METHODOLOGY OF INVESTIGATION

4.1 INTRODUCTION

Methodology layout helps the investigator to proceed with the proposed research in a systematic way. The Chapter on Methodology of investigation is followed by the literature review and conceptual framework. This chapter outlines the research design, research settings, sampling strategy, instrumentation, reliability and validity, data collection procedure and various techniques used for analysis. The research design gives the background of scientific inquiry and research studies and discusses various research options. Here the investigator justifies the use of particular types of research such as either qualitative or quantitative as well as the appropriate research methods such as surveys, experimental or case studies based on the particular research question under consideration. Next section in the methodology describes the research settings – the context and background of the research study is described followed by the sampling strategy, which outlines the techniques applied in selecting the sample respondents from the population under study.

The instruments used in a research study will vary based on research design and research technique. The validity and the reliability of the instruments should also be established if the instrument was developed by the investigator. After the instrumentation the investigator outlines the data collection technique and how it was carried out. The last element of methodology describes about the method of analysis whether statistical or descriptive analysis was employed in the study and if statistical, the various statistical techniques used.

In this Chapter, the investigator discusses the research design, research settings, sampling strategy, instrumentation, reliability and validity, data collection procedure and various statistical techniques used for analysis.

4.2 STATEMENT OF THE PROBLEM

In the present study the investigator was mainly interested in knowing how the cognitive processing in children influences their achievement. Also how each student
perceives his or her disabilities in basic skills like reading, writing, and mathematics? Do their perception and their achievement go together? Considering the above discussion the statement of the problem is as follows –

“A STUDY ON COGNITIVE PROCESSING AND SELF PERCEPTION OF DISABILITIES AND ITS EFFECT ON ACADEMIC ACHIEVEMENT AMONG CHILDREN OF ELEMENTARY INCLUSIVE SCHOOLS IN KERALA”

4.3 DEFINITION OF KEY TERMS USED IN THE STUDY

4.3.1 COGNITIVE PROCESSING

The media dictionary defines cognitive processing as the way in which a person changes external information into patterns of thought and how these are used to form judgements or choices.

Dictionary of Business and Management defines cognitive processes as the broad range of mental activities, including perception, learning, memory, thinking, information processing, and reasoning, that involves the interpretation of stimuli and the organisation of thoughts and ideas.

4.3.2 PERCEPTION

Perception is the process by which an organism attains awareness or understanding of its environment by organizing and interpreting sensory information. All perception involves signals in the nervous system, which in turn result from physical stimulation of the sense organs. (Wikipedia)

Perception is a central step in the processing of sensory/ attention information. Information perceived through sensory systems is later transformed into higher – order codes for use by the various higher – order cognitive subsystems. Perceptual functions include activities such as awareness, recognition, discrimination, patterning and orientation (Lezak, 1995).

4.3.3 SELF PERCEPTION

According to Merriam Webster’s Learner’s Dictionary self-perception is the idea that you have about the kind of person you are. It is defined as an awareness of the characteristics that constitute one's self; self-knowledge (thefreedictionary.com).
4.3.4 DISABILITIES

A condition that damages or limits a person’s physical or mental abilities or it is the condition of being unable to do things in the normal way, the condition of being disabled (Merriam Webster’s Learner’s Dictionary).

4.3.5 EFFECT

Effect is a change that result when something is done or happens; an event; condition, or state of affairs that is produced by a cause (Merriam Webster’s Learner’s Dictionary).

4.3.6 ACADEMIC

Academic that is relating to school and education. Academic relates to scholarly activities, especially those involving study within subject areas or disciplines (Dictionary of education).

4.3.7 ACHIEVEMENT

Achievement refers to the act of accomplishing something (The Free Dictionary)

4.3.8 CHILDREN


4.3.9 ELEMENTARY

An elementary school is an institution where children receive the first stage of compulsory education known as elementary or primary education. Elementary school is the preferred term in some countries, particularly those in North America. Primary school is the preferred term in the United Kingdom, India, Ireland, Pakistan, Australia, Latin America, South Africa and New Zealand and in most publications of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (Wikipedia).

4.3.10 INCLUSIVE SCHOOLS

Inclusive schools are schools where the students with special needs are educated along with students without special needs. (Wikipedia)
4.4 VARIABLES CONSIDERED FOR THE PRESENT STUDY

Variable means ‘a name for something that is thought to influence a particular state of being in something else…a special kind of concept that contains within it a notion of degree or differentiation’ (Hoover, 1980). It can also be defined as any characteristic or quantity that can take on two or more values. According to Kerlinger (1986) ‘A variable is a property that takes on different values. Putting it redundantly, a variable is something that varies……a variable is a symbol to which numerals or values are attached’. The variables considered in the present study are as follows-

4.4.1 Independent Variable–The Independent variables are the conditions or characteristics that the experimenter manipulates or controls in his or her attempt to ascertain their relationship to observed phenomenon. In a research study independent variables are antecedent conditions that are presumed to affect a dependent variable. They are either manipulated by the researcher or are observed by the researcher so that their values can be related to that of the dependent variable.

The independent variable considered for the present study is Cognitive processing i.e. Planning, Attention, Simultaneous and Successive processing and self-perception of learning disabilities of inclusive elementary school children.

4.4.2 Dependent Variable- The dependent variables are the conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes independent variable. It is that factor which is observed and measured to determine the effect of the independent variable. In a research study, the independent variable defines a principle focus of research interest. It is the consequent variable that is presumably affected by one or more independent variable that are either manipulated by the researcher or observed by the researcher and regarded as antecedent conditions that determine the value of the dependent variable. The dependent variable is the outcome. In an experiment, it may be what was caused or what changed as a result of the study.

The dependent variable of the present study is Academic achievement of the elementary inclusive school children.
4.4.3 **Intervening Variable** – Intervening Variable, sometimes called the confounding variable, (Grinnell, 1988) links the independent and dependent variable. It is also called a mediator variable. In certain situations the relationship between an independent variable and dependent variable cannot be established without the intervention of another variable. The cause variable will have the assumed effect only in the presence of an intervening variable.

The intervening variables used in the study are age, sex, class, medium, type of school, school locale, father’s education, occupation, mother’s education, occupation etc.

### 4.5 GENERAL OBJECTIVES OF THE STUDY

Considering the problem under study the following general objectives were formulated.

- To construct and validate a tool based on PASS model of cognitive processing
- To construct and validate a tool based on self-perception of learning disabilities
- To study the influence of Cognitive processing, self-perception of learning disabilities on achievement.
- To categorize the normal school children based on their performance on the cognitive processing and self-perception of learning disabilities.

### 4.6 SPECIFIC OBJECTIVES OF THE STUDY

From the above stated general objectives the following specific objectives were framed for the present study-

- To find out the dimensions of cognitive processing and self-perception of learning disabilities among the elementary inclusive school children.
- To bring out the descriptive typology of the elementary inclusive school children based on their cognitive processing and self-perception of disabilities (learning).
- To ascertain the relationship between achievement, cognitive processing and self-perception of learning disabilities among the elementary inclusive school children.
- To study the difference in achievement between the high and low groups on cognitive processing and self-perception of learning disabilities.
4.7 HYPOTHESES

Formulation and testing of hypothesis is an important phenomenon in social science research. Hypothesis is an assumption about relationship between variables. In common usage in the 21st century, a hypothesis refers to a provisional idea whose merit needs evaluation. The important phenomenon in scientific research is the formulation of hypothesis. A hypothesis is an empirically testable statement about a relationship involving two or more variables. Hence a hypothesis is a tentative statement that proposes a possible explanation to some phenomenon or event. It brings clarity, specificity and focus to a research problem, but is not essential for the study. Theodorson and Theodorson (1969) defined, ‘a hypothesis is a tentative statement asserting a relationship between variables’.

According to Kerlinger (1986), ‘A hypothesis is a conjectural statement of the relationship between two or more variables’. Webster’s New International dictionary of English Language defines it as ‘a proposition, condition, or principle which is assumed, perhaps without belief, in order to draw out its logical consequences and by this method to test its accord with facts which are known or may be determined’. Testing of hypothesis is important to ascertain whether formulated hypothesis is wrong or right. The following are the characteristics of a good hypothesis - It should be simple, specific and conceptually clear, and capable of verification. It should be related to the existing body of knowledge and operationalisable. Broadly there are two types of hypothesis namely research hypothesis and alternate hypothesis. The main function of the alternate hypothesis is to explicitly specify the relationship that will be considered as true in case the research hypothesis proves to be wrong. An alternate hypothesis is the opposite of research hypothesis. Conventionally, a null hypothesis of no difference is formulated as an alternate hypothesis.

To examine the general and specific objectives listed above the following hypotheses were put forth for the present study-

Hypothesis 1 There will be patterns of clustering of relationships among cognitive processing of elementary inclusive school children.
Hypothesis 2 There will be patterns of clustering of relationships among the self-perception of learning disabilities of elementary inclusive school children.

