Chapter 3

Methodology

3.0 Introduction

This chapter describes the methodology adopted for the study. It consists of the following:

1. Design of the study
2. Sample identification and selection
3. Tools used for sample selection and treatment
4. Statistical treatment of data

3.1 Research design

The study was conducted using the pre test posttest control group experimental design. The study was conducted in two phases. Both phases employed this design.

The design includes two groups. The subjects of both are selected randomly. Both groups are pre tested on the dependent variable. The experimental group receives treatment following which a posttest is administered to both the groups.

The experimental design is schematically represented as:

\[
\begin{array}{c}
R & O_1 & X & O_2 \\
R & O_3 & O_4 \\
\end{array}
\]

R represents the selection of subjects to experimental and control group is randomized.

O_1 and O_3 represent the skill of the subjects before training.

X represents the training of the caregivers and their children.

O_2 represents the post test for experimental and control group.
02-O1=X gain

O4-O3= Gain

### 3.2 Control of threats to the validity of the research design

The following threats to validity (Trochim, 2006) were controlled in the study to maintain the conditions for an experimental design

**Maturation**

The effect of maturation on the outcome of the study was controlled by the following factors:

a. The sample of caregivers selected for the study did not have any prior experience in Augmentative and Alternative Communication

b. The organizations from which samples were drawn for the study did not practice AAC in facilitating language and communication of children with disability

**Instrumentation**

The investigator developed two tools for measuring the dependent variables for the two phases of the study. The measurement at both pre and post test levels at each phase was done using the respective tool for that phase. The internal consistency for the two tools were also established

**Regression**

The caregivers and children with disability for the study were randomly selected and assigned to experimental and control group before the administration of the pre test. This random assignment of caregivers and children ensured parity between the groups.
Experimenter bias

The Independent raters who were not familiar with the caregivers and subjects rated their skills on the tools developed for the study.

Experimental mortality

During data collection, mortality of caregivers and children was not experienced. Hence no attrition occurred in both phases of the study.

Experimental setting

The following steps were taken to counter the threats in the experimental setting:

a. The training sessions were conducted as a variant of regular curricula.

b. The training and testing sessions were integrated into normal routine in the familiar environment of the special school.

Testing

Phase 1: Testing was done through the Observational Schedule for Caregivers (OSC). Since OSC was an observational tool, the caregivers were not familiarized with the contents of the tool. Informing the caregivers regarding the observations to be carried out for the study ensured ethical safeguards. Informed consent was sought from the caregivers to be part of the study.

The children subjects were in the age range of 6-10 years with moderate to severe deficits in speech and language skills and a diagnosis of mental retardation or cerebral palsy. Due to the nature of their difficulty, exposure to items on a single instance during the pre test did not have a sensitization impact in posttest

Extraneous variables

Changes in the behavior following treatment were ascertained by the inclusion of a control group.
3.3 Sample identification and scale

The following characteristics defined the caregivers:

Age: 26-40 years

Sex: Female

Minimum Qualification: 12 standard education

Language Background: Bilingual (Mother tongue and English)

Economic status: Middle to Upper Middle class

Phase 1

The process of selection was as follows and is represented in table 3.1.

Stage 1: 80 caregivers (N=80) attending a special school, serving children with disability were identified.

Stage 2: Caregivers who had any exposure to AAC and whose characteristics did not fulfill the above-mentioned criteria were subsequently excluded from the study. This process yielded a sample of 54 caregivers who had the required common characteristics.

Stage 3: Caregivers (n=48) were randomly drawn from the available sample. These subjects were randomly assigned to experimental (n=24) and control group (n=24) for the purpose of the study.
Table 3.3

Sample identification and selection of caregivers at phase 1

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of the</td>
<td>Sample at the selection</td>
<td>Assignment of final</td>
</tr>
<tr>
<td>sample</td>
<td>criterion level</td>
<td>sample</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=80</td>
<td>n=54</td>
<td>n=48</td>
</tr>
</tbody>
</table>

|                           | Experimental group             | Control Group            |
|                           | Experimental group             | Control Group            |
|                           | n=24                           | n=24                     |

Though the subjects shared common characteristics, the obtained pre test scores of
the two groups were compared statistically in order to ensure that there was no true
difference between the mean scores of the groups. t test, which is a parametric test,
was used for testing the significance of difference between the obtained means. Table
shows that the subjects included in the sample were comparable. The t critical value
(1.810) at df=46 does not reach any level of significance

