CHAPTER 3

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A review of the literature on memory functioning reveals that in the last two decades, tools for assessing memory functioning have been developed with increasing methodological sophistication. However, there is still scope for newer scales in this domain as none of these has been entirely free of methodological drawbacks. In the Indian context assessment of memory development in children is emerging as a distinct research area, especially relevant in clinical and educational settings. The present study aims to develop one such test for assessing memory functioning in children.

Since the majority of assessment methods for memory functioning are meant for adults, the earlier batteries obviously have had limited applicability to children. The evidence from various disciplines indicates that there are at least two types of memory deficits in children, namely, those who deviate developmentally and those who through disease or accidents, have dysfunction of the brain. Identification of memory deficits in children has presented a serious problem to teachers, psychologists and special educators.
Objectives of the study:

1. To construct a scale to assess various aspects of memory in children.
2. To standardize the scale on normal children in the age range of 7 to 11 years.
3. To establish reliability.
4. To establish validity.
5. To provide age norms and memory profile chart for the individual child.
6. To establish clinical validity.

Sampling procedure

For the present study development of memory scale for children—ideally it would have been feasible to use random sampling procedures for data collection. Since it is extremely time consuming to match each child on certain demographic variables such as religion, socioeconomic background and type of school the child attends, nonprobability sampling procedures were considered and purposive sampling was used. Within the framework of purposive sampling it was decided to use as large a sample as possible, since large samples give the principle of randomization a chance to work in the final sample selected (Kerlinger, 1973).
1. **CHILDREN'S BEHAVIOUR QUESTIONNAIRE (RUTTER, 1967)**

Rutter's form A and B (1967) are screening instruments to be completed by teachers. The CBQ is in the form of a questionnaire, with descriptions of the student's classroom behaviour and academic achievement. Form A pertains to scholastic ability and achievement, while Form B deals with behavioural problems of psychological nature. On Form B the teacher has to indicate whether each description "does not apply", "applies some what", or "definitely applies", to the child in question. Accordingly, each item is scored 0, 1 or 2 based on the rating and these scores are added to obtain a total score. The teacher's response to the descriptions on form A cannot be scored as they only indicate the presence or absence of a scholastic problem.

Test-retest reliability of form B was 0.89 over a 3 month period and inter-rater reliability was 0.72 indicating good reliability. The test was used to discriminate between children attending a child guidance clinic and children in the general population, to agree with psychiatric judgements and to differentiate between main types of personality disorders (Rutter, 1967; Rutter, Shafter and Sturge, 1975; Tizard and Whitmore, 1970).

The internal consistency of the CBQ was determined by examining the pattern of inter correlations between items in
the CBQ. In the Isle of Wight study (Rutter et al., 1970), the internal characteristics of the scale in one sample are closely similar to those in the other samples studied. Rutter (1967) and Rutter et al., (1975) found that a cut off score of 9 or more had a discriminative value as it selected 12.7% of boys and 10.9% of girls in the general population (Appendix-A).

2. COLOURED PROGRESSIVE MATRICES (RAVEN, 1965)

The Coloured Progressive Matrices (CPM) is described as a test of "observation" and "clear thinking". The Coloured Matrices makes it possible to explore the psychological significance of observed discrepancies between a person's present capacity for productive thinking and his recall of information. The three sets of twelve problems constituting the coloured matrices are arranged to assess the chief cognitive processes of which children under 11 years of age are usually capable. The three sets together provide three opportunities for a person to develop a consistent theme of thought, and the thirty six problems as a whole are designed to assess, as accurately as possible, mental development upto intellectual maturity. The Coloured Matrices sets A,Ab,B are arranged to assess mental development upto the stage when a person is sufficiently able to reason by analogy to adapt this way of thinking as consistent method of inference. This tool was used to screen out children functioning below average intellectual capacity.
The reliability of the Raven's Coloured Progressive Matrices has been investigated in several studies. Freyberg (1966) and Jordon (1959) report that Raven Coloured Progressive Matrices is internally consistent and found no difference in ability estimates between genders or among ethnic groups.

Age

An unrestricted age range could result in a heterogeneous group, where adequate representation of various age levels could be difficult, it was decided to study children between 7 and 11 years of age. Equal number of male and female children were included as it is commonly done in studies pertaining to norm development.