Hypothesis 3 Different groups based on the cognitive processing will emerge from the elementary inclusive school children.

Hypothesis 4 Different groups based on the self-perception of learning disabilities will emerge from the elementary inclusive school children.

Hypothesis 5 There will be significant relationship between cognitive processing and achievement of elementary inclusive school children.

Hypothesis 6 There will be significant relationship between self-perception of learning disabilities and achievement of elementary inclusive school children.

Hypothesis 7 There will be significant mean score difference in achievement between the high and low groups in factors that emerged in cognitive processing among the elementary inclusive school children.

Hypothesis 8 There will be significant mean score difference in achievement between the high and low groups in factors that emerged from self-perception of learning disabilities among the elementary inclusive school children.

Hypothesis 9 There will be significant mean score difference in achievement scores between the high and low groups based on cluster in cognitive processing among the elementary inclusive school children.

Hypothesis 10 There will be significant mean score difference in achievement scores between the high and low groups based on cluster in self-perception of learning disabilities among the elementary inclusive school children.

4.8 OPERATIONAL DEFINITIONS OF TERMS USED IN THE STUDY

Considering the conceptual framework, review of related studies and relevant literature of the present study certain concepts and terms used in the study need to be defined so as to operationalize the design of the investigation of the present study. The operational definitions of the concepts and terms used in the study are as follows-
4.8.1 COGNITIVE PROCESSING

In the present study, cognitive processing refers to planning, attention, simultaneous and successive processing. Planning is central to all activities. Attention is also very much necessary to do any task along with planning so that an individual can process the information simultaneously and successively to bring out the result.

4.8.2 PLANNING

Planning is a mental process by which an individual determines, selects, applies, and evaluates solutions to problems. The Planning Process provides the means to solve problems of varying complexity and involves processes like attention, simultaneous and successive processing, and includes a knowledge base. It is central to all activities in which there are both intentionality and a need for some method to solve a problem. This process includes self-monitoring and impulse control as well as plan generation.

4.8.3 ATTENTION

In this study, attention is a mental process by which an individual selectively focuses on particular stimuli while inhibiting responses to competing stimuli presented over time. It is a process involving the act of listening, looking at or concentrating on a topic, object or event for the attainment of a desired result. The Process of attention is assessed by the tasks that demand focused, selective, sustained, and effortful activity. It is carried out through cognitive abilities and helped by emotional and conative factors to select something out of the various stimuli present in one’s environment and then to bring it to the centre of one’s consciousness in order to perceive it clearly for deriving the desired ends.

4.8.4 SIMULTANEOUS PROCESSING

Simultaneous processing is a mental process by which an individual integrates separate stimuli into a single whole or group. The essential ingredient of simultaneous processing is that the person must see how all the separate elements are interrelated in a conceptual whole.
4.8.5 SUCCESSIVE PROCESSING

Successive processing is a mental process by which the individual integrates stimuli into specific serial order based on relationship that forms a chain-like progression. In successive processing each element is only related to those that precede it, and these stimuli are not interrelated. It involves both the perception of stimuli in sequence and the formation of sounds and movements in order.

4.8.6 LEARNING DISABILITY

Heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be the central nervous system dysfunction and may occur across the life span.

4.8.7 COGNITIVE ASSESSMENT

A cognitive assessment is an examination conducted to determine someone's level of cognitive function. In cognitive assessment, the subject will be asked to complete a series of tasks which require cognitive skills. The cognitive assessment tests were broken up into several different components to test Planning, Attention, Simultaneous and Successive processing. Each section is scored separately, and the results are used to compare with those of other people who have taken the test to see where someone falls on a rubric of cognitive performance.

4.8.8 ACADEMIC ACHIEVEMENT

Academic achievement measures an individual’s current level of competence, knowledge, skill and understanding capabilities in a particular cognitive domain. It refers to children’s scores in their academic subjects. In the present study, terminal examination and continuous evaluation marks in all the subjects of the elementary school children were considered as academic achievement.

4.9 METHOD USED FOR THE STUDY

4.9.1 DESCRIPTIVE RESEARCH

The aim of descriptive research is to describe the state of affairs, as it exists. The main drawback of this type is that the researcher may not have control over the
variables. In social sciences research, this type of research is often termed as Ex-Post Facto studies. This research mostly uses survey methods including comparative and correlation analysis. However, researcher does not have any control over the variables, but they try to find out the causes.

4.9.2 SURVEY METHOD

The Survey is known as ‘systematic collection of data concerning social problems, and situations in a particular area or region’. The survey methods are mostly used in marketing and social science research. Surveys are widely used for gathering scientific information. The survey method is useful to get first-hand information related to the social and economic problems of the society. The purpose of a survey is to determine how people feel about a particular issue and to offer scientifically gathered facts or materials affording a basis for the social theorists to set up their conclusion. Surveys are conducted in case of descriptive research studies. The Survey method gathers data from relatively large number of cases at a particular time; it is essentially cross sectional. It is concerned with describing, recording, analysing and interpreting conditions that either exist or existed.

It is only concerned with conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident or trends that are developing. They are primarily concerned with the present but at times do consider past events and influences as they relate to current conditions. Thus in surveys, variables that exist or have already occurred are selected and observed. In addition surveys provide an opportunity to examine correlations among the participant’s responses and to look for possible patterns of cause and effect. The major function of surveys is to dispel myths. The success of a survey depends upon the careful design and systematic execution, which includes careful planning and systematic data collection. For data collection special type of training is required in certain context and also required to formulate some meaningful and specific hypotheses that have to be tested.

Surveys are also known as mapping exercise, which provides an empirical snapshot of how things are at the specific time at which the data were collected. The emphasis is on breadth of coverage and representativeness of the population being studied in order to
give credibility to any generalizations made based on the research. It is concerned with hypothesis formulation and testing the analysis of the relationship between non-manipulated variables. Surveys may either be census or sample surveys. They may also be classified as social surveys, economic surveys or public opinion surveys. The method of data collection may be observation, or interview or questionnaire/opinionnaire or some projective techniques. In case of surveys, research design must be rigid, must make enough provision for protection against bias and must maximise reliability to obtain complete and accurate information. For the present study the investigator used normative survey method.

4.10 POPULATION AND STUDY AREA

Population or universe is the aggregate of all units possessing certain specified characteristics on which the sample seeks to draw inferences. In other words, the group the researcher wishes to generalise is often called the population of his study. Population is denoted in research as (N). From this group the researcher will select the samples. The Elementary school children constitute the population of the study.

The study area of the present study is Kerala state which is southernmost state of India. It is famous for its backwaters and natural beauty. Most of its region is touched by coastal areas as in its south is Indian Ocean and Arabian Sea at its west. Among the other states of India, Kerala has the highest literacy rate 90.9%, of which the male literacy rate is 94.2% and female literacy rate is 87.7%. In Kerala the education system is divided into Primary, High school, Secondary/Vocational education and Higher education.

School level education in Kerala is basically divided into two parts, lower primary education and higher primary education. Under the realm of both these parts, a huge number of private, government and government aided schools exist. Most of the Kerala schools provide students with all basic infrastructural facilities to create a proper ambiance of study. Schools in Kerala with respect to governing can be broadly segmented into two parts, the CBSE Schools and State Board Schools. There are many CBSE schools all over Kerala and due to government initiative a number of State Board Schools are also established in various districts of the state.
The primary education starts with pre-primary institutions like Anganvadis and play schools, which form the basic stage in schooling. Primary school is further divided into Lower primary (LP), classes’ I-IV and into upper Primary UP, classes V-VII. High school education starts from Class VIII and ends by Class X usually for the age group of 14 to 16 and also an entry for higher education. These schools are controlled by National Boards like the CBSE or State Boards.

According to the District Information System for Education (DISE) flash statistics 2009-2010 of the 14 districts covered in Kerala, data reported from 164 blocks/taluks, 1421 clusters and 1,877 villages, the total number of recognised schools imparting elementary education are 12,425, of which the number of government schools are 5095 and private schools are 7327. The percentage of private aided schools is 54.45% and private unaided is 4.52%. Among these the total number of primary schools is 6685. The District Information System for Education (DISE) statistics says that during the year 2009-2010 enrolment in classes I – V was 19, 87,815 and classes VI – VIII was 13,68,183. The gross enrolment at primary level during 2009-2010 was 75.63%. And net enrolment at primary level was 65.48%. The gross enrolment at upper primary level was 84.71% and net enrolment at upper primary level was 67.61%. Among the 14 districts of Kerala the northernmost districts includes Kasaragod, Kannur, and Calicut. Kasaragod district was taken as the study area. In Kasaragod district there are 4 blocks and 24 clusters. According to 2010-2011 census the number of government schools in Kasaragod district at the lower primary level is 141, aided 115 and unaided 12 which accounts to a total of 268 schools. At the upper primary level there are 72 government schools, 72 aided schools and 15 unaided forming a total of 159 schools. The total number of high schools is 127 of which 77 are government schools, 33 aided and 17 unaided. Among these the upper primary levels are of interest to the investigator.