Table 3.3.1

Pre test parity between Experimental and Control Group (Caregivers) Phase 1

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>df</th>
<th>t value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>24</td>
<td>28.96</td>
<td>2.866</td>
<td>46</td>
<td>1.810</td>
<td>*Not Significant</td>
</tr>
<tr>
<td>Control</td>
<td>24</td>
<td>27.46</td>
<td>2.874</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not Significant at t critical value P < 0.001(2.013) at .05
Phase 2

This phase involved the children with mental retardation and/or cerebral palsy as per school records. The samples for the study were drawn from 8 special schools in Bangalore. The following characteristics were considered for selection of children as subjects for the study:

a. Age-The children belonged to the age groups between 6-10 years
b. The children did not have any other associated problems
c. Children had normal hearing sensitivity
d. Children had a moderate to severe intellectual disability with IQ falling in the range of 30-49 as per school records.
e. Geo-cultural background: The children belonged to Karnataka and lived in Bangalore.
f. Speech and language skills: all children had a significant delay in speech and language development.

The process of selection was as follows and is represented in table 3.2
**Stage 1:** 90 Children (N=90) who fulfilled the above mentioned criteria as per school records were initially identified in 8 special schools of Bangalore.

**Stage 2:** These children were assessed for candidacy for symbolic augmented systems on Augmentative Communication Assessment Protocol for Symbolic Augmentative Systems (ACAP-SAS) (Gamel-McCormick & Dymond, 1994). This exercise yielded 52 children who demonstrated poor scores on this protocol.

**Stage 3:** 48 children from the available sample of 52 were randomly assigned to experimental (n=24) and control group (n=24).

Table 3.3.2

*Sample identification and selection of children at phase 2*

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of the sample</td>
<td>Sample at the selection criterion level</td>
<td>Random selection</td>
</tr>
<tr>
<td>N=90</td>
<td>n=52</td>
<td>n=48</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assignment of final sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
</tr>
<tr>
<td>Control Group</td>
</tr>
<tr>
<td>n=24</td>
</tr>
<tr>
<td>n=24</td>
</tr>
</tbody>
</table>

Though the subjects shared common characteristics, the obtained pre test scores of the two groups were compared statistically in order to ensure that there was no true difference between the mean scores of the groups.

$t$ test, which is a parametric test, was used for testing the significance of difference between the obtained means. Table shows that the subjects included in the sample were comparable. The $t$ critical value for different components of the scale with corresponding degrees of freedom as indicated in the table below $P < .05$ indicating no significant difference between the experimental and control groups in pretest.
Table No 3.3.3

*Pre test parity between Experimental and Control Group (Phase 2)*

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>df</th>
<th>t value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>24</td>
<td>108.79</td>
<td>22.821</td>
<td>46</td>
<td>0.607</td>
<td>*Not Significant</td>
</tr>
<tr>
<td>Control</td>
<td>24</td>
<td>105.38</td>
<td>15.483</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not Significant at t critical value P < 0.001(2.013) at 0.05

Figure 3.3.3 *Pre test parity between Experimental and Control Group (Phase 2)*

3.4 Tools

The following tools were used for the study.

Tools for identification and selection of sample:

Tools for treatment:

1. Augmentative and alternative communication (AAC) training module

Tools for measurement:

1. Observational Schedule for Caregivers (OSC)
2. Communication Scale for Children (CSC)
3. Reaction scale (RS)

3.4.1 Tools for identification and selection of sample:


Augmentative Communication Assessment Protocol for Symbolic Augmentative Systems (Gamel-McCormick & Dymond, 1994) was used to ascertain the candidacy of children for symbolic augmented systems after identification in stage 1 of subject selection process. (See appendix to view Protocol)

This protocol is designed to help collect information with which decisions can be made about symbolic augmentative communication systems to be used. The ACAP-SAS was administered to consider candidacy for Makaton Signing and Picture Communication. The tool was not used in its entirety. The sections suitable and applicable to the age and functioning level of the children were used.

