intervention. SGDs provide a child with auditory feedback, images and symbols on communication boards and touch screens provide visual and tactile cues and reinforcement to give substance to words that are often abstract (e.g. "the") and difficult for children with autism to understand. AAC can help individuals with autism manage the challenges of social communication. When eye contact, facial expressions and sensory stimulation are over whelming individuals with autism may disengage from social interactions. A speech generating device can be their "voice" to clearly communicate messages and thereby encourage appropriate socialization. Evidence suggests that early augmented language intervention that emphasizes opportunities for communication and capitalizes on family involvement using AAC gets results. For this reason, and unlike conventional speech therapy, AAC therapy involves training both the user and his or her communication partners at home and in the community [18]. A study investigated the effect of AAC intervention on language and social behaviour of children with autism. The children were given training to use Makaton Vocabulary Language Program, a system of AAC. Results indicated that use of AAC had a positive effect on children's receptive and expressive language, and also enhanced social behaviour [1]. Researchers compared PECS and MTS (match the sample) methods on mastery of picture discrimination tasks. During MTS intervention, the children were asked to match a given picture to one of a set of objects. Correct matches were rewarded with w preferred item. In the PECS condition, child-preferred and non-preferred items were displayed, and the child was given two corresponding pictures. When the child gave one of the pictures, he/she received the matching item. Four out of five children required fewer trials to master the picture discrimination tasks under PECS condition than MTS condition [19]. Children with autism with poor communication abilities were taught spontaneous demand skill through PECS and cognitive interventions. Results showed that children learned spontaneous communication during PECs training. They were able to generalize the skills to non-structured setting too. Cognitive interventions served as necessary scaffold for acquisition of task [20].

According to the guidelines on nonmedical interventions that address cognitive function and core deficits in children with autism spectrum disorders (ASDs) and sets priorities for future research, there is scientific evidence (from controlled trials and observational studies) of the effectiveness of the Picture Exchange Communication System (PECS) in increasing child-to-adult initiated communication, primarily requesting communication acts. Therefore, Individuals with ASDs who have limited verbal language, or those who do not respond to multiple interventions aimed at improving communication, should be offered the opportunity to use the PECS [21]. A randomized clinical trial compared Pivotal Response Training (PRT), a verbally-based intervention to PECS on acquisition of spoken language by 39 young (2-4 years), nonverbal or minimally verbal children with autism. The children were randomly assigned to either PRT or PECS condition. All children received 23 weeks of intervention. The measured dependent variables included overall communication, expressive vocabulary, pictorial

communication and parental satisfaction. Children in both intervention groups demonstrated increases in spoken language skills, with no significant difference between the two conditions. Majority of the children exited the program with more than 10 functional words. Parents were very satisfied with both programs but indicated that PRT was easier to implement [22]. PECS has been found to be an effective intervention for reducing maladaptive behaviours in children with autism. In a study, 3 young boys with autism were given PECS training and its effect on requesting, use of intelligible words and maladaptive behaviour was measured. Results indicated that all participants quickly learned to make requests using pictures and that two used intelligible speech following PECS instruction. Maladaptive behaviours were variable throughout baseline and intervention phases [23]. Effectiveness of PECS protocol for the first three phases was evaluated with 3 adults with autism. A multiple baseline across participants design was used to assess the effect of the training package consisting of a video, written and verbal instructions, modelling, rehearsal, and feedback. Results showed significant improvements relative to baseline in a short amount of training time, and that skills generalized to a learner with a severe developmental disability [24].

6. Method

This experimental study used a pre-test post-test control group design. The study sought to determine the effect of PECS intervention on development of functional language of children with autism, and to compare the acquisition of functional language abilities by children who received the PECS intervention to those who did not.

6.1. Subjects

The study was conducted in Mumbai, India on 30 children in the age range of 8 to 12 years. The participating children were selected from 3 special classes for children with autism and intellectual disabilities. The subjects consisted of nonverbal and minimally verbal children with autism. As per records their psychometric performance placed them in the range of severe to moderate intellectual disability. The schools they attended provided speech and language intervention but the intervention was not AAC based. After selection all children were pre-assessed on Functional Language Assessment Scale (FLAS). Subsequently, they were randomly assigned to experimental and control groups so that each group had 15 children. The experimental group received PECS intervention for 15 sessions of 30 minutes each. The control group continued with the language intervention provided by the school.