4.11 SAMPLE SELECTION

Real success of a research depends on how best the researcher is able to select or devise a sample design. The samples selected for the research must, always be the true representative of the population. Here, sampling is the process of selecting a sample from the population to conduct the study. The ultimate goal of any sampling procedure is to
ensure that the sample is the best representation of the population. The very purpose of sampling is to make generalisations about the whole population which are valid and which allow prediction. Therefore, avoiding any bias or negative influence on the findings of the research is necessary. It is advocated that random sample selection is the best way to ensure an unbiased representative sample.

In Random sampling or probability sampling, it is imperative that each element in the population has an equal and independent chance of selection in the sample. Equal implies that the probability of selection of each element in the population is the same; that is, the choice of an element in the sample is not influenced by other considerations such as personal preference. The concept of independence means that the choice of one element is not dependent upon the choice of another in the sampling; that is, the selection or rejection of one element does not affect the inclusion or exclusion of another. Random sampling includes the simple random sampling, stratified random sampling and cluster sampling. Simple random sampling method is the most commonly used method of selecting a probability sample. In line with definition of randomisation, here each element in the population is given an equal and independent chance of selection.

The stratified random sampling method was adopted by the investigator to select the ten upper primary schools in Kasaragod district which included the government, aided and unaided. Stratified sampling involves dividing the population into homogenous groups, each group containing subjects with similar characteristics. Here first the investigator divided the wider population into inclusive schools and special schools. Considering only the inclusive schools stratified into homogenous groups of government, aided and unaided elementary schools and the subjects were selected randomly.

The study was mainly concentrated in northern Kerala, various Upper primary schools of Kasaragod district. Ten schools were selected by stratified sampling technique by the investigator for the present study. The subjects were selected by random sampling technique.

4.11.1 THE SAMPLE

Goode and Hatt (1952) defined, “A sample is a smaller representation of a larger whole”. Thus sample is a portion of people drawn from large population. It is a small subgroup chosen from the larger population, which is representative of that population.
The main principle behind sampling is that - seek knowledge about population by observing a few units. Moreover studying the entire population requires time, money, and efforts. Therefore the samples avoid these things. However, for selecting the sample the researcher has to get clear-cut picture of the population before selecting the sample, instead of studying the population explicitly. Data for the present study was collected from sixth and seventh graders of upper primary schools of Kasaragod district in Kerala. Table 4.1 shows the sample distribution.

**Table 4.1 shows sample distribution**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of variable</th>
<th>Groups</th>
<th>Total Number of students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>School type</td>
<td>Govt.</td>
<td>43</td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aided</td>
<td>25</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private</td>
<td>32</td>
<td>32%</td>
</tr>
<tr>
<td>2.</td>
<td>Class</td>
<td>6(^{th}) grade</td>
<td>51</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7(^{th}) grade</td>
<td>49</td>
<td>49%</td>
</tr>
<tr>
<td>3.</td>
<td>Sex</td>
<td>Male</td>
<td>52</td>
<td>52%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>48</td>
<td>48%</td>
</tr>
<tr>
<td>4.</td>
<td>Medium</td>
<td>Malayalam</td>
<td>65</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>English</td>
<td>35</td>
<td>35%</td>
</tr>
<tr>
<td>5.</td>
<td>School locale</td>
<td>Urban</td>
<td>51</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rural</td>
<td>49</td>
<td>49%</td>
</tr>
</tbody>
</table>

### 4.11.2 SAMPLE SIZE

The number of units in the sample is called sample size. The size of the sample refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of the sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which
fulfils the requirement of efficiency, representativeness, reliability, and flexibility. Here the investigator considered 100 subjects from the elementary grades. So the sample size in the present study was 100. It is usually denoted by the letter ‘n’.

4.12 INSTRUMENTATION

The result of any scientific investigation depends upon the tools used in the study. To arrive at logical conclusions, reliable and valid tools play a vital role. There are many standardised tools available which may vary in design, administration and interpretation. Depending on the nature of the study, a researcher can make use of standardised tools or they can develop their own tools. Considering the nature and purpose of the study, the investigator decided to construct tools for the present study.

The primary goal of test construction is to create a valid measure of an underlying construct. We need to look into the theoretical principles, practical issues, and pragmatic decisions to maximize the construct validity of tests and subtests. First, it is essential to begin with a clear conceptualization of the target construct. Moreover, the content of the initial item pool should be over inclusive and item wording needs careful attention. Next, the item pool should be tested, along with variables that assess closely related constructs, on a heterogeneous sample representing the entire range of the target population. Finally, in selecting test items, the goal is unidimensionality rather than internal consistency; this means that virtually all inter item correlations should be moderate in magnitude. Factor analysis can play a crucial role in ensuring the unidimensionality and discriminant validity of tests.

Considering the objectives of the study the investigator had developed the following tools for the study-

- Cognitive Assessment Test Battery (CATB)
- Children’s learning disability perception Inventory (CLDPI)
- Personal Proforma

4.12.1 CONSTRUCTION OF COGNITIVE ASSESSMENT TEST BATTERY (CATB)

The CATB was designed to measure PASS model of intelligence. PASS model includes the four dimensions namely Planning, Attention, Simultaneous and Successive Processing. The following are the definitions of the key terms used in CATB-
4.12.1.1 DEFINITION OF KEY TERMS USED IN CATB

**4.12.1.1 Planning** – Planning is a mental process by which the person determines, selects and uses efficient solutions to problems. The basic elements of planning are: Problem solving, Forming Mental representations, Impulse control, Control of processing, Retrieval of knowledge, students demonstrate selective prefrontal cortex activation during planning tasks. The planning subtests require the child to develop a plan of action, evaluate the value of the method, monitor its effectiveness, revise or reject a previous plan as the task demands change, and control the impulse to act without careful consideration. Planning is central to all activities in which there are both intentionality and a need for some method to solve a problem. This process includes self-monitoring and impulse control as well as plan generation.

**4.12.1.2 Attention** – Attention is a mental process by which the person selectively attends to some stimuli and ignores others. The basic elements for arousal or attention are: focused cognitive activity, selective attention, resistance to distraction, orienting response, vigilance, reticular formation as substrate, under/over arousal.

**4.12.1.3 Simultaneous processing** – Simultaneous processing is a mental activity by which the person integrates stimuli into groups. The basic elements of simultaneous processing are: Stimuli are seen as a whole or gestalt, each piece must be related to the others, simultaneous processing is not necessarily nonverbal, associated with the integrity of the parieto-occipital temporal regions.

**4.12.1.4 Successive processing** – Successive processing is a mental activity by which the person integrates stimuli in a specific order. The basic elements of successive processing are: stimuli form a chain like progression, successive processing is not necessarily verbal and associated with fronto-temporal regions of the brain. The test that involves successive processing must demand that the child attend to and work with the linear order of events.

These four dimensions were assessed using 12 subtests. These tests were individually administered paper pencil tests with fixed time for each. The scoring was done manually by the investigator. This was developed for the age group 7-11 years. These tests are Norm Referenced tests, which is used to compare the performance of the
subjects. It is based primarily on the speed of the candidate rather than the power. This test includes both verbal and non-verbal tests which are used to assess the cognitive processing (information processing) of the individual. The names of these subtests were adopted by the investigator from Das and Nagilieri’s Cognitive Assessment System (1994). The steps involved in the construction of CATB are as follows.

4.12.1. 2 CREATION OF ITEM POOL

The process starts from the literature review to construct the initial test items. The investigator has collected the literature based on PASS model and found out the various tests used in those studies and other studies for cognitive processing. From this the investigator identified twelve subtests that are based on PASS model. After collecting information on the various tests, the literatures based on these tests were collected for finding out the way of constructing it. Going through the literature and examples given for each the investigator made an attempt to write as many items under each subtest as possible. The descriptions of these 12 subtests are as follows –

4.12.1.2.1 Planning Subtests

Planning involves three subtests namely- matching Numbers, Planned Codes, and Planned Connections. The descriptions of these tests are as follows-

Matching Numbers

At first the investigator wrote down series of numbers starting with one digit numbers. Then they were arranged in rows by taking into consideration similar numbers and also confusing numbers like ‘9’ and ‘6’ put in one series and 3 and 8 put in the other to distract the subjects. It was arranged in 12 rows with 6 numbers each in one series. Proper care was taken to put numbers that look similar to be put in one series. Thirdly, three digit numbers and four digit numbers and five digit number series were written. In each set numbers were arranged in 12 rows with 6 numbers in each item. The fourth and fifth sets were constructed such that there were 12 rows with 5 numbers in each item. At last, all the one digit number series items were put in Part A, two digit number series in part B, three digit number series in Part C, four digit number series in Part D, and five digit number series in Part E to make up the test. At the top of the first page clear cut
instructions were written for each section and also the time limit was stated. At the bottom of each page the total score for each set was mentioned and at the end the Grand total. There were a total of 60 items in this test.