The ACAP-SAS protocol consists of two main parts:

Part 1: Student skills

Part 2: Communication settings

Part 1 (Student skills) assesses the children under 5 domains, namely:

a. Expressive communication,

b. Cognitive Skills (including receptive communication characteristics),

c. Motor Skills,
d. Visual skills, and
e. Auditory skills

Part 2 (Communication settings) assesses the communication environment. It includes the following:

i. Settings Where Communication Will Take Place
ii. Probable Content of Communication
iii. Specific vocabulary that may be needed
iv. Probable Recipients of Communication
v. Student Preferences
vi. Family and Care giver Preferences for Communication Modes/Methods

Part 2 of ACAP-SAS helps assess the communication settings, content, recipients, and child and family preferences. The purpose of part 2 of the protocol is essentially for planning. This was not required for as it is beyond the scope of this study.

As stated above Part 1 has 5 subsections. Section A has 10 items which help identify the methods used by the child in expressive communication for requesting items, requesting interaction, making a choice etc. Observations made on these items not only identified the presence of basic communicative intentions in children but also the mode they were employing to communicate.

Section b has 4 items representing the cognitive skills. This includes 4 items, which are important for introducing symbolic augmented systems.

Section C has 11 items, which relate to motor skills. Item number 2 was omitted, as it was non-specific and open ended.

Section D has 8 items representing visual skills.

Section E, which relates to auditory skills, was not considered as the basic criteria in subject selection was to exclude children with developmental disability who had below normal hearing sensitivity.
Of all the behaviors listed, children showing only 40% of those were considered for the study.

Refer Appendix 7 for the ACAP -SAS form.

3.4.2 Tools for treatment:

Augmentative and Alternative Communication (AAC) Training Module

The primary aim of this research is to equip and empower the caregivers of children with developmental disabilities with skills to introduce an AAC system and facilitate development of language and communication skills. This was achieved through the development of a training module. The training module was designed to be a guide for professionals across disciplines in successfully training caregivers in AAC implementation. The module facilitates training of caregivers in understanding concepts of speech language and communication and AAC, gaining insights and practical know how in effective strategies for implementing AAC and enhancing language skills in children (appendix for details of the training module-pilot version). The module focused on multiskilling the caregivers in using Makaton, an effective system of AAC and using pictures/symbols for communication.

Pilot study of training module: As a part of pilot study, the training was conducted for 5 caregivers of children with developmental disability in a special school serving children with mixed disabilities. The pilot of the training module was conducted across 2 days that included lectures, demonstrations by the tutor, video recordings and practice sessions for the trainees. The total duration of the training was for 16 hrs including breaks. Of this 8.5 hrs were devoted to practice and usage of signs and symbols through activities.

The training schedule was as follows:

DAY 1 (Total time 7 hrs including breaks)

- Introduction to Communication, Language & Speech - 30 mins
- Development of Language in children - 1 hr (will run through a checklist in a simplified manner)
- Language deficits in children with disabilities – 45 mins
- AAC - Concept, Types and Importance – 45 mins
- Signing - sign language, sign system, benefits - 1 hour
- Symbol - types of systems, usage - 30 minutes
- Picture communication – concept - 30 minutes
- Strategies for implementing AAC - 45 minutes
- Introduction to Makaton – 45 minutes

**DAY 2 (total time 9 hrs including 2 breaks)**

- Teaching and practice of Makaton stages - 4 hours
- Demonstration of Makaton teaching session (teaching signing and usage of symbols) – 1 hour (stage 1-4)
- Use of picture communication - 1 hour
- Practice of AAC strategies - 1 hour
- Simulations - 1 hour 30 minutes

Feedback was sought on the content, modes of training, clarity, relevance, and duration of the training module. The feedback included the following:

1. The contents included in the module were reported to be relevant and easy to understand.

2. Power point presentations, video demonstrations and hands on trials used in the training made it very clear for practical use with their children

3. The caregivers felt the language used during presentation and training was simple and easy to understand.

4. Caregivers preferred to spread the training across 3 half days rather than 2 full days with adequate breaks between sessions

5. The need to include more exercises for signs and strategies was evident during the trial of the module.
6. The practice for AAC implementation was essentially through simulation exercises and role plays in the pilot module. As the dynamics in implementation with children can be quite different, trial runs with children at the end of training was incorporated.

The training module was conducted across 3 days. Introduction to speech language communication, its normal development and language difficulties were discussed on the first day of training.

The focus of the second day of training was on Introduction to AAC, signs and symbols with specific attention to Makaton and Picture Communication and strategies for implementing AAC.

Day three focus was on practice and use of signs and pictures in activities through demonstrations, simulated lessons and video recordings. At the end of the training when the caregivers demonstrated fluency and confidence, a trial lesson with a child with disability was facilitated.

(Refer Appendix 8 for the complete training module).