6.2. Instruments

The researchers used PECS intervention and Functional Language Assessment Scale as instruments. A brief description of both is given below.

- *PECS Intervention*: The intervention consisted of the first 3 phases of PECS, namely, picture exchange, expanding spontaneity, and picture discrimination. PECS phases were taught

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using such techniques of applied behavioural analysis (ABA) as prompting, shaping and reinforcement.

a. Phase 1 taught a child how to communicate by exchanging a picture card for a desired item. This phase was taught by seating the child at a desk with a communicating partner. Another adult was asked to provide prompts to the child while the exchange happened. Only one desired object and its corresponding picture card was used in this phase. The desired object was shown to the child. As the child reached for the object, e/she was guided to pick up the picture card and give it to the communicating partner in order to get the object.

b. Phase 2 introduced distance between the child and the desired object. The child now learned to seek out the picture card of the desired object and take it to the adult for exchange. This phase shaped the child's responses by slowly increasing the distance between the picture card and the communicating partner.

c. Phase 3 required the child to learn to select the picture of the desired object from a set of pictures. Initially it was taught by introducing only one distractor picture with the picture of the desired object. As the child learned to pick up the right picture, more distractors were introduced. For some children this incremental complexity in task was difficult to master, while others learned it soon. Some preferred actual photos of objects to their graphic symbols.

- *Functional Language assessment Scales:* Two instruments were developed by the authors for measuring the acquisition of receptive and expressive language skills. The Functional Language Assessment Scale (FLAS) and Functional Language Assessment Scale (for Parents) or FLAS (P). The FLAS consisted of a list of items categorized as food items, classroom items, household items, names of common animals and play items, and verbs. The items were selected after an extensive review of curriculum for language and communication used in special classes within schools in Mumbai. The authors involved classroom teachers of children with autism to share the language intervention goals for their children. Additionally, parents were consulted for input on functional communication needed at home. After the content was validated by domain experts, the instrument was pilot tested. Since the children ranged between 8-12 years, the FLAS included a level of complexity in items to address the variety in functioning levels of the children. It contained a total of 80 items. Both receptive and expressive language skills were measured on a 4-point scale of 'Correct Response (CR), 'Response with Verbal Prompt' (RVP), 'Response with Gestural Prompt' (RGP), and 'Response with Physical Prompt' (RPP). Whereas 4 points were allotted to a CR and a RPP was given a score of 1 point. The combined maximum score attainable on FLAS was 640 and the minimum 160. The FLAS (P) was designed as a rating scale to be used by parents of children in the experimental group at post intervention condition. The scores on FLAS (P) were correlated with that on FLAS. The FLAS (P) followed the structure of FLAS in that it measured the development of functional communication through receptive and expressive language skills. Only those items that reflected communication needs at home were retained in FLAS (P). While the number of items were reduced in FLAS

(P) to 50, they were categorized and scored in the same manner as in FLAS. For details of FLAS structure and sample of items included in it please refer to Table 1.

6.3. Procedure

The intervention commenced after assessing the children's baseline functional language skills on FLAS. All 30 children were underwent the assessment before being randomly assigned to experimental and control groups. The assessments were done following the steps given below.

- For assessment of receptive language, a child was asked to pick up the picture of a named item from a group of 2-3 pictures. If the child selected correct picture without any prompts he/she was allotted 4 points. A prompted response was marked anywhere between 3 and 1 depending on the level of prompt required by the child.
- Since the research was conducted on nonverbal or minimally verbal children with autism, expressive language was measured in terms of the child's ability to match a picture to a given object. A child was shown a real object or its model and asked to pick up the picture from a set of pictures that represented the object. Scoring was similar to that for receptive language.

Once the participating children were assigned to experimental and control groups, the parents of experimental group children were shown how to use FLAS (P), and then asked to record their child's response to each item with respect to receptive and expressive language. The parents were provided pictures and models where real objects could not be used. The intervention began once the assessment process was completed. As stated earlier, only 3 phases of PECS training was considered for intervention. Each child received 15 sessions of intervention of 30 minutes duration. A description of intervention steps is given below.

a. As PECS is based on the principles of ABA, determining the motivator for a child was important. Hence, parents and teachers of experimental group children were consulted for this. A list of reinforcers to be used in subsequent sessions was made.