Medium of Instruction

Education level for the samples had to be specified so as to include respondents who would comprehend the items adequately enough to respond to the questions. These subjects had to possess adequate knowledge of English.

Urban

With the vast socioeconomic differences in the rural and urban setting, inclusion of children from both areas would not be justified in research. Thus, subjects from urban schools alone were included in the study for reasons of convenience, familiarity, and suitability for responding to testing situation.
As indicated with review of literature, though there are a few tests available to assess memory functioning in children, by and large, the existing batteries have inadequate norms with limited scope and applicability. The tests are too lengthy and have reported only cumulative scores. A more serious problem is that there is considerably less evidence regarding the validity of tests employed by clinicians. The tests have failed to distinguish subjects suffering from different types of memory impairment, making its clinical usefulness very doubtful. For most of the tests reliability and validity were not reported. The tests need to assess the relative efficacy of visual and verbal modes of input of learning materials and how this relationship may change with age.

The developmental progression in memory was identified between 7-11 years, consisting of frequent use of storage strategies, retrieval strategies and their use of mnemonics. Children prior to 7 years do not make use of strategies because of unfamiliarity. Children above 11 years do so with increasing flexibility and proficiency. Their strategy use approximates adult performance. There is a clear ontogenic trend evident. Hence the present focus of study will be restricted to 7-11 years old normal children.

In planning the present study, conscious effort has been made to overcome some of the drawbacks highlighted in the
earlier review. The subtests selected have equal representation from both visual and verbal areas adequately covering the entire area of memory functioning. A well represented homogeneous sample will be selected to standardize the Tests of Memory for children. The scoring procedures will be simple. The profile scores on different abilities and a total score will provide the overall score on this battery. The reliability and clinical validity of this battery will be established.

SAMPLE

The samples used at various phases of the scale construction procedure comprised two kinds of groups i.e.,

A - Normal group. B - Clinical group.

Inclusion Criteria

1) Age 7-11 years.
2) Studying in an English medium school between IIInd and VIth standards.
3) Residing in the urban area.

Exclusion Criteria

2. History of any physical or mental handicap.
3. Specific learning difficulty.
I shows the phases involved in tool construction

ITEM GENERATION
SUB TESTS: 18
NO. OF ITEMS: 191

↓

SCREENING (CBQ & RCPM)

NORMALS (N = 219)
7-11 YEARS

↓

ADMINISTRATION OF TESTS OF MEMORY FOR CHILDREN

HASE II ← NORMAL (N = 200)
ILOT STUDY CLINIC (N = 15)

MODIFICATION OF SCALE
NO. OF ITEMS: 147

HASE III ← MAIN STUDY
Inclusion criteria for clinical group
1. 1,2,3 as for the normal group
2. Subjects with seizures under control.
3. Duration of epilepsy for two or more years and on antiepileptic medication.

Exclusion Criteria
1. Subjects with only febrile convulsions.
2. Criteria 1,2,3 and 4 as for the normal group.

FIG. 1 SHOWS THE STEPS INVOLVED IN TOOL CONSTRUCTION

STEPS INVOLVED IN TOOL CONSTRUCTION

PROCEDURE

The study was conducted in three phases:
Phase I - Preparation and initial trial of the battery.
Phase II - Administration of the test on a pilot sample.
Phase III - Final tryout on a large sample.

PHASE I

STEP 1: ITEM GENERATION

The first stage for tool construction is the selection of items forming the initial item universe. In most of the test construction procedures reviewed earlier, selection of tests from various published tools has been a commonly used approach. Another option is to generate items on certain theoretical propositions of memory functioning. But this was not suitable as the study did not aim to validate any
particular theoretical model of memory development. For the present study, the first approach was followed. The battery were generated from the available tests developed in the West and from the existing adult memory tests developed in Indian set up. The items related to various aspects of memory functioning, presumably suitable for the Indian children.