**Makaton Vocabulary Development Program (MVDP)**

MDVP, a system of AAC (Lal 2010) was used as an instrument of intervention in the study. Makaton is a multimodal system that encourages functional communication and socially interactive behavior in individuals with communication and language difficulties. Use of Makaton has shown significant gains in language behavior for children with developmental disabilities (Walker, Lal 1999). Since the caregivers included in the study did not have prior awareness and knowledge of Makaton, both theory and practice of signs was incorporated into the training. An overview of the concepts underlying Makaton, its salient features and its effect on speech language and communication was discussed. The vocabulary pertaining to the activities to be used in this study for AAC training was drawn from the Indian version of the Makaton vocabulary list. The use of signs and symbols in the activities was demonstrated to the caregivers. Simulated practice sessions and video recordings of Makaton use with children were used during training. Initial lesson with Makaton was in accurately producing the Makaton signs with appropriate placement, direction and
accuracy. Then the caregivers were given exercises to practice in activities relevant to the training module. (Refer Appendix 9 for some examples of Makaton resources)

**Picture communication**

As has been discussed in the introduction chapter, Picture communication is an aided system of AAC wherein the symbols used include gestures, hand signal, photographs, pictures, line drawings, words and letters. The choice of symbols depends on the skills and users abilities including visual, motor and cognitive. Picture communication in the form of pictures, photographs and Makaton symbols were used in this study.

The appropriateness of using symbolic augmented systems such as Makaton and Picture communication was ascertained in the assessment of the subjects on the ACAP-SAS. Subjects were found to best respond to Makaton and Picture communication represented by pictures and photographs.

Familiarization with the pictures and photographs relevant to the activities was carried out. Video and live demonstrations along with simulated exercises were used to demonstrate the strategies used to introduce picture communication. Opportunities were provided for the caregivers to practice use of pictures.

As has been stated in the discussion on research design, the control group of caregivers underwent a half-day seminar on orientation towards speech language and communication and AAC. This would avert the ethical issue of “no treatment” to the control group of subjects.

**3.4.3 Tools for measurement:**

**Observational Schedule for Caregivers (OSC)**

The Observational schedule for caregivers (OSC) was developed by the investigator with the aim to assess the caregiver skills in signing, facilitating comprehension through alternative modes, providing opportunities for communication and their ability to use effective communication skills during their interaction with children.
The OSC was used as a pretest and posttest in the study. The scale consists of 4 parts:

1. Signing behavior
2. Usage of alternative modes for comprehension
3. Response to communication
4. Communication style

Each part consists of a list of behaviors, which are important for the skill under assessment. The measure of presence or absence of a scale was assessed on a 4-point scale, namely behavior always evident, frequently evident, occasionally evident and not evident at all. Part 1 of the OSC enlisted 5 behaviors on signing and included items on position, direction/movement and body language accompanying the sign. Part 2 consisted of 6 behaviors on alternative modes for comprehension, which include use of pictures and symbols to facilitate comprehension. Part 3 enlisted 5 behaviors on strategies used during communication, namely communicative temptations, waiting for response and opportunities for turn taking. Part 4 consisted of 4 behaviors on style of communication, which included communication at the word and phrase level. For details of items on OSC, please refer Appendix.

Content validity of OSC was ensured after obtaining expert opinion about the items in the tool. Items on the OSC were selected after careful scrutiny of studies and documents on communication development process, strategies used for effective facilitation of communication and approaches to teaching language through alternative and augmentative means. Additionally suggestions by experts were included.

Pilot Testing of OSC: Five caregivers in a special school were observed during their interaction with children with disability for the purposes of testing the efficacy of OSC. Care was taken to make observations during activities such as playing ball, art and craft, which facilitate dynamic interaction and communication between caregivers and children. The trial showed the suitability of the items included. The scores of the five caregivers were similar in nature demonstrating inadequate skills in AAC and patchy skills in facilitating communication. This was expected, as caregivers did not have any experience with AAC or formal training in
communication. Therefore it clearly indicated the scope for development of a training module to develop skills of caregivers in facilitating communication and AAC. (Refer Appendix 1 for OSC –Pilot Version)

Content validity of the tool developed was obtained by seeking the judgment of 6 senior professionals and experts (educators and speech therapists) . The observations during the pilot, feedback from professionals was incorporated. Modifications and suggestions drawn from this are discussed below:

1. A 3 point rating scale may not adequately account for emerging skills. Therefore 4 point rating scale was suggested, as it would be more useful in rating skill behaviors of caregivers.