Receptive Language				Items	Expressive Language			
CR	RVP	RGP	RPP		CR	RVP	RGP	RPP
				Food items				
				· biscuit				
				· chocolate				
				· wafer				
				· apple				
				· banana				
				· samosa				
				Classroom items				

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Receptive Language				Items	Expressive Language			
CR	RVP	RGP	RPP		CR	RVP	RGP	RPP
				· Bag				
				· Book				
				· crayon				
				· desk				
				· pencil				
				· Paper				
				Household items				
				· Bed				
				· Chair				
				· toothbrush				
				· plate				
				· spoon				
				Animals & Play items				
				· Cat				
				· Dog				
				· Cow				
				· Blocks				
				· Ball				
				· Bat				
				Verbs				
				· To eat				
				· To sit				
				· To drink				
				· To run				
				· To sleep				
				· To Jump				

Table 1. FLAS structure and sample of items

b. The initial sessions aimed to help a child learn how to communicate. The first session began by showing the child the desired item, and encouraging him/her to pick up the matching picture. Since the children wanted the reinforcer, they could pick up the corresponding picture easily. At this point only one picture card was introduced. For children who required assistance to understand the concept of exchanging the picture for

what they desired, another adult prompted them to give the card to the communicating partner who held the desired item. Once the children learned the process of exchanging picture card for desired item they were shown other items and their corresponding pictures. Both correct and prompted responses would be followed by a reinforcer. This ensured that a prompted response shaped into correct response as the sessions progressed. The selection of items for a given session was based on the child's level of functioning as pre-tested on FLAS.

c. Once the children learned social interaction by exchanging picture cards for items sitting on a desk with a communicating partner, the intervention moved to the second phase of PECS training. The researchers introduced distance between the picture card and the communicating partner. Now the cards were either kept on a nearby table or stuck on a board. The children were expected to pick up the card and take it to the communicating partner. They were taught persistence by increasing the distance from the partner with desired item, so they learned to walk across the room to complete interaction.

d. Distractor picture cards were introduced during the third and last phase of training. Different picture cards served as distractors for teaching a child to select the target picture. The cards consisted of pictures of items included in the FLAS. Children's responses were shaped though the required level of prompts. Initially this was done sitting on a desk with the communicating partner. As the children learned to give correct response, distance was reintroduced in the session. Hence, the children were expected to select the target picture from a set of pictures on a board and bring it to the adult for the interaction to be completed.

While the children in the experimental group received PECS training for 15 sessions, those in the control group continued with the language intervention program provided in their schools. After intervention period all children were post tested on FLAS. Parents of experimental group children were asked to reassessed their children on FLAS (P). Figures 1-6 show some intervention sessions.



Figure 1. Introducing a desired food item with matching picture

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Figure 2. Learning to match object to picture



Figure 3. Exchanging picture card for desired food item



Figure 4. Selecting target picture from a group of pictures



Figure 5. Introducing verb cards

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Figure 6. Introducing distance between picture and desired object