STEP 2: ITEM SELECTION

To generate items for the test to be constructed to measure various aspects of memory, the following procedure was adopted - the subtests selected were (i) Personal Information (12 items), (ii) Mental Control (6 items), (iii) Sentence Repetition (14 items), (iv) Logical Memory: Story Recall Immediate (18 facts), Story Recall Delayed (18 facts), (v) Word Recall Meaningful (10 words), (vi) Digits Span Test: Digit Backward (9 items), (vii) Brown Peterson test (10 items), (viii) Delayed Response Learning (5 items), (ix) Word Recall Non Meaningful (10 items), (x) Picture Recall (4 items), (xi) Cattell's Retentivity Test (10 items), (xii) Picture Scanning (3 items), (xiii) Knox Cube Imitation Test (12 items) (xiv) Benton Visual Retention Test (10 items), (xv) Complex Figure (1 item), (xvi) Paired Associate Learning (30 items). The above sixteen subtests were the pooled together for item generation with 191 items in the initial step. Description of each of these subtests as follows:
i) **Personal Information (PI)**

The personal information (Out of 12 items only 5 items) is adopted from Wechsler memory scale (Wechsler, 1945), PGI memory scale (Pershad, 1977) and Mini Mental State Examination (Strub & Black, 1977). This test is a measure of remote memory which constitutes recall of past events of personal life.

ii) **Mental Control (MC)**

The mental control (Out of 6 items only 5 items) is adopted from Boston memory scale (Boston, pg; c.f. Pershad, 1977). These verbal automatisms learned by rote in early childhood and frequently used throughout life were normally recalled so unthinkingly, effortlessly and accurately.

iii) **Sentence Repetition (SR)**

The sentence repetition (Out of 14 items only 5 items) is similar to that of items present in the PGI memory scale (Pershad, 1977). This measures sequential reproduction of the sentences verbatim. For this test, sentences were taken from their English Readers. The sentences consisted of 4 to 13 words arranged in increasing order of difficulty.

iv) **Logical Memory (LM)**

The passage recall is similar to the logical memory test in Wechsler memory scale (Wechsler, 1945). The subject has to recall a given number of ideas correctly in the immediate and delayed recall (after 30 seconds) of the logical material.
v) Word Recall Meaningful (WRM)

On a card 10 meaningful words are presented for 30 seconds after a 2 minute pause; the subject has to recall the meaningful words he has already seen from the second card. These words were taken from their English text books. This test was subsequently retained for the final tryout without any alteration.

vi) Digit Span (DS)

This subtest is taken from Wechsler Memory Scale (Wechsler, 1945). This comprises of span for digits forward and backward. The maximum number of digits used in the series is limited to 9. This is a test for measuring attention and concentration.

vii) Brown Peterson Test (BPT)

The most popular technique to use distracted task is to prevent rehearsal of material being held for short term retention testing developed by (Peterson, 1959; Brown, c.f. Baddeley 1976).

This test presents ten nonsense syllables in combinations of three consonants eg. BFH, SZP etc. which the subjects will rehearse three times, then they remain busy for (2 minutes) repeating names of 4 primary colours i.e. red, green, yellow, blue, after which they will be asked to recall the three syllables spoken to them in the beginning. This test measures short term retention of nonverbal memory.
viii) Word Recall (Non meaningful) (WRN)

This subtest is similar to Cattell's retentivity for ten nonsense syllables (Cattell, 1953). On a card 10 nonsense syllables are presented for 30 seconds; after a 2 minute pause, the subject has to show from the second card the nonmeaningful words he has already seen. This test was retained without modification for the final tryout.

ix) Delayed Response Learning (DRL)

This essentially requires the ability to delay the previous response in order to arrive at a final solution (Berman, 1982). There are four sets of fairly simple arithmetic problems. Each problem consists of two parts, presented one after the other. In the first part, a simple arithmetic problem is given, the child solves it and keeps the result in mind and then solves the 2nd part of the problem 10 seconds later, incorporating the result from the previous part. The problems were modified and made simple for children.

x) Mann-Suiter Visual Memory Screen For Objects (MSVM)

The Mann-Suiter (1984) visual memory span for objects is designed to assess the ability to visualize pictures of common objects presented in groups. There are four cards. On the first card there are two pictures and it was exposed for two seconds. On the second card there are three pictures and it was exposed for three seconds. On the third card there are
four pictures and it was exposed for four seconds. On the fourth card there were five pictures in a row and it was exposed for five seconds. The child was expected to recall the pictures in the same sequence. This test measures short term visual memory.

xi) Picture Scanning (PS) (Kamat, 1967)