2. The assessment on observational schedule did not clearly identify the skill level of caregivers on Makaton and Picture Communication. Separate sections for observing skill levels on Makaton and Picture Communication will serve the purpose of assessment better.

3. The items under Picture/Symbol communication should represent use in a communication perspective rather than identification perspective. E.g. the item on matching symbols is replaced by use of symbols for communication.

4. Introducing communication through use of objects is not required as subjects included in this study can identify pictures /symbols.

5. Modify the strategies to include opportunities for communication and reinforcements for communicative attempts.

6. The items under communication style are broad and general. They need to be more specific to facilitate for skill observation and measurement.

Item analysis of the tool was carried out through factor analysis. The analysis identified 3 factors, namely signing behavior, facilitation of communication, which included usage of alternative modes for communication and communication style. The following extraction values were derived on factor analysis.
Table 3.4.3a Extraction values on factor analysis for OSC

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-signing behavior</td>
<td>1.000</td>
<td>.968</td>
</tr>
<tr>
<td>C &amp;B-facilitation of communication &amp; usage of alternate modes</td>
<td>1.000</td>
<td>.766</td>
</tr>
<tr>
<td>D-communication style</td>
<td>1.000</td>
<td>.797</td>
</tr>
</tbody>
</table>

In order to maintain objectivity and avoid personal bias in measuring the behaviors of caregivers, subjects were simultaneously observed by 2 two observers who were trained in advance on techniques of systematic observation.

Coefficient of correlation between the scores of the investigator (R1) and two observers was (R2) 0.989 and (R3) 0.975 (P< 0.01) indicating the reliabilities to be good.

Table 3.4.3b

Inter Rater Reliability Index for OSC

<table>
<thead>
<tr>
<th></th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Pearson’s correlation</td>
<td>*0.989</td>
</tr>
<tr>
<td></td>
<td>Significance</td>
<td>0.561</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>20</td>
</tr>
</tbody>
</table>

- Correlation is significant at 0.01 levels
Test retest reliability was computed using Pearson’s correlation. Coefficient of correlation on test retest was .400 (p < .01), which is significant.

Table No 3.4.3c

*Test Retest Reliability Index for OSC*

<table>
<thead>
<tr>
<th>Total-Test</th>
<th>Pearson’s Correlation</th>
<th>Significance (1-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total test</td>
<td>0.400*</td>
<td>0.003</td>
<td>47</td>
</tr>
</tbody>
</table>

Significant at 0.01 levels

Refer Appendix 4 for OSC-Test Version.
**Communication Scale for Children (CSC)**

Developed by the investigator the CSC aimed to assess the level of language comprehension and expression of children. The CSC was used as a pretest and post test in the study. The CSC comprised of five sections. Each section corresponded to five aspects of language, namely, Nouns, action words, locative words, descriptive words and simple commands. Each section consisted of vocabulary corresponding to the activities identified for AAC training. These were selected based on normal development and frequently used activities for children in different contexts (home, special school). The words selected would constitute a core and fringe vocabulary, which would have opportunity for use by children in frequently occurring contexts.

Therefore the scale measures the child’s comprehension and expression in three modes:

1. Verbal (use of words alone)
2. Signs
3. Pictures

The language measures include:

1. Comprehension of nouns
2. Comprehension of action words
3. Comprehension of locative words
4. Comprehension of descriptive words
5. Comprehension of simple commands
6. Expression of nouns
7. Expression of action words
8. Expression of locative words
9. Expression of descriptive words
10. Expression of simple commands

The tool was shown to a panel of experts’ in order to ensure the validity of the content.
Following is a summary of the observations on the pilot study and the feedback from experienced professionals:

1. Since the aim was to identify whether children developed language through AAC, the scale modified to measure the language behaviors on mode of comprehension or expression would serve the purpose best. Therefore the rating of behaviors was modified to assess language comprehension and expression evident through verbal means, through signs or through pictures/symbols instead of rating behavior as always evident or frequently evident.

2. Since training and facilitation of AAC is through activities, inclusion of items related to activities will form the core of the tool and make it amenable for measurements.

3. Items on nature of interaction, purposes of communication, contexts of communication, modes of expression need not be included as separate items but will be accounted for in the vocabulary of listed activities. The items will get demonstrated when children show comprehension and expression of activities by using the relevant vocabulary. (Refer Appendix 2 for CSC Pilot Version and Appendix 5 for test version.)