7. Results

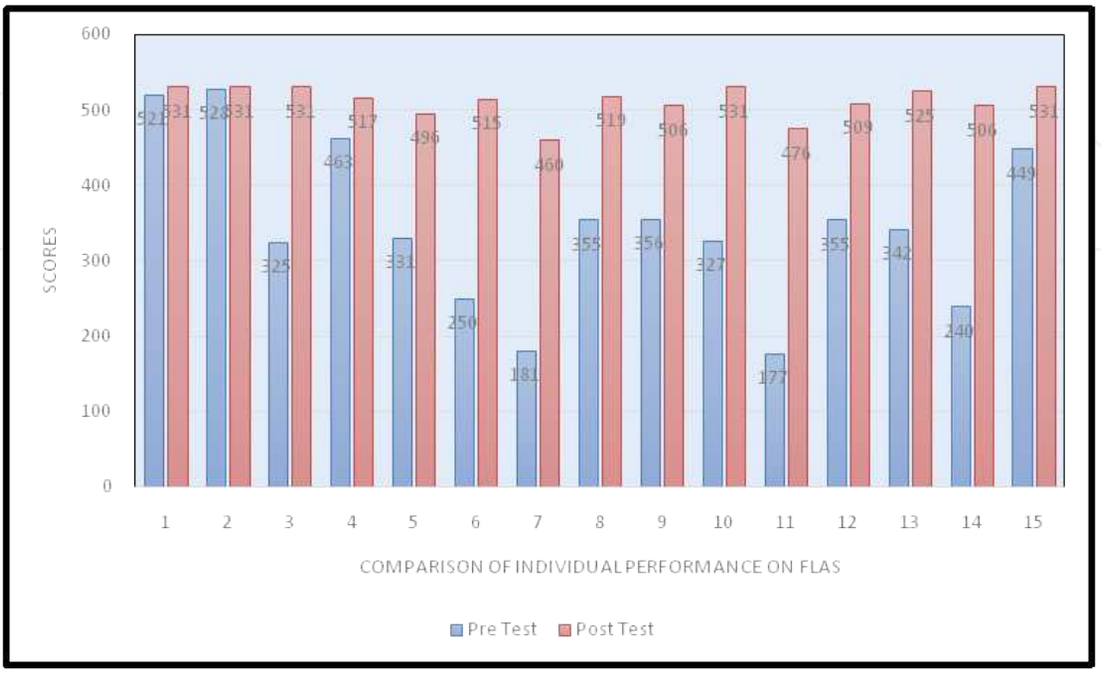
The study aimed to determine the efficacy of PECS based AAC intervention on development of functional language abilities of children with autism. The children under PECS condition showed quantitative change in their social interactions. A comparison of their composite mean score on FLAS at baseline with that at post intervention showed a significant difference (refer to table 2). As the selection of the children was random, the data was analysed using t-test.

Condition	N	Mean	r	t-value	df	Significance
Pre-test	15	346.66	0.72	6.80	14	P<.001
Post-test	15	512.26				

Table 2. Comparison of pre and post-test composite mean scores of experimental group on FLAS

The effect of PECS intervention was evident to people who interacted with the children in the experimental group. They noted the difference in the children's ability to communicate meaningfully. Statistical analysis of data supported this observation. The average score at baseline (346.66) showed a significant increase post intervention (512.26). Each of the 15 children in the experimental group benefitted by the intervention. This led to the large

difference between pre and post mean scores. The positive effect of training on the children is clear when their pre and post-test individual scores are compared (Figure 7).



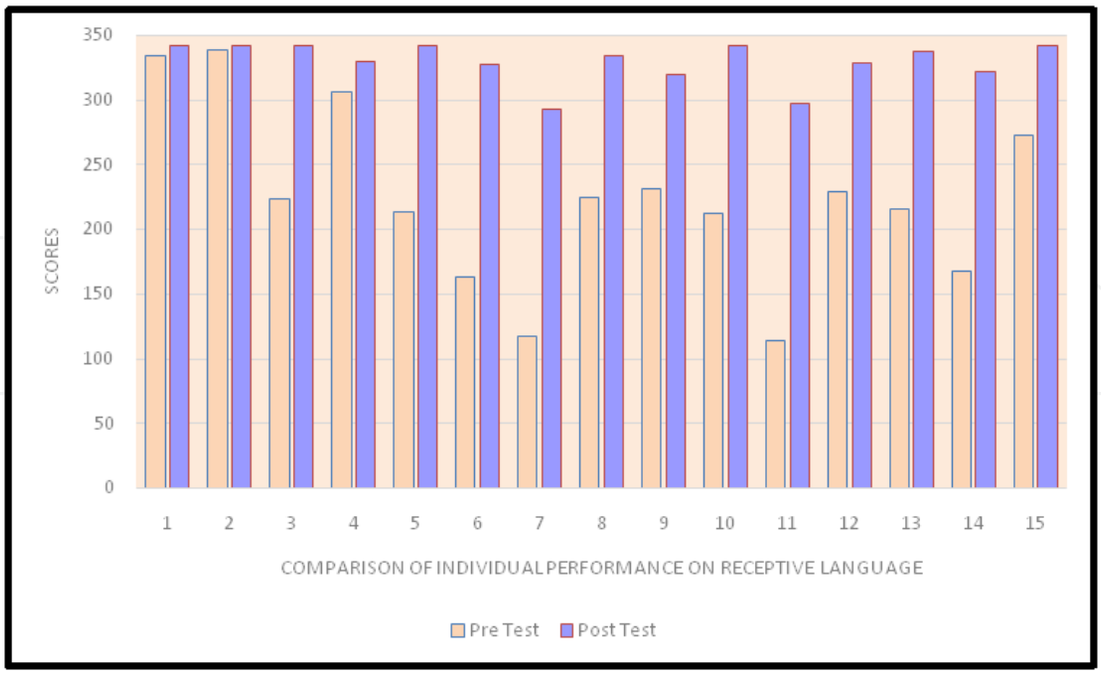
As may be seen from Figure 7 that all children gained from the intervention, though some gained more than others. This may be understood in terms of the initial differences that existed among the children due to factors such as age and intellectual levels.