**Planned Codes**

This subtest has alphabets connected to codes/symbols. For constructing this test the investigator wrote down 8 selected alphabets from English Alphabet letter series, simultaneously certain symbols and codes were written down. Next she assigned these symbols and codes to each alphabet. Then arranged them in order, with alphabet and the corresponding code/symbol to form the problem (like A,B,C to <,>, =). At top of each part indicates how alphabets relate to symbols/codes (eg. A, B, C to <,>, + respectively). Then the same alphabets were given with empty boxes below for the subjects to fill in. This part had 8 columns and 8 rows in it with alphabets and the corresponding codes/symbols given in the problem and alphabets with empty boxes below it to fill in. There were a total of 64 items in this part. The second part of this test was constructed by writing down 8 alphabets with two boxes below each with certain codes/symbols as problem; below it alphabets were arranged in diagonal manner with empty boxes given for the subjects to fill in. Here the subject had to write down the correct codes in the empty boxes provided beneath the alphabets without committing errors. This part also contained 8 rows and 8 columns. Clear instructions were given at the beginning of the test with the time for the entire test. Here the total number of items was 64, accounting to a total of 128 items from both parts.

**Planned Connections**

In this test at first the investigator wrote, 6 one digit numbers in order like 1, 2, 3,4,5,6 then these numbers were put into quasi random order on a page. Instructions were given to the subject to connect these numbers using lines in serial order by taking precaution that no two lines cross each other. Similar random number sets were constructed by considering one, two and three digits. There were 12 items in this part. Secondly letters and numbers were written by the investigator like (1,2,3,A,B,C) then they were put in random manner on a page, so that the subjects had to connect numbers
and letters in a sequential order as 1-A, 2-B, 3-C etc., using lines by taking care that no two lines cross each other. There were 12 items in this part also. The two parts comprised of a total of 24 items.

4.12.1.2.2 Attention Subtests- Expressive attention, number Detection and Receptive attention were the subtests included in attention. Their description is as follows-

Expressive Attention

At first in this test names of colors were written by the investigator like red, blue, green etc., and then they were arranged in 7 columns and 10 rows. Secondly she drew circles and triangles in different colors. They were arranged in 5 columns and 7 rows. Thirdly number of color words was written in different inks arranged in 7 columns and 10 rows. The first part consisted only the color words were the subject was instructed to read the color words, the second part to name the color of the triangles and circles and third, to name the color of the ink the word was printed in. Here the last part of the test was alone used to assess the child’s expressive attention and the other two parts were the orientation to this test. The total number of items in this test was 70.

Number Detection

In Part A, four numbers with open font and different styles (like 4, 2, 7, 9) were considered as target stimuli and subject had to identify them from among the distractors given below it. Target stimuli mixed with distractors were written by the investigator below it in 6 rows and 10 columns. The construction of Part B and Part C was similar to Part A except that the target stimuli were different. Total number of targets was 60, with 20 in each.

Receptive Attention

This is a two page paper pencil test. On the first page, letter pairs with same letter in capital and small case were targets and on the second page letter pairs with both capital cases were targets. There were 100 items (both targets stimuli and distractors) in each set with 30 targets. The target stimuli for both parts were 30 each. So that the total target items accounted to 60. At first the investigator wrote down many letter pairs, with targets
(for example, Rr, Tt, Aa,) and distractors (Db, Nm, Li) Then she arranged it in 7 rows. For the second part the targets were (BB, HH, KK) and distractors were (BH, HI, KY). The child has to identify the target and encircle it.

4.12.1.2.3 Simultaneous Processing involves three subtests namely Non-Verbal Matrices, Spatial Relations, Figure Memory. Their description is as follows-

Non-verbal Matrices

Here the investigator has adopted certain items from the Raven’s Progressive Matrices (RPM). The RPM is a sixty item test with geometrical designs and shapes given with missing parts in it. Six choices are given below it. The difficulty and complexity of the items increases as we move along the test. The investigator numbered the items and selected all the even numbered items from the set of 60 items. Here the total Number of items was 30. Each item composed of geometric designs or shapes, a part of which is missing. Subjects had to decode the relationships among the parts of the item and choose the missing part which will fit the best from the six options given.

Verbal Spatial Relations

In this test the subject was shown items with six drawings and a printed question based on it. Items involve objects and shapes arranged in specific spatial manner. The child is required to select the option that matches the verbal description. Number of items in this test was 40.

Figure Memory

In this test the investigator drew a simple figure first and based on the simple figure a complicated figure was drawn embedding the simple figure mentioned as figure1 and plate1 in Appendix A. Likewise 50 simple and complicated figures (with simple figure embedded in it) were constructed. Next these simple figures were arranged according to their difficulty with very simple ones at the first and as we move on the complexity increases. The embedded figures were also arranged accordingly corresponding to simple figures. Two /three dimensional geometric figures were shown to the subjects for five seconds. The figure was then removed and the child was presented with a response sheet with the original design embedded in a more complex geometric pattern
(enclosed as Plates in Appendix B - Test IX). The subject had to identify the simple figure embedded in the complex one and redraw the simple figure. Subjects were asked to identify the original design embedded within the more complex figure. For a response to be scored correct, all the lines of the design have to be indicated without additions or omissions. Fifty items were present in this test initially.

4.12.1.2.4 Successive Processing Subtests were word series, Sentence Repetition and Sentence Questions. Their description is as follows-

**Word Series**

The investigator started this test by writing down many single syllable words. The single syllable words were selected such that there were noun, verbs, and adjective in it. They were then classified and put into three parts. Part A with verbs, Part B with adjective and Part C with nouns. Next these words were arranged into word series in such a way that the length of the word series ranged from 2 to 9. Then they were sequentially arranged in ascending order with the smallest word series at the first with 2 words and the longest at the last with 9 words. The arrangement was similar with all the parts. It had thirty six items initially, with 12 items in each part.

**Sentence Repetition**

In this test the investigator constructed 35 sentences composed of color words. The sentences that were constructed had no meaning, so that it reduces the influence of simultaneous processing. (For example, “The blue greened the red”). Next the investigator arranged these sentences as shortest/smallest and simplest at the first and as we move on the difficulty and complexity increases. The longer sentences were placed at the last. The subject is required to repeat the sentence as presented to him.

**Sentence Questions**

The sentences given in sentence repetition were taken and a question based on each item was constructed. (For example –‘The blue greened the red’, and the subject is asked the question ‘who greened the red?’). Then it was rearranged with sentence at first and the question based on it, below it. The subject has to read the sentence and answer the questions based on it. The total items in this were 35.
4.12.1.3 PRE-PILOT STUDY-After the construction of CATB, it was administered to a group of 30 subjects. The data was collected and analysed. Based on subjects and teachers’ feedback and suggestions, changes were made in the items, instructions were made much simpler. Expert’s opinions were also sort to make some modifications in it. In the next stage this modified tool was used for the pilot study.

4.12.1.4 PILOT STUDY

Before the test battery was finalized, the pre pilot version of the test items was implemented with the target subjects (30 subjects). On collecting the returned pilot data, the investigator handled the issue of item analysis.

4.12.1.5 ITEM ANALYSIS

Item analysis is a statistical technique designed to analyse individual items on a test after a test has been given to a group of examinees. This Post-hoc analysis is often performed in order to evaluate the test’s effectiveness. One primary goal of item analysis is to help improve the test by revising or discarding ineffective items. Another important function is to ascertain what test takers do and do not know. The specific component of analysis, Hills (1981) referred to as three levels, or degrees, of analysis. The first level, item difficulty, indicates the percentage of students who correctly answered each test item. The second level of item analysis, item discrimination specifies the degree to which each test item distinguishes between the more verses less knowledgeable students. This information will help to evaluate the difficulty of each item. The third level of analysis, distractor analysis, evaluates the effectiveness of the options to multiple choice items.

For the calculation of item difficulty index (p) and item discrimination index (d), the test takers were divided into three groups according to their scores on the test as a whole, an upper group consisting of the 27% who make the highest scores, a lower group consisting of the 27% who make the lowest scores and a middle group consisting of the remaining 46%.