The reliability coefficients were computed for the Communication Scale for Children. The Cronbach Alpha value obtained was .845 indicating a high internal consistency among the items of the scale.

Table 3.4.3d

*Internal consistency for items on CSC*

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>Cronbach’s Alpha based</th>
<th>No. of items standardized</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.845</td>
<td>0.894</td>
<td>28</td>
</tr>
</tbody>
</table>
The correlation between forms using spearman brown coefficient and Guttman Split half coefficient was found to be .803 and .678 also indicating a good internal consistency.

Table no 3.4.3e

*Reliability for CSC-correlation between forms*

<table>
<thead>
<tr>
<th>Correlation Between Forms</th>
<th>.720</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman-Brown Coefficient</td>
<td>Equal Length</td>
</tr>
<tr>
<td></td>
<td>Unequal Length</td>
</tr>
<tr>
<td>Guttman Split-Half Coefficient</td>
<td>.827</td>
</tr>
</tbody>
</table>

Item analysis of the CSC tool was carried out through factor analysis. The values show to be significant as P value is <0.05 and therefore indicating that the variables are correlated and suitable for factor analysis.

Table No 3.4.3f

*KMO and Bartlett's Test for sampling adequacy*

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | .696* |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 324.222 |
|                                  | Df   | 105 |
|                                  | Sig. | .000** |

*KMO measure greater than .05 (0.696) indicating the variables are suitable for factor analysis

**Bartlett’s test of sphericity observed significance level 0.000 indicating the strength of relation among variables to be strong and amenable for factor analysis.
Table no 3.4.3g

Eigen values & extractions for CSC pre test scores

**Total Variance Explained**

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>5.286</td>
<td>35.241</td>
<td>5.286</td>
</tr>
<tr>
<td>2</td>
<td>2.074</td>
<td>13.829</td>
<td>2.074</td>
</tr>
<tr>
<td>3</td>
<td>1.303</td>
<td>8.685</td>
<td>1.303</td>
</tr>
<tr>
<td>4</td>
<td>1.262</td>
<td>8.415</td>
<td>1.262</td>
</tr>
<tr>
<td>5</td>
<td>.935</td>
<td>6.230</td>
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</tr>
<tr>
<td>6</td>
<td>.814</td>
<td>5.423</td>
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<tr>
<td>7</td>
<td>.732</td>
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<td>.568</td>
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<td>.429</td>
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<tr>
<td>11</td>
<td>.395</td>
<td>2.635</td>
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</tr>
<tr>
<td>12</td>
<td>.254</td>
<td>1.693</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>.210</td>
<td>1.403</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>.127</td>
<td>.848</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>.117</td>
<td>.781</td>
<td></td>
</tr>
</tbody>
</table>

In the above table it can be seen that the first 4 factors are significant by the criterion of eigen value=1. These 4 factors explain 66.170% of total variance in the 15 variables.
Table 3.4.3h

*Factor analysis with Rotated Component Matrix for CSC*

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive Nouns Verbal Pre</td>
<td></td>
<td></td>
<td></td>
<td>.925</td>
</tr>
<tr>
<td>Receptive Nouns Speech Pre</td>
<td>.468</td>
<td>.446</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Nouns Picture Pre</td>
<td>.606</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Action Words Verbal Pre</td>
<td>.723</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Action Words Speech Pre</td>
<td>.730</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Action Words Picture Pre</td>
<td>.545</td>
<td>.409</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Locative Words Verbal Pre</td>
<td>.720</td>
<td>.409</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Locative Words Speech Pre</td>
<td>.731</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Locative Words Picture Pre</td>
<td>.518</td>
<td>.581</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Descriptive Words Verbal Pre</td>
<td>.631</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Descriptive Words Speech Pre</td>
<td>.681</td>
<td>.505</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Descriptive Words Picture Pre</td>
<td></td>
<td></td>
<td></td>
<td>.912</td>
</tr>
<tr>
<td>Receptive Simple Commands Verbal Pre</td>
<td></td>
<td></td>
<td></td>
<td>.613</td>
</tr>
<tr>
<td>Receptive Simple Commands Speech Pre</td>
<td>.809</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive Simple Commands Picture Pre</td>
<td></td>
<td></td>
<td></td>
<td>.762</td>
</tr>
</tbody>
</table>

The above-rotated matrix in table shows that all the variables in the scale can be explained by 4 factors.