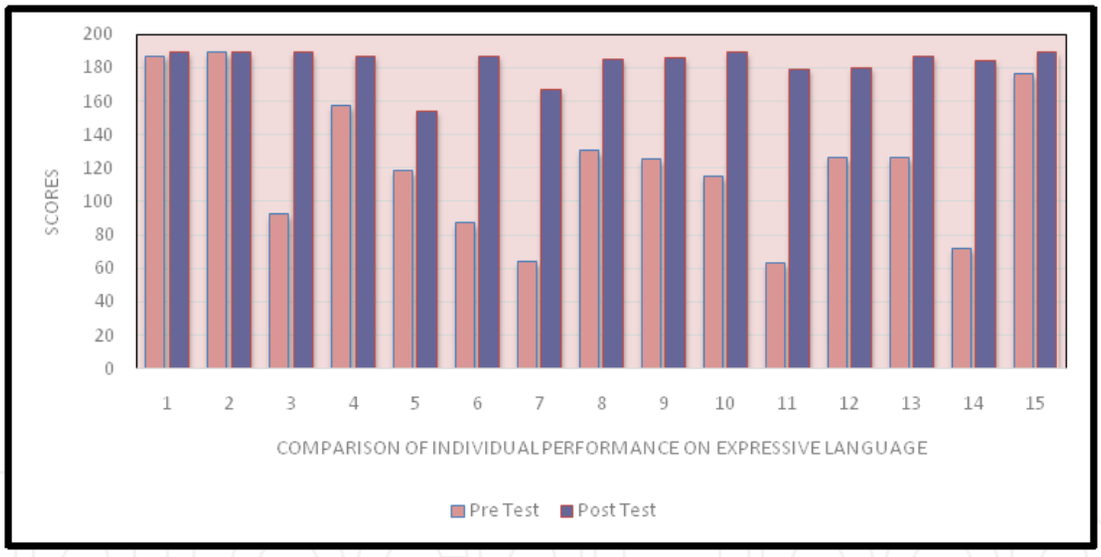
Functional language skills were measured through receptive and expressive language on FLAS. The mean scores on these component skills were compared. The baseline average score on receptive language (224.2) was significantly lower than that at post intervention (329.53) as indicated by the derived t-value (7.05; $p<.001$). From figure 8 it is evident that all children improved their performance from pre to post test. However, in comparison with others the observed gain was not as much in two of the children.

With respect to expressive language skills, the children's base line mean score on FLAS was 121.8. After 15 sessions of intervention their performance was observed to have improved. They had learned to use picture or symbols to convey their wishes and desires. They were able to engage in more meaningful social interaction. This was also supported by their post-test performance. The average score on FLAS (182.73) was significantly higher as indicated by the derived t-value (6.01, $p<.001$). This suggested the positive effect of PECS on communication ability. Figure 9 presents the details of pre and post-test individual performance on expressive language skill post intervention.

While the experimental group children received PECS based intervention, those in the control group continued with the intervention provided by their respective schools. At the end of intervention period all children were reassessed on FLAS. The second objective of the study