One useful indication of test-item quality is its difficulty. The most common index of difficulty is the p-level, the value of which ranges from 0 to 1.00, indicating the percentage of students who answered the item correctly. A ‘p’ value of ‘0’ indicates that
no one answered the item correctly and a value of ‘1’ indicates that every student answered the item correctly (Nitko and Brookhart, 2007). The difficulty index commonly is interpreted to mean that items with p-values of 0.20 and below are difficult and items with p-values 0.80 and above are easy. For most tests whose results will be interpreted in a norm–referenced way p-values of 0.30 to 0.70 for test items are desirable. Very easy and very difficult items have little power to discriminate between students who know the content and who do not and they also decrease the reliability of the test scores. Item difficulty information helps to identify the need for remedial work related to specific content or skills or to identify test items that are ambiguous. The discrimination index is a powerful indicator of test item quality.

4.12.1.6 PROCEDURE OF ITEM ANALYSIS OF THE SUBTESTS

Item Analysis for each subtest of CATB was done by the investigator. For each test the scores of the 30 samples were taken and arranged in descending order of the scores with highest score at the top and the lowest at the bottom. Then the 27 per cent of the samples from the upper group and 27 per cent from the lower group were taken into consideration based on their scores for item analysis. A chart was plotted with items and subjects name taking 8 subjects out of 30 in the upper group and lower group separately. The scores for each subject were noted down in the chart for each item and scored for the upper and lower group separately. Then the difficulty index and discrimination power were calculated by using the formula Di=(U+L)/2N and Dp= (U-L)/N; where ‘U’ is the total score for the upper group and ‘L’ the total score for the lower group and ‘N’ the number of subjects considered. Where Di measure content validity, Dp measures construct validity of the test.

Di and Dp interpretation subtest wise-

In matching numbers test there were 60 items, with first 12 items composed of one digit numbers, next 12 two digits, three, four and five. After item analysis Di values ranging 0.625-0.875 and the Dp value 0.3- 0.75 were taken into consideration and retained 50 items in the test eliminating 10 items. Higher values of Di indicate that items were easy.
The Planned Codes test had 128 items of which the first 64 items the subjects were required to write down the codes given in the problem in the boxes given below each alphabet without committing errors, and for the next 64 items the subjects had to identify the code given for each alphabet in the problem and write it down below in the boxes given below each alphabet. Items of difficulty index (p) value between 0.625-0.875 were taken into consideration by the investigator. Higher the ‘p’ value more easier the items. The discrimination power (d) value for the items in this test was found to be ranging from 0.3-0.75. Considering these aspects maintaining 56 items in part 1 and 64 items in part 2 a total of 120 items retained.

Planned Connection had 24 items with numbers and letters given were the subjects had to connect the numbers and letters using lines and part A with numbers alone were they had to connect numbers using lines in a serial order. After item analysis procedure items of discriminating power between 0.25-0.875 and difficulty index value of range 0.375-0.875 were taken into account retaining 20 items in the test.

Expressive Attention had 70 items of colour words. Here the subjects had to identify the colour of the words given in the test. On item analysis items of Di ranging from 0.562-0.875 and Dp ranging from 0.3-0.875 were retained. Thus six items were omitted retaining 64 items out of 70.

Number Detection, there were 60 target items with 20 items in each part. The subject had to identify the number and font style as given in the problem among the numbers given below it and encircle them. On item analysis 45 items with Di ranging from 0.625-0.875 and Dp ranging from 0.3-0.625 were retained.

Receptive Attention had two parts with 100 items in each with 30 targets in each. The subject had to find the same letter pairs in capital and small case in the first and same letter pairs in capital case in the second and encircle them. After item analysis of the target items Di ranging from 0.3-0.875 and Dp ranging from 0.3-0.75 were taken into account and 5 items were omitted from part A and 5 items were omitted from part B, retaining 50 target items.
Non-verbal Matrices there were 30 items of geometrical designs and shapes. After item analysis, items with Di 0.25-0.875 and Dp 0.25-0.875 were taken into consideration, thus omitting 4 items and retaining 26 items.

Verbal Spatial Relations had 40 items with six drawings in each and a question based on it, were subject had to identify the drawing as stated in the question. On item analysis items with Di 0.437-0.812 and Dp 0.3-0.875 were taken into account and 5 items were omitted and 35 items were retained in the test.

In Figure Memory there were 50 items with problem figures and answer figures. The subject had to identify the problem figure in the more complicated answer figure and draw it in answer figure. After item analysis items with Di ranging from 0.25-0.812 and Dp ranging from 0.3-0.875 were taken into account and 4 items were omitted and 46 items retained.

Word Series had three parts with 36 word series with 12 in each part, whose length ranges from two through nine. After item analysis items of Di ranging from 0.25-0.875 and Dp ranging from 0.25-0.875 were retained. Items with word series length 8 and 9 were omitted from each part of the test as it had no Dp. And modification was done in the test retaining 30 items.

Sentence Repetition had 35 sentences composed of colour words. After the item analysis items with Di ranging from 0.312-0.75 and Dp ranging from 0.375-0.875 were taken into account, thus omitting 5 items and retaining 30 items.

Sentence Questions was similar to that of test 11 with 35 sentences composed of colour words and a question for each, which the subject had to answer. On item analysis items of Di ranging from 0.25-0.625 and Dp ranging from 0.5-0.875 were retained .5 items were omitted from the test retaining a total of 30 items. Table No. 4.2 shows the total number of items in each subtest after item analysis.
### Table 4.2. Total No. of items in each subtest after the item analysis

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Subtests</th>
<th>Total number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Matching Numbers</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Planned Codes</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Planned connections</td>
<td>20</td>
</tr>
<tr>
<td>Attention</td>
<td>Expressive Attention</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Number Detection</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Receptive Attention</td>
<td>50</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>Non-verbal matrices</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Verbal Spatial Relations</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Figure Memory</td>
<td>46</td>
</tr>
<tr>
<td>Successive</td>
<td>Word Series</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Sentence Repetition</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Sentence Question</td>
<td>30</td>
</tr>
</tbody>
</table>

After item analysis the modified CATB tool was administered to 100 subjects for standardisation.

**4.12.1.7 STANDARDIZATION**

Standardization of a test or tool involves finding out its reliability and validity. Before the CATB is finalized to find out the reliability and validity of the CATB it was administered to 100 subjects. On collecting the returned pilot data the investigator found the reliability and validity.

**4.12.2 VALIDITY AND RELIABILITY**

“Validity is the most fundamental consideration in developing and evaluating tests. The process of validation involves accumulating evidence to provide a sound scientific basis for the proposed score interpretations” (Salvia and Ysseldyke, 2007) In the field of measurement, the concept of validity and reliability is concurrently
associated. The validity is commonly defined as whether a measurement operation can really measure what it intends to measure, while reliability designates that the same results of the research should be derived if the measurement is repeated. (Meister, 2004; Suter, 2006).

Four types of validity were addressed relative to the present study: face validity, content validity, discriminant validity and construct validity.

4.12.2.1 FACE VALIDITY

Face validity refers to the extent to which the items in an instrument actually address the important aspects of the domain the instrument is intended to assess. Stated differently, each question or item must have a logical link to some important aspect of the domain being addressed. Face validity describes how well a measurement instrument appears to measure what it was designed to measure. The subtest of CATB has items to test the subject’s numerical ability, language ability, and spatial ability. So it has face validity.

4.12.2.2 CONTENT VALIDITY

Content validity includes any validity strategies that focus on the content of the test. To demonstrate the content validity, testers investigate the degree to which a test is a representative sample of the content of whatever objectives or specifications the test was originally designed to measure. To investigate the degree of match, test developers often enlist well-trained colleagues to make judgement about the degree to which the test items matched the test objectives or specifications.

To establish the content validity the CATB tool was put for expert’s opinion. Based on their feedback and suggestions modifications were made in the tool.

4.12.2.3 DISCRIMINANT VALIDITY

The items in CATB could discriminate between the low, medium and high achievers. So it has discriminant validity.

4.12.2.4 CONSTRUCT VALIDITY

Construct validity is appropriate whenever the test user wants to draw inferences from test scores to a behaviour domain which cannot be adequately represented by a single criterion or completely defined by a universe of content. A test’s construct validity is the degree to which it measures the behaviour domain or other theoretical constructs or
traits that it was designed to measure. More specifically, construct validity can be understood as the extent to which the behaviour domain or the constructs of theoretical interest have been successfully operationalized. It also refers to the extent to which the items in an instrument address the underlying latent factors within a domain.

Establishing construct validity is an on-going process that involves the verification of predictions made about the test scores. Procedures for construct validation may include correlations between test scores and designated criterion variables, differentiation between groups, factor analysis, multitrait-multimethod matrix analysis, or analysis of variance components within the framework of generalizability theory. The typical procedure for establishing construct validity is to conduct a factor analysis on the items of the instrument. The following section will contain introduction and explanations of one of the procedures for determining construct validity: factor analysis.