In order to maintain objectivity and avoid personal bias in measuring the behaviors of children with disabilities, subjects were simultaneously observed by 2 two observers who were trained in advance on techniques of systematic observation.

Coefficient of correlation between the scores of the investigator (R1) and two observers was (0.678-R2) and (R3- 0.742) (P< .01) indicating the reliabilities to be good.
Table 3.4.3i

**Inter Rater Reliability Index for CSC**

<table>
<thead>
<tr>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>Pearson's Correlation</td>
</tr>
<tr>
<td></td>
<td>Significance</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
</tbody>
</table>

*Correlation is significant at 0.01 levels

Figure 3.4.3i  **Inter Rater Reliability Index for CSC**

Test retest reliability was computed using Pearson’s correlation. Coefficient of correlation on test retest for experimental group was 0.717(p < .01), which is significant at 0.01 levels.
Table 3.4.3j

*Test Retest Reliability for Experimental Group on CSC*

<table>
<thead>
<tr>
<th>Total test</th>
<th>Pearson's Correlation</th>
<th>Significance (1-tailed)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.717*</td>
<td>0.000</td>
<td>24</td>
</tr>
</tbody>
</table>

*Significant at 0.01 levels

Coefficient of correlation on test retest for experimental group was 0.950 (p < .01) which is significant at 0.01 level.

Table 3.4.3k

*Test Retest Reliability for Control Group on CSC*

<table>
<thead>
<tr>
<th>Total test</th>
<th>Pearson's Correlation</th>
<th>Significance (1-tailed)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.950*</td>
<td>0.000</td>
<td>24</td>
</tr>
</tbody>
</table>
• Significant at 0.01 levels

(Refer Appendix 5 for CSC-Test Version.)

**Reaction scale**

The Reaction Scale was developed to measure the perception of experimental group caregivers towards AAC and AAC training as an appropriate method to develop language and communication skills in children with disabilities.

The scale was designed like a Likert scale consisting of 20 statements. The reaction scale had a mixture of positive and negative statements relating to AAC and AAC training. Responses required the caregivers to indicate their position regarding each statement on a 5-point scale. (Refer Appendix 3 for RS Pilot version and Appendix 6 for test version).

Statements related to four areas of the training:

1. Perception about the training
2. Usage of AAC post training
3. The communication aids and strategies recommended during training
4. Perception on child’s responses following introduction of AAC

Some general guidelines were kept in mind while constructing the statements;

1. Care was take to keep the language simple and non technical
2. Statements were short
3. The length of the RS was kept short and quick to complete. So that it did not tax the efforts of the caregivers in completing the form
4. Instructions were clearly explained to the caregivers and any doubts clarified promptly.
5. The scale was designed with 5 options so that it would give room for expression and at the same time not be laborious and overwhelming.
6. Caregivers were encouraged to give their frank opinion by choosing the most appropriate unit of scale.
The RS was given to a panel of experts to scrutinize for content validity. Their valuable suggestions were considered and the final statements of the RS drawn out. (Refer Appendix 3 for RS –Pilot Version and Appendix 6 for Test Version.)

3.5 Procedure for data collection

The data collection for both phases of the study was done according to the steps given below:

1. Identification of sample
2. Administration of pretest
3. Treatment
4. Administration of post test

The data collection procedure is described phase wise.

Phase 1

Identification of sample: Eight schools serving children with developmental disabilities in fairly distributed locations of a metropolitan city were approached with a proposal for this research study. All the schools were willing and approved for the study to be conducted in their centre. 80 caregivers from the special schools were identified. On receiving permission from the heads of the centers, demographic information and awareness of AAC was obtained. By this the caregivers with no awareness and prior experience in AAC were identified (N=54).

From this available sample with required characteristics, subjects were randomly selected (N=48) and then randomly assigned to experimental (N=24) and control group (N=24) for the study.

Administration of pre test: Subjects of both experimental and control groups were observed for their skills in AAC and communication on the OSC during their interaction with children with developmental disability.
Since the caregivers regularly came to the centre and worked with their children for one hour under the guidance of special educators, the subjects did not have the experience of being in a contrived experimental setting.

As has been discussed earlier (Table 3.4), in order to avoid personal bias and subjectivity, the caregivers were observed simultaneously by two observers and the reliabilities between their observations were found to be good. The subjects included in the sample were also found to be comparable at pretest based on t test analysis of the pretest scores (Table 3.6).