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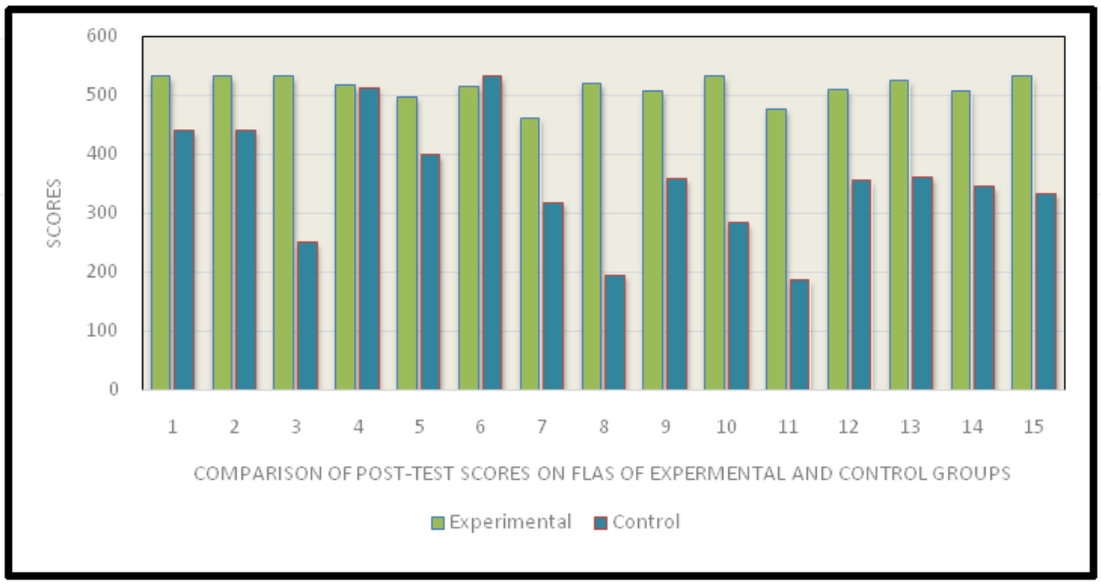


was to compare the post intervention performance of experimental group children to children in the control group. The difference was analysed for statistical significance (Table 3.)

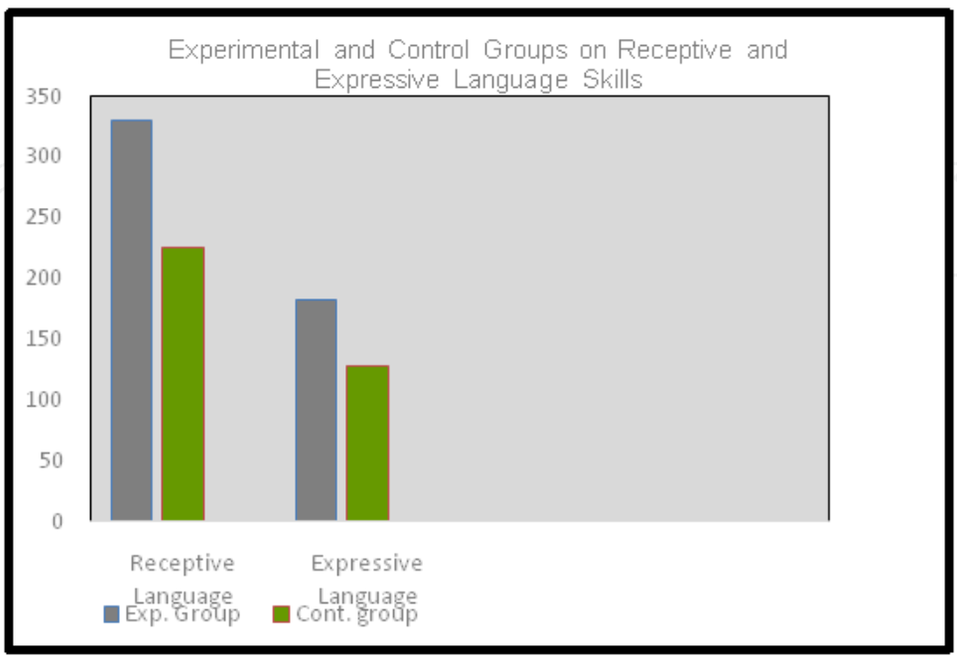
Groups	N	Mean	t-value	df	Significance
Experimental	15	512.26	5.92	28	P<.001
Control	15	353.13			

Table 3. Comparison of post-test composite mean scores of experimental and control groups on FLAS

The resultant t- value (5.92, p<.001) was highly significant. This indicated that PECS based intervention was effective than traditional intervention methods for children with autism.. Figure 10 shows the quantitative difference in performance of children in experimental and control groups.