Factorial validity is a form of construct validity that is established through a factor analysis. Factor analysis (FA) and its extensions are widely used in social and behavioural sciences, and can be considered useful tools for exploration and model fitting in multivariate analysis (Yalcin and Amemiya, 2001). Factor Analysis constitute one major source of statistical evidence regarding the structural validity of test’s scores (Benson, 1998).

A Factor analysis is a data reduction technique to summarize a number of original variables into smaller set of composite dimensions or factors. It is an important step in scale development and can be used to demonstrate construct validity of scale items. It is a term that represents a large number of different mathematical procedures for analysing the interrelationships among a set of variables and for explaining these interrelationships in terms of a reduced number of variables, called factors. A factor is a hypothetical variable that influences scores on one or more observed variables.

4.12.2.5 ITEM REDUCTION USING FACTOR ANALYSIS

Item reduction to form the CATB was based on the revised pool of items that resulted from item analysis. Next step of item reduction consisted of factor analytic procedures designed to establish discriminability and homogeneity within each of the 12 subscales of CATB. The remaining item reduction and instrument formation procedures were guided by a combination of formal exploratory Factor Analysis (EFA) and rational item selection.
Item homogeneity-It has been recognised that validity is enhanced when homogeneity is established on the irreducible components of a construct, as opposed to homogenizing a higher-order construct (Smith and McCarthy 1995; Smith et al., 2003). Accordingly the remaining CATB items were submitted to repeated Factor Analytic procedures for the purpose of producing content homogeneity within each separate subtest. Following procedures for item homogeneity as described by Clark and Watson (1995), Factor Analysis were separately conducted on each subtests of CATB.

Only those items with factor loading of at least 0.50 and above were retained on the first factor. In other words, items that did not load highly and preferentially on the first factor are likely poor exemplars of the CATB component, they were designed to measure, and they were therefore deleted from the item pool. Repeated factor analysis systematically reduced the number of items in each component until all items met the criteria for retention. This procedure reduced the pool of items of the subtests of CATB. And the final form of the CATB after item elimination using Factor Analysis consisted of the following subtests and the total number of items in each is displayed below in table 4.3.

Table 4.3. Shows Total no of items in CATB after Factor Analysis

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>SUBTESTS</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Matching Numbers</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Planned Codes</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>Planned Connections</td>
<td>18</td>
</tr>
<tr>
<td>Attention</td>
<td>Expressive Attention</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Number Detection</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Receptive Attention</td>
<td>42</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>Non-Verbal Matrices</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Spatial Relations</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Figure Memory</td>
<td>33</td>
</tr>
<tr>
<td>Successive</td>
<td>Word Series</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Sentence Repetition</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Sentence Questions</td>
<td>30</td>
</tr>
</tbody>
</table>
4.12.2.6 RELIABILITY

The reliability of a measure concerns its ability to produce similar results when repeated measurements are made under identical conditions. Reliability states some form of consistency or stability in the values of the scores that an instrument elicits (Franzen, 1989). In technical terms, the measures of test reliability makes it possible to estimate as to what proportion of the total test score is error variance. In terms of variance reliability is the proportion of the ‘true’ variance to the total obtained variance of the data yielded by the measuring instrument and it is the proportion of error variance to the total obtained variance of the data yielded by the measuring instrument subtracted from 1.00. The index of 1.00 indicates perfect reliability. The more variability we observe the less reliability is the measure. Procedure used to assess reliability differs depending on the type of measure.

Assessing the reliability of measures of psychological variables such as intelligence, introversion, extraversion, anxiety level, mood etc., pose a special difficulty in that these variables tend to change naturally over time. By the time we repeat a measurement of anxiety level or mood, for example the underlying quantity being measured in the individual may have changed. The measure will appear to be unreliable even though the changes in measured value reflect real changes in the variable. It is impossible to administer psychological assessment devices to the same individual several times to determine the precision of the measure. Thus an alternative strategy is needed for assessing the reliability of these measures. Methods employed to assess the reliability of a psychological test are - test retest, parallel forms, Cronbach’s Alpha, method of rational equivalence and split- half reliability assessments.

The reliability of the CATB was addressed by computing two types of reliability coefficients: a split-half reliability coefficient and Cronbach’s alpha coefficients. The split-half reliability coefficient is appropriate when an instrument is intended to assess more than one factor. Stated differently split half reliability is appropriate when an instrument is not unidimensional. This is certainly the case with CATB. Cronbach’s alpha is appropriate when an instrument is unidimensional. Cronbach’s alpha and split half is used to assess the internal consistency of the test.
4.12.2.6.1 Split- Half Reliability

Split- Half Reliability method helps to reduce the problem caused by changes between administrations in the quantity being measured. It is advantageous than the test-retest and parallel form method. In this method, the test is scored for the single testing to get two halves, so that variation brought about by difference between the two testing situation is eliminated. One method to divide the test is into odd and even items where odd items and even items are scored separately and those are considered separate halves. The other method to divide the test into two halves is to consider the first 50 per cent items as one half and the second 50 per cent items as the other half. When the difficulty level of the test items is not the same we apply odd-even method, and if the difficulty level is the same, then we apply the first half and the second half method to divide the test into two halves. Once the two halves have been obtained for each individual score, these halves will be correlated with the help of the Pearson product-moment formula.

The reliability coefficient of this type is called a coefficient of internal consistency. The reliability depends on the test length. When we score as two halves, we cut the length of the original test to half. Therefore the reliability which we have calculated is equivalent of one for a test of half of the size of our original test. Thus we make correlation of test length to get the reliability of the total original test. For this Spearman-Brown formula is used for doubling the length of the test.

4.12.2.6.2 Cronbach’s Coefficient Alpha

Internal consistency is an approach to estimating test score reliability in which the individual items of the test are examined (Gall et al., 1996). Cronbach’s Coefficient Alpha is one of the ways we can use to estimate a test’s internal consistency (Gall et al., 1996). Cronbach’s alpha is equivalent to the average split-half consistency coefficient for all possible divisions of the test into halves. Franzen (1989). Internal consistency reliability attempts to partial out the impact of error resulting from imperfect content sampling and content homogeneity (Franzen, 1989). For research purpose the magnitude of the Cronbach alpha estimates are appropriate for the proof of the reliability (Henson, 2001). Therefore, to fulfill the requirement of the reliability in this study, Cronbach Alpha is adopted to secure reasonable item coefficients.
The Split half reliability of CATB was calculated by splitting the test into two halves namely by adopting the second method described above splitting the items into the first half and the second half method. The Split half and Cronbach Alpha reliability of the CATB subtests was found by using the SPSS software. Table 4.4 shows the comparative description of the Split Half and Alpha reliability Coefficients for the subtests.

Table 4.4 SplitHalf and Alpha reliability Coefficients Subtest wise

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Number of Items</th>
<th>Split Half Coefficients</th>
<th>Alpha coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matching Numbers</td>
<td>45</td>
<td>0.676</td>
<td>0.966</td>
</tr>
<tr>
<td>Planned Codes</td>
<td>112</td>
<td>0.333</td>
<td>0.984</td>
</tr>
<tr>
<td>Planned Connections</td>
<td>18</td>
<td>0.694</td>
<td>0.899</td>
</tr>
<tr>
<td>Expressive Attention</td>
<td>60</td>
<td>0.980</td>
<td>0.978</td>
</tr>
<tr>
<td>Number Detection</td>
<td>36</td>
<td>0.528</td>
<td>0.948</td>
</tr>
<tr>
<td>Receptive Attention</td>
<td>42</td>
<td>0.774</td>
<td>0.956</td>
</tr>
<tr>
<td>Non-Verbal Matrices</td>
<td>20</td>
<td>0.840</td>
<td>0.879</td>
</tr>
<tr>
<td>Spatial Relations</td>
<td>25</td>
<td>0.865</td>
<td>0.886</td>
</tr>
<tr>
<td>Figure Memory</td>
<td>33</td>
<td>0.903</td>
<td>0.921</td>
</tr>
<tr>
<td>Word Series</td>
<td>27</td>
<td>0.911</td>
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</tr>
<tr>
<td>Sentence Repetition</td>
<td>25</td>
<td>0.872</td>
<td>0.967</td>
</tr>
<tr>
<td>Sentence Question</td>
<td>30</td>
<td>0.940</td>
<td>0.980</td>
</tr>
</tbody>
</table>

From the table it is seen that the split half reliability coefficients significantly lesser than the alpha coefficients. From the tables it is seen that the split half coefficients are above 0.5 except for Planned codes subtest which is 0.333 (moderate). This implies that the subtests are highly reliable. Thus establishes the internal consistency of the test. To support this Cronbach’s Alpha was also found. Table 4.4 shows that the alpha coefficients are higher than the split-half coefficients. This implies that CATB is internally consistent. Thus confirming the split half reliability and in turn the reliability of the test.
4.12.2.7 THE FINAL FORM OF CATB

In the final form the CATB after refinement using item analysis and factor analysis was used to measure the four dimensions namely Planning, Attention and Simultaneous and Successive Processing using these subtests namely matching numbers, Planned codes, Planned Connections, Expressive attention, Number Detection, Receptive Attention, Non-verbal matrices, Spatial relations, Figure memory, Word series, Sentence Repetition and Sentence Question. The number of items in each subtest with time limit for each is displayed in table 4.5. Clear cut instructions for each subtest were given. Final form of CATB is enclosed as Appendix B.