**Treatment:** The experimental group of caregivers was given a 3 day training workshop on orientation to speech language communication, nature of its difficulties in children with CP & MR, AAC concepts, classification, strategies and specific focus on Makaton and Picture communication. The total duration of the workshop was 18.5 hrs inclusive of breaks. On completion of the training, the caregivers implemented the training through activities with children with disability for 15 sessions under the guidance of the investigator.

The control group of caregivers was given a half-day seminar on speech language concepts and AAC. This group continued with regular activities with the children in special schools.

**Administration of posttest:** After completion of 15 sessions the experimental and control group caregivers were observed during their interaction with their child. The skills of the caregivers were observed on the OSC.

Following completion of phase 2 the experimental group caregivers were administered the Reaction scale in order to obtain their opinion towards AAC and AAC training. This indicated whether the caregivers found AAC to be a suitable method of developing language and communication in children with disability.

**Phase 2**

**Identification of sample:** Children with disability were identified from eight special schools that were willing and approved for the study to be conducted in their
centre. On permission from the heads of the centre, the school evaluation records of children were scrutinized.

90 children (N=90) within the age group of 6-10 yrs diagnosed with mental retardation or cerebral palsy with IQ between 30-49 on psychological evaluation, speech and language delay, normal hearing sensitivity and no other associated problems based on evaluation reports in school records were initially identified in the special schools.

These children were assessed for candidacy for symbolic augmented systems on Augmentative Communication Assessment Protocol for Symbolic Augmentative Systems (ACAP-SAS) (Gamel-McCormick & Dymond, 1994). n=54 children who demonstrated poor scores on this protocol were considered and others excluded from the study.

From the available sample, children (n=48) were randomly selected and then randomly assigned to experimental (n=24) and control group (n=24).

**Administration of Pre test**: Subjects of both experimental and control groups were observed for their receptive and expressive language skills on the CSC. As stated before, two observers who were trained in advance on techniques of systematic observation for the purposes of the study observed the children simultaneously. The inter rater reliability was found to be good (Table 3.12) and the subjects in the experimental and control group were found to be comparable (Table 3.15)

**Treatment**: Experimental group children received 15 sessions of AAC training from caregivers. The control group children continued on the regular curriculum in the school.

**Posttest**: After completion of 15 sessions the experimental and control group were assessed on the CSC by the investigator and two independent observers.

Test retest was conducted to determine the correlation between test scores and retest scores.
3.6 Statistical Treatment of Data

The data were analyzed using a variety of statistical procedures. Reliability of tools was determined using Cronbach Alpha measures.

Cronbach's \( \alpha \) (alpha) is a statistic. It is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees. Cronbach's alpha will generally increase as the intercorrelations among test items increase, and is thus known as an internal consistency estimate of reliability of test scores. Because intercorrelations among test items are maximized when all items measure the same construct, Cronbach's alpha is widely believed to indirectly indicate the degree to which a set of items measures a single unidimensional latent construct. Therefore cronbach alpha was used to determine the reliability of the tools developed for the purposes of this study, namely Observational schedule for caregivers and communication scale for children. Use of cronbach alpha helped ascertain the internal consistency of the items included in the tools.

The correlation between two variables reflects the degree to which the variables are related. The most common measure of correlation is the Pearson Product Moment Correlation. Inter rater reliability was determined using Pearson’s coefficient of correlation. Pearson’s correlation coefficient is known as the best method of measuring the correlation, because it is based on the method of covariance. Pearson’s correlation coefficient gives information about the degree of correlation as well as the direction of the correlation and correlation coefficient value lies between +1 to -1.

\( t \) test was used to compare the means at pre training and post training in order to determine whether the differences between the means is significant due to change. To test the significance a risk level, called the alpha level is set. And the degrees of freedom (df) determined for the test. In the \( t \)-test, the degree of freedom is the sum of the persons in both groups minus 2. Given the alpha level, the df, and the \( t \)-value, \( t \)-value is determined in the standard table of significance to determine whether the \( t \)-value is large enough to be significant. The \( t \) test was used to determine if the differences in means were significant for subjects in pre test and post test, between experimental and control group of subjects’ pre and post test and in test retest condition.
The reaction scale consists of statements regarding AAC and AAC training and caregivers had to give their degree of agreement to the statements. As the items are organized on a likert type of scale, the percentage of positive and negative opinion on the RS was calculated.