Every child except one in the experimental group performed better than his/her counterpart in the control group. Some experimental children scored significantly higher than their control group peers. A similar trend was seen when mean scores on receptive and expressive language skills were compared (refer to Figure 11)



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The children in the experimental group performed better on FLAS component skills. But the difference was more in receptive language. This might be due to the limited number of intervention sessions. Due to the short duration of intervention, the experimental group children could not demonstrate similar gain in both receptive and expressive language skills. However, in order to ensure that acquisition and demonstration of newly acquired functional communication ability was not limited to intervention setting, the experimental group individual scores on FLAS was correlated with the respective scores given to children by their parents on FLAS (P). The parents administered FLAS (P) on their respective children at the end of the intervention period. Their children's gain in communication skills was reported by the parents. When FLAS (P) scores were correlated with scores on FLAS using Product Moment method, a high correlation ($r = 0.89$) resulted between the two sets.

8. Discussion

Among the various difficulties faced by individuals with autism, communication has been described as being at the core. It is believed that one third of all individuals with autism may never acquire oral expressive language sufficient to meet their daily needs [3]. It is imperative that they learn to use an alternative and augmentative mode for communication. As mentioned earlier, there are a variety of AAC systems available for children with disabilities. Selection of a suitable system must depend on its ability to respond to the unique features of a specific disability. One of the first communication difficulties with autism is with development of paralinguistics [25]. They do not understand the underlying meaning of a message that are embedded in the speaker's facial expression, body language, eye gaze and tone of voice. Learning to understand paralinguistics is important for development of receptive language. In a typically developing toddler paralinguitics emerge as a consequence of parent-child interactions. The parent smiles and waves a milk bottle before the infant, and asks in a high pitched tone if the infant wants milk. The infant looks at the smiling and nodding parent, and understands that something pleasant is going to happen. This is the premise that was used in PECS intervention. The communicating partner showed or pointed to a picture of the object that was desired. When the picture was exchanged the child was given the object with a smile and a nod from the communicating partner. Besides motivating the child to communicate, these paralinguitics provided social meaning to the exchange. Children with autism are visual learners. Research on graphic symbol learning indicates that symbols with iconicity are easier to learn [26]. The symbols used during the PECS intervention resembled their referents. The children could learn to identify and exchange them easily for desired items. The significant increase in children's receptive language skills post intervention could be attributed to this. Research also suggests that children with autism are more interested in inanimate objects than in human interaction [12]. They are able to process better when information is presented in static form. Pictures and symbols are inanimate and provide static information. The use of PECS as an AAC system in this study responded to the learning preferences of the selected children. PECS was designed specifically for children with autism who have limited verbal ability [27]. It addressed the difficulty children with autism have in social initiations. Teaching

a child to approach an adult and request for a desired object using a picture not only improved communication but also developed social interaction. Successful outcome of each attempt reinforced a child's communicative behaviour. The performance of the experimental group children on FLAS was significantly higher than those in the control group. The control group children also attended school and received speech and language intervention. Notwithstanding that they belonged to the same age group, the intervention goals would essentially consist of teaching similar language concepts, the control group children did not demonstrate gains equal to their experimental group counterparts. The principles of applied behaviour analysis is central to the PECS program. The ABA methods such as rewards and prompts are systematically used to shape a child's verbal behaviour though out the program, and much more rigorously in the initial phases. The ABA methods were used during the intervention period. This adherence to ABA principles might not be existing in the language interventions given to the control group children. Hence, as the children were not frequently rewarded or guided to produce correct response of identifying pictures, their gain on receptive language was below the children who received PECS training. Similarly, with respect to expressive language skills, in the traditional intervention setting the emphasis was on naming the picture orally. This might have been impacted their learning as the control group children like their peers in the experimental group were nonverbal or minimally verbal. The positive gains by the experimental group might be attributed to PECS training. That the change in ability to communicate was beyond the intervention settings was evidenced by parents, and borne by the positive correlation between observations made by the researchers and that by the parents.

9. Conclusion

Difficulties in social relationships and interactions have been the defining features of autism. Therapists and teachers frequently use augmentative communication systems with children with autism to support development of interactive behaviour. AAC systems follow a topographically based taxonomy. Some are selection-based systems in which each response is topographically identical and others are topography-based systems in which each response is topographically distinct [28]. PECS being a selection based system follows a topographically identical (e.g. card selection and exchange) pattern. It suits the literal thinking ability of a child with autism. The pictures and symbols are static, literal and clear, and enable children with autism to process information easily. The outcome of this study substantiate the findings of previous researches supporting use of PECS as a suitable augmentative communication system for children with autism.

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