Table 4.5 Subtest wise total no of items in final form of CATB

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Subtests</th>
<th>Number of Items</th>
<th>Maximum Time Limit (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Matching Numbers</td>
<td>45</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Planned Codes</td>
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<tr>
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<td>Planned Connections</td>
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<tr>
<td>Attention</td>
<td>Expressive Attention</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Number Detection</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Receptive Attention</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>Non-Verbal Matrices</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Spatial Relations</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Figure Memory</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>Successive</td>
<td>Word Series</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Sentence Repetition</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Sentence Question</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>

4.12.3 SCORING PROCEDURE- For the purpose of statistical analysis, the collected data need to be quantified. To quantify the data the following scoring procedure was adopted.
The scoring procedure of CATB was done manually as it was a paper pencil test. In each subtest, correct response was scored ‘1’ and incorrect ‘0’. Subtest wise scoring is as follows-

**Matching Numbers** - In this test each item was scored ‘1’ for correctly identifying the same numbers and a ‘0’ if he/she cannot identify.

**Planned Codes** - In this test a credit of ‘1’ was given if the subject correctly writes the symbols in the boxes below the alphabets and a ‘0’ if he/she cannot.

**Planned Connections** - Here in Part A if the numbers are connected in correct sequential order with lines and in Part B if the numbers and letters are connected in correct sequential order with lines a score of ‘1’ is given and a ‘0’ if wrongly connected.

**Expressive Attention** - If the subject was able to identify the colour of ink in which the word is printed, he/she is credited ‘1’ and if the subject cannot identify a ‘0’ was given.

**Number Detection** - In this test with numbers with open font and different styles as target stimuli, if the subjects were able to identify the target from among the distracters a score of ‘1’ was given and a ‘0’ if he cannot.

**Receptive Attention** - If the letter pairs were correctly identified then he is credited with ‘1’, otherwise ‘0’.

**Non-verbal Matrices** - If the child correctly identified the missing part of the design or patterns then a score of ‘1’ was given and if he cannot identify a score of ‘0’ was given.

**Verbal Spatial Relations** - If the subject identifies the drawing as stated in the question below the drawing, he is scored ‘1’ otherwise ‘0’.

**Figure Memory** - In this test if the child identified the original design embedded in a more complex figure and drawn it correctly without any additions or omissions he is credited with ‘1’ and a ‘0’ for incorrectly identifying it.

**Word Series** - A score of ‘1’ is given if each word series was repeated correctly in order and a ‘0’ if repeated incorrectly.

**Sentence Repetition** - In this test each item is scored ‘1’ if the sentence is repeated exactly as presented and a ‘0’ if the subject cannot reproduce it.
Sentence question - If the subject answers the question given below each sentence correctly he is credited ‘1’ mark otherwise ‘0’.

4.12.4 CONSTRUCTION OF CHILDREN’S LEARNING DISABILITY PERCEPTION INVENTORY (CLDPI)

For constructing the Children’s Learning Disability Perception Inventory (CLDPI) the investigator gathered data regarding the types of disabilities to be tested. Based on the characteristics she identified certain dimensions under which children had to identify their learning disabilities. The ten dimensions on which the tool was constructed was reading, writing, spatial relationships, oral expressive language, receptive language, mathematical skill, sequencing, organisation, memory and social skills. The tool was translated into regional language (Malayalam) by the investigator with the help of experts.

Initially the development of CLDPI was started with a precise and detailed conceptualisation of the target construct and its theoretical context. The investigator wrote a brief description of the construct, which was useful in crystallizing the concept. She went through the theory based on it. To articulate the basic construct on clearly and thoroughly as possible. It was necessary to review the relevant literature to see how others have approached the same problem. Initially the review included the previous attempts to conceptualise and assess both the same construct and closely related constructs. Such a review helped the investigator to clarify the nature and range of the content of the target construct and help to identify the problems with the existing measure.

4.12.4.1 CREATION OF AN ITEM POOL

The investigator after identification of the construct i.e., learning disability perception and conceptualising the theory behind it like knowing the characteristics and types of disability, started with the initial item writing.

Item generation dimension wise

Reading skills: Reading skills are specific abilities which enable a reader.

- to read the written form as meaningful language
- to read anything written with independence, comprehension and fluency, and
- to mentally interact with the message.
Items included in reading skill were ‘I am a poor reader’, ‘I skip words when I read’, and ‘I reverse letters when I read’ etc. A total of 12 items were included in this.

**Writing skills:** Writing skills are specific abilities which help writers put their thoughts into words in a meaningful form and to mentally interact with the message.

Writing skills included Items like ‘My handwriting is poor’, ‘I find it difficult to copy notes from the board’, etc. A total of 12 items were included in this.

**Oral Expressive language skills:** Oral Expressive language skill refers to the person’s ability to express one’s thoughts, feelings and knowledge using spoken language.

This included items like ‘It is difficult for me to speak about myself’, ‘I don’t get the right words to speak, while speaking with friends’, etc. A total of 6 items were included in this.

**Receptive language skills:** Receptive language skills refer to the person’s ability to understand what is being said to him or her.

For example the Receptive language skills included items like ‘I find it difficult to follow others’, ‘I find it difficult to tell the direction from which sound comes from’ etc. A total of 8 items were included in this.

**Sequencing skills:** Sequencing skill refers to a person’s ability to break down complex actions into manageable units and prioritize them in the right order.

Sequencing skills included items like ‘I have trouble telling time’, ‘I find it difficult to tell the alphabet in order’, etc. A total of 8 items were included in this.

**Spatial relationships skills:** Spatial relationships skill refers to the ability to understand spatial relationship between objects.

The items included in this were I find it difficult to identify my left from my right’, ‘I cannot differentiate below and above’ etc. A total of 8 items were included in this.

**Mathematical skills:** Mathematical skills include the basic skills like counting, adding, subtraction and multiplying numbers etc.

Mathematical skills included items like ‘I tend to switch numbers around’, ‘I am poor at basic mathematics’. A total of 6 items were included in this.
**Organisation skills:** Organisation skill includes categorising, chunking and grouping similar items together to aid recall.

This skill included items like-‘My study room is not neat’, ‘I tend to throw everything into my bag’ etc. A total of 8 items were included in this.

**Memory:** Ability or processes that are used to acquire, store, retain and later retrieve information. There are three major processes involved in memory encoding, storage and retrieval.

Items included in Memory skill were ‘It is hard for me to memorize things for school’, ‘I learn something today but do not remember it the next day’ etc. A total of 6 items were included in this.

**Social skills:** Social skills are those communications, problem solving, decision making, self management, and peer relations abilities that allow one to initiate and maintain positive social relationships with others.

Children’s social skill included items like- ‘I have few friends’, ‘Friends do not call and ask me to do things with them’ etc. A total of 9 items were included in this.

The initial item pool of CLDPI consisted of 83 items, which were subjected to revision based on expert’s opinion. Once the item pool was established, two or three experts reviewed the proposed item and commented on item clarity and significance. Through this review some of the items were discarded and others were revised. A preliminary pool of 66 items remained covering the following content areas: reading, writing, body awareness/spatial relationships, oral expressive language, receptive language, maths, sequencing, organisation memory and social skills.

After administering to a 100 sample the collected data were analysed. The correlation matrix of the 66 item pool was subjected to principal- axis factoring and scree test and eigenvalue greater than 1.0 criteria (Cattell, 1978), and indicated the relative suitability for rotation. From the initial solution items with loadings 0.5 and above were retained on the first factor and the other items were discarded. Finally after varimax rotation a total of 30 items remained in CLDPI. The final form of the CLDPI is enclosed as Appendix C. The retained items were then subjected to varimax rotation with four factor solution.
4.12.4.2 RELIABILITY AND VALIDITY OF CLDPI

4.12.4.2.1 RELIABILITY OF CLDPI

In the present study out of the four methods of establishing the reliability, the test retest method, alternate or parallel form, rational equivalence method and split half method, the split half method was used for calculating the reliability of CLDPI. Here variations brought about by differences between the two testing situations are eliminated. In this the tool was divided into two equivalent halves and the correlation was found for these half tests by using Karl Pearson’s Correlation Coefficient formula. From the reliability of the half test, the self-correlation of the whole test is then estimated by using Spearman Brown Prophecy formula.