This test was taken from Binet Kamat test of intelligence. This is a test of visual scanning and measures attentional ability. The picture contains one theme which can be properly interpreted by carefully scanning the different parts of the pictures and their relations to one another. The picture contains sufficient number of familiar objects.

xii) Knox Cube Imitation Test (KCIT) (Arthur, 1947)

This is a test of attention and concentration, and examines the sequential, time dependent functions of the left hemisphere. The four blocks of the knox-cube test are affixed in a row. The examiner taps the cubes in prearranged sequences of increasing length and complexity and the subject must try to imitate the tapping pattern exactly. The examiner, holding the fifth cube in his hand says "watch carefully and then do as I do in the same order". He then taps the cubes with the fifth cube in a prescribed definite order (and at about one tap per second) always beginning with the cube at the left of the subject between the second the third cubes.
xiv) Complex Figure (CFT) (Osterrieth, 1944)

This test was developed by Osterrieth. Most examiners give both immediate and delayed recall trial of the CFT; the amount of delay varies among examiners. The length of delay is apparently of little consequence. Performance on the recall trials helps the examiner to sort out different aspects of the constructional and memory disabilities that might contribute to defective recall of the complex figure. Subjects with left sided lesions often produce drawing with disordered visuospatial abilities. They may improve their performance on the immediate recall. Subjects with left
sided lesions also recall the overall structure of the figure with simplification and loss of details. Subjects with right sided lesion who have difficulty in copying the figures display even greater problems with recall. Subjects with right hemisphere damage tend to lose many of the elements of the design, making increasingly impoverished reproduction, will also increasingly distort and confuse the configurational elements of the design.

xv) Paired Association Learning Test (PALT)

This test is similar to associate learning test in WMS (Wechsler, 1945) and PGI memory scale (Pershad, 1977). It consists of 30 items of ten word pairs familiar to children, six forming easy associations (eg. Needle - thread) and the other four "hard" word pairs that are not readily associated (Penknife - Eraser). The list is read three times, with a memory trial following each reading. This list is sensitive to learning. It is also a measure of well learned verbal associations and retention of new, unfamiliar verbal material.

xvi) Cattell's Retentivity Test (CRT)

This test is taken from Cattell's Retentivity Test, (Cattell, 1953). It consists of of complex and unfamiliar designs of irregular geometrical figures. Which cannot elicit any verbal associations. On a card 10 geometrical figures are presented for 30 seconds; after a 2 minute pause and from
the second card the subject has to recognize the geometrical figures which he has already seen in the first card. This test measures visual recall for irregular geometrical designs.

Validity of the scales has often been questioned for its insufficient evidence. The present study was to use clinical validity of the scale by using a clinical group of subjects with epilepsy. The effectiveness of the scale, thus developed needs to be assessed for use in the clinical setting with subjects having epilepsy.

Since inadequate reporting of reliability data is often pointed out for many published tests, care was taken in the present study to provide test-retest reliability and internal consistency.

Scoring procedure to evaluate the performance of the subjects on this test was kept as simple as possible. Care was taken to adopt a scoring system which might not appear too complex or too difficult to the clinicians.

PHASE II
STEP 3 : PILOT STUDY

The 18 subtests were given to five judges who were trained clinical psychologists for content validation; in order to arrive at a set of items to be included for the pilot study.
The judges evaluated each of the items on the following aspects.

i) If the items were culturally relevant;

ii) If the items could be easily comprehended by the target population;

iii) If the items represented the hypothesized aspect of memory function.

There was equal representation of both visual and verbal memory tests, measuring immediate and delayed recall. There was consensus among all the five judges. The screening tools and the battery of memory tests was ready for the Pilot try out.

STEP 4 : ITEM GENERATION

A face sheet was prepared to obtain the socio demographic data along with instructions for administering the test.

A pilot study was conducted in order to make certain modifications in tests of memory for children and to allow the investigator to familiarise with tests. On the basis of the pilot study, certain decisions were made with regard to the administration of the tests. The pilot study also served the purpose of evaluating the memory test battery the time required per child to complete the test and to ensure that
they were able to comprehend the instructions was tested. The subtests were screened for duplication in form and content.

STEP 5 : SCREENING TOOL FOR BEHAVIOUR PROBLEMS

CHILDREN'S BEHAVIOUR QUESTIONNAIRE (RUTTER, 1967)

Child Behaviour Questionnaire Proforma A and B was administered on a large sample of 219 children with the purpose of screening for behavioural disturbance. Four children (three boys, and one girl) who scored above the cut off point were dropped from the sample.