The Split Half reliability Coefficient and Cronbach’s alpha were calculated using the SPSS package. For the Children’s Learning Disabilities Perception Inventory (CLDPI) the Split Half reliability Coefficient was found to be 0.927 and Cronbach’s alpha was found to be 0.948 which is higher than the split half coefficient and also the two values shows high correlation coefficient which implies that the tool is reliable and hence valid.

4.12.4.2.2 VALIDITY OF CLDPI

The validity of the CLDPI was addressed using the following aspects. They are - Face validity, Content validity, and Construct validity.

4.12.4.2.2.1 Face Validity- A test has face validity if an examination of the items leads to the conclusion that items are measuring what they are supposed to be measuring. The items in CLDPI measures what they are supposed to measure, so it has face validity.

4.12.4.2.2.2 Content validity- Content validity focuses on the content. To demonstrate content validity, testers investigate the degree to which a test is a representative sample of the content of whatever objectives or specifications the test was originally designed to measure. To establish content validity CLDPI was put forth expert’s opinion and certain revisions in the items had been made.

4.12.4.2.2.3 Construct validity of CLDPI - The construct validity was established using factor analysis. The CLDPI had initially 66 items. On exploratory factor analysis with
varimax rotation items with loadings 0.5 and above were retained, thus reducing the 
items of CLDPI to 30.

4.12.4.3 SCORING PROCEDURE-This inventory consisted of two responses namely 
Yes/ No. An Item is to be scored ‘1’ if ‘Yes’ and ‘0’ if ‘No’.

4.12.5 PERSONAL PROFORMA

Personal Proforma covering almost all the personal details were prepared by the 
investigator to gather information from the subjects. The personal Proforma for the students 
included general information like- name, age, sex, grade, school type, school locale, medium 
of instruction, Father’s education, Mother’s education, Father’s occupation and Mother’s 
occupation etc. The final form of the Personal Proforma is enclosed in Appendix A.

4.13 DATA COLLECTION PROCEDURE

The investigator got the prior permission from the school heads of the inclusive 
schools before the data collection. Next in each school the class teachers of 6th and 7th 
grades were consulted and students were chosen randomly.

Data collection for the present study was done in different phases. They are-

4.13.1 Phase 1: The CATB was first administered to the students individually. Before 
administering the test a brief orientation to the test was given. The maximum time limit 
for each test was clearly given at the beginning of each test (Appendix B). The data 
collection procedure included the following set of tasks for the subjects. In the CATB the 
subject had to undergo the following task in a stipulated time limit.

For the Planning Process

Matching Numbers- Here subject had to identify the similar numbers in a given set of 
numbers and encircle them. This test had five parts and the subject had to finish this test 
within 4 minutes.

Planned Codes– In this test subject had to write down the given set of codes in problem 
in the corresponding boxes provided. Planned codes had two parts which the subject were 
asked to complete within 3 minutes.
Planned Connections- The subject is asked to connect series of numbers in proper sequence. The numbers, which are placed on the page in random order, are restricted by a requirement that no lines intersect. The second part of the test consisted of letters and numbers which the subject had to connect in proper sequence using lines. The total time given for this test was 15 minutes.

**For the Attention Process**

Expressive Attention- In this test subject had to identify the colour of the words printed in different ink. The total time limit for this test was 3 minutes.

Number Detection- This task requires the subject to find and encircle all the numbers on a page that fits a specific description. Numbers that appear in different font and styles were given to the subject as problem. The maximum time limit for this test was 3 minutes.

Receptive Attention- At first Subjects were asked to identify the same letter pairs in small and capital case and next they had to identify letter pairs in capital case alone. The subject was instructed to finish this test within 2 minutes.

**For Simultaneous Processing**

Non-verbal Matrices- The subjects had to identify the missing part of a geometrical design or shape and write down their corresponding numbers in the answer sheet. The maximum time given for this test was 10 minutes.

Verbal Spatial Relations- In this child had to identify the figure from among the six figures that is verbally described in the question. The subject was instructed to finish this test within 12 minutes.

Figure Memory- A Geometric figure is shown to the subject for 5 seconds. When the stimulus is removed the subject is presented with a complex drawing that contains the previously displayed figure. The subject is asked to trace the original design without making any additions or omissions. The maximum time fixed for this test was 15 minutes.

**For Successive Processing**

Word Series- The subject is asked to repeat in correct order a series of spoken single-syllable words. The number of words in the series ranges from two to nine. There were three parts in this test and the maximum time was 6 minutes.
Sentence Repetition-The subject is asked to repeat sentences in which colour words were present. Here the subject had to finish the whole test in 7 minutes.

Sentence Questions- The subject had to answer a question based on the sentence given in sentence repetition. The maximum time for this test was 10 minutes.

4.13.2 Phase II – The Personal Proforma and the Children’s Learning Disability Perception Inventory were administered to the subjects. Clear cut instructions regarding answering the inventory were given to them. They were asked to answer them truthfully.

4.13.3 Phase III- ACHIEVEMENT SCORES- The investigator also collected one Terminal exam grades and two continuous evaluation grades of the students in all the subjects and it was converted to concerned percentage standards set by them. Averages of the three were taken as the achievement scores. The terminal exam and continuous evaluation grades were collected from the concerned teachers of all the subjects.

4.14 STATISTICAL TECHNIQUES USED IN THE STUDY

Based on the data collected using the CATB, self-perception of learning disabilities inventory and achievement scores appropriate statistical technique was employed to analyse the data. Factor Analysis and Cluster Analysis was employed for the present study, as the aim of the study was mainly to evolve groups based on cognitive processing and self-perception of learning disabilities and to know the artificial dimensions of cognitive processing and self-perception of learning disabilities.

The following statistical technique was used by the investigator to analyse the data. They are-

- **Factor Analysis**- Here in this study Factor Analysis was employed to condense, simplify a large number of observed variables and to see the relationships between them. It was used to discover the patterns of variables or relation between several variables. This is achieved through the generation of artificial dimensions or factors that correlate highly with several of the real variables that are independent of one another. In factor analysis the artificial dimensions created will be highly correlated with each of the items (variables). This technique was used in this study to find out the artificial dimensions of cognitive ability.
• **Cluster analysis**- Cluster analysis is a group of multivariate techniques used to identify similar entities from the characteristics they possess. It identifies and classifies objects or variables so that each object is very similar to others in its cluster with respect to some predetermined selection criteria. The resulting object clusters should then exhibit high internal (within-cluster) homogeneity and high external (between – clusters) heterogeneity. It has been variously referred to as Q- analysis, typology, classification analysis, and numerical taxonomy. This variety of names is due in part to the usage of clustering methods in such diverse disciplines as psychology, biology, sociology and business. Although the names differ across disciplines, they all have a common dimension: classification according to natural relationships. Present study adopted this technique to group the elementary school children based on their cognitive ability.

• **Correlation**- The degree of relationship or association between two variables is referred to as correlation. The measure of correlation is called the correlation coefficient or the coefficient of correlation. The correlation coefficient is an index of the extent of relationship between two variables that can take on values from -1.00 through 0 to +1.00, inclusive. The greater the absolute value of the coefficient, the stronger the relationship. The end points of the interval indicate a perfect correlation between the variables; whereas a correlation of 0 indicates no relationship between the variables. The sign on the coefficient, plus or minus, indicates the direction of the relationship between the variables. If the sign on the coefficient is plus then it indicates that there is positive relationship between the variables i.e., if one variable increases the other variable also increases. If it is minus then it indicates a negative relationship between the variables i.e., if one variable increases the other variable decreases and vice versa. Correlation was employed in this study to find out if there is any relationship between cognitive processing, self-perception of disabilities and achievement among the elementary school children.

• **‘t’ test**- ‘t’ test is based on t- distribution and is considered an appropriate test for judging the significance of a sample mean or for judging the significance of difference between the means of two samples in case of small sample(s) when
population variance is not known. In case two samples are related, we use paired sample ‘t’ test for judging the significance of the mean of difference between the two related samples. The relevant test statistic, ‘t’ is calculated from the sample data and then compared with its probable value based on t-distribution (to be read from the table that gives probable values of t for different levels of significance for different degrees of freedom) at a specified level of significance for concerning degrees of freedom for accepting or rejecting the null hypothesis. ‘t’- test is applied only in case of small sample(s) when population variances is unknown. ‘t’ test was employed in this study to find if there is difference between the groups on cognitive processing and self-perception of disabilities in achievement.

All the statistical techniques were computed using the SPSS software package.

4.15 SUMMARY

This chapter on Methodology clearly put forth the research design of the present study, the sample selection, instrumentation and the statistical techniques used for the study, which helped the investigator to collect the data in a systematic way and further helped her to do the analysis and interpret it.