STEP 6 : SCREENING TOOL FOR INTELLECTUAL SUBNORMALITY

The Coloured Progressive Matrices was administered to a sample of 215 children. Fifteen cases 8 boys, 7 girls who scored below the 5th percent rank were dropped from the study.

STEP 7 : INITIAL TRY-OUT

The battery of memory tests was administered individually to those children who scored above the 5th percentile rank on Coloured Progressive Matrices test 200 (121 boys, 79 girls). It took about one hour to one and a half hours to complete the test battery. The children in the age range of 7 to 11 years studying in the 2nd to 6th standards were tested. The sample was drawn from one school.
A matched sample of 15 epileptic children with two or more years duration on antiepileptic medication, attending neurology OPD, NIMHANS, Bangalore was selected as the clinical sample.

STEP 8: ITEM REDUCTION

The data was scored and for each item, the percentage of passes was calculated for each age group of the normals and the epileptic group. Mean S.D. and chi-square were calculated for normal and clinical groups and significance level was estimated for each item in a subtest. The items which significantly discriminated the groups were retained. Items which were too easy and too difficult across 7-11 years, among the normals were dropped. There were tests which were similar: these were as follows: Knox cube was similar to Digit Span test; Brown Peterson test was similar to Word Recall non meaningful test. Hence these tests were deleted from the battery. Pictures Scanning was found too simple by all the children and the Complex Figure test was too difficult for children to perform both these were deleted. Consequently the battery was reduced to 12 subtests instead of 16.
FIG. II SHOWS THE STEPS INVOLVED IN THE MAIN STUDY

MAIN STUDY

SCREENING - I

BOYS (N = 400) GIRLS (N = 317)

SCREENING-II OF (RCPM) (N = 651)

FINAL SAMPLE (NORMALS N = 573)

BOYS (N = 277) GIRLS (N = 296)

ADMINISTRATION OF TEST OF MEMORY FOR CHILDREN (N = 573)

VALIDITY CLINIC SAMPLE EPILEPSY

BOYS (N = 41) GIRLS (N = 34)

RELIABILITY RETEST @ 6 WEEKS (N = 38)

BOYS (N = 21) GIRLS (N = 17)

ANALYSES
Table - 2 : Shows the following subtests with items that were too easy* and too difficult items**

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Items which were</th>
<th>too easy</th>
<th>too difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Personal Information</td>
<td>1,4,5,6,7</td>
<td>2,3,11,12</td>
<td></td>
</tr>
<tr>
<td>2) Mental Control</td>
<td>5</td>
<td>11,12</td>
<td></td>
</tr>
<tr>
<td>3) Sentence Repetition</td>
<td>1,2,3,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Story Recall Immediate</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Story Recall Delayed</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Word Recall Meaningful</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Digit Forward</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Digit Backward</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Word Recall Non-Meaningful</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Delayed Response Learning</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Picture Recall</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Benton Visual Retention</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Paired Associate Learning</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14) Cattell's Retentivity Test</td>
<td>All the items were retained</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* More than 75% of children performed successfully.

** Less than 25% of the children could successfully perform.

From the array of memory tests, overlapping tests measuring almost similar memory constructs were dropped and a few tests which were found difficult by most of the children.
were eliminated. After minimal modification the Battery of memory tests was finalized for the next tryout.

STEP 9 : ITEM REVISION

The final battery consisted of 12 subtests, and the number of items in each subtest were revised. This battery was employed for phase 3.

FIG. - 2 SHOW THE STEPS INVOLVED IN THE MAIN STUDY

PHASE III

STEP 10 : MAIN STUDY

For the main study a sample of 714 normal children (400 boys and 314 girls) was tested. With the use of purposive sampling procedure for the study, certain socio demographic characteristics had to be controlled in the sample selection. A purposive sample of 714 children between the age range of 7-11 years was selected. The children were selected from four English medium, Government aided, co-educational schools catering to children from middle socio-economic status. Their syllabus and teaching methods were comparable. The primary, middle and the high school were situated in the same campus. There were about 50-60 children in each section and three to four sections in each class. Each class had a class teacher and separate language/subject teachers and physical instructors. The four schools were comparable on all aspects.
STEP 11 : SCREENING FOR BEHAVIOUR PROBLEMS

A screening tool CBQ form A and B was used to screen children with any behaviour problem 63 (40 boys and 23 girls) were excluded from the main study who scored above the cut-off score.

STEP 12 : SCREENING FOR INTELLECTUAL SUBNORMALITY

The Raven Coloured Progressive Matrices was administered on 651 normal children (311 boys, 340 girls) to assess the intellectual functioning of children. 78 were excluded from the main study. 18 protocols were incomplete, 60 scored below the 5th percentile rank (37 boys, 33 girls).

STEP 13 : FINAL TRY OUT

In this final stage, the test of memory with the 12 subtests and (147 items) was ready for the try out.

It was administered to a sample of 573 children of age group between 7-11 years (277 boys and 296 girls).

1) Personal Information - 5 Items
2) Mental Control - 5 Items
3) Sentence Repetition - 5 Items
4) Story Recall Immediate - 18 Facts
   Story Recall Delayed - 18 Facts
5) Word Recall Meaningful - 10 Words
6) Digit Forward - 9 Items
   Digit Backward - 9 Items
7) Word Recall Non-Meaningful - 10 Items
8) Delayed Response Learning - 4 Items
9) Picture Recall - 4 Items
10) Benton Visual Retention Test - 10 Items
11) Paired Associate Learning - 30 Items
12) Cattell's Retentivity Test - 10 Items

Table - 3: Shows the number of children tested in different age groups

<table>
<thead>
<tr>
<th>Age group</th>
<th>Standard</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 years</td>
<td>II</td>
<td>56</td>
<td>55</td>
<td>111</td>
</tr>
<tr>
<td>8 years</td>
<td>III</td>
<td>58</td>
<td>53</td>
<td>111</td>
</tr>
<tr>
<td>9 years</td>
<td>IV</td>
<td>55</td>
<td>70</td>
<td>125</td>
</tr>
<tr>
<td>10 years</td>
<td>V</td>
<td>53</td>
<td>55</td>
<td>108</td>
</tr>
<tr>
<td>11 years</td>
<td>VI</td>
<td>55</td>
<td>63</td>
<td>118</td>
</tr>
</tbody>
</table>

STEP 13: RETEST RELIABILITY

The Tests of Memory were readministered on a part of the subsample 38 children, (21 boys, 17 girls) of 7-11 years after a period of 6 weeks, in order to establish the test-retest reliability.

STEP 14: CLINICAL VALIDATION

The clinical validity of the scale was evaluated using the clinical sample 75 (Boys=41, Girls=34) of the age group of 7-11 year the children presented at the Neurology O.P.D.
National Institute of Mental Health and Neuro Sciences, Bangalore, with a history of two or more years of epilepsy and on regular antiepileptic medication and their seizures were under control. These children were administered only Tests of Memory for children. The data of the clinical sample were compared with those of matched normal sample, to establish the clinical validity.

**STEP 16 : DATA ANALYSIS**

The data collected through testing were subjected to analysis. In Pilot Study, the statistical techniques adopted to reduce the number of items were as follows. The number of passes for each items was estimated. Chi square and P values were estimated for each subtest on the memory battery for both the normal and clinical samples. In the main study, means, standard deviations, minimum and maximum scores and adjusted means for Coloured Progressive Matrices scores for each of the five age groups were computed. The inter-correlation of subscales with the total memory scores was also computed. In addition, percentage of cases falling between $+1$ SD, $+2$ SD and $+3$ SD limits were computed. Similar analysis was done for the clinical group.

Cronbach's coefficient alpha (Cronbach, 1953) was used to calculate the internal consistency of the scale; Pearson's Product Moment Correlation coefficient (Snedecor and Cochran, 1937) provided the test-retest reliability coefficients for the scale.
Norms were provided with means and standard deviations and 't' tests were used to find out if there were any significant difference on the mean scores between normal and clinical groups was established to indicate, for the clinical validity.

Ethical Issues

Ethical guidelines for conducting the research on human behaviour were followed for the study. Oral informed consent was obtained from all the participants of the study. The purpose of the research was explained to each subject, and confidentiality was maintained for any information collection for the research. The subjects were also informed about their freedom to exclude themselves at any point of the time for the study.