CHAPTER III
RESEARCH DESIGN OF THE STUDY

3.1. Introduction

In the present economy research activity is part of each and every systematic knowledge era. Research has now become an integral part, not only of academic pursuits but for practical achievements by all areas of modern society. Research is a careful and scientific inquiry into every subject, subject matter or area, which is an endeavor to discover variable information which would be useful for further application. Present chapter is drawn under the subject of research design with reference to, construction of the tool, population, sample, data analysis and method of using statistical technique is primarily introduced as a plan of research design.

3.2. Types of Research

Present descriptive type of used is the survey type of research, described as follows.

Survey Research:

Survey type research is rut here a new technique for field of research. Survey research defined as a technique a here by the use archer studies the whole population with aspect to certain sociological and psychological variables. Depending upon the ways of collecting data survey research can be classified into different categories. For the present study Clerical Aptitude Test (CAT) constructed by the investigator.

3.2.1 Definitions and Operational Definitions of the study

Definitions and Operational Definitions are very useful to construction of the tool, so it can be provide a concrete base line for the fulfillment of objectives by the tool. For the present study, definitions like Commerce, BBA, BCA, Students, University and operational definitions of Clerical Aptitude Test (CAT) are given in the chapter four. According to definitions and reviewing the related literature construction of the tool is prepared by collection of statements are given as under as follows.

3.3 Construction of Tool

Construction of the tool is one of the most important and necessary technique works for research. Preparation of Clerical Aptitude Test (CAT) is one of the objectives of the study. According to Mahesh Bhargav :“In the hand of tested a psychological test is an objective and standardized, instrument to measure quantitatively and qualitatively the variables psychological aspects are as abilities, potentialities, achievement, interest and personality charter tics with reveal the behavior of the
individual at a phase in a systematic and scientific fashion. It also involves the study of individual differences and the study of various groups whom they are company.”

**Steps of Test construction:**

Steps of Construction of tool/test are as follows.

- Planning the test
- Preparing the preliminary draft of the test
- Trying out of the preliminary draft or pilot study of the step.
- Evaluating the test
- Construction of find draft of the test.

**Collection of statements**

Sources of collection of statement for the present tool are given as under.

- Review of literature
- Discussion with sample mode
- Visit to experts

After collecting the necessary adequate statements Clerical Aptitude Test (CAT) (Appendix-B) is given to the tool experts for further improvement of the tool. For the present study of Clerical Aptitude Test (CAT) and their component items collected from the interview the post graduate students, principles of college’s professor of colleges and expert of research, to more effectiveness of items suggestion of Adverts (1957) follows they are as under:

- Avoid past-tenses sentence items
- Avoid two or more meaning of items.
- According to suggestion of ad arch research has collected 144 items for the Clerical Aptitude Test (CAT), for each six component total eighteen items were selected for the preliminary test for try-out the experiment of tool items and its effectiveness.
- Suggestion of experts of tool for Clerical Aptitude Test (CAT) inform and schedule Rating Scale.

Primary tool of Clerical Aptitude Test (CAT) (Appendix-B) contains 144 items were selected posted to 30 experts of tool, psychology and aptitude test for getting suggestions for further improvement of tool. The objectives to give to experts are given as under.

- To get suggestions for improvement of tool.
To check content validity of tool.
To check items necessity according to objectives of research.
To prepare and construct items for the final try-out of the tool.

(Total 20 experts (Appendix-A) of tool have given their ideas and suggestions for further development of tool are given as follows.)

- There are spelling-mistakes, confused word or statement.
- Make a simple sentence items and according to understanding of sample mode.
- Need to improve grammar of sentence for purpose of tool.
- For the each tool it is necessary to take at least 10 items for each component.
- There is need to mix-up the items of components and prepare a quality test by applying Lickert Method.

**Table: 3.1**

Component wise Total Items Selected

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Component</th>
<th>Total Items Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Account</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>Numerical</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>Management</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Correspondence</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>Practical</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Computer</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>Spelling</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>Reasoning</td>
<td>18</td>
</tr>
</tbody>
</table>

**3.3.1 Pre Try Out Of Test Of tool**

In this present research Self-made tool of Clerical Aptitude Test (CAT), is tested under pre-try out of the study on the total sample of 80 graduate Students studying in Graduation College.

**Objectives of getting suggestion of experts**
To decide significance of item
To check content of tool is adequate or not
To check adequate of items according to item
To check and decide positive and negative items
To divide total items for the tool

According to variable of the study total 80 students were selected for the pre try out of try-out of the study. Total 80 items of Clerical Aptitude Test (CAT) decided to try out.

3.3.2. Preliminary Try out of the Study.

Objectives Preliminary Try out of the Study is given as under.

- To find t-value of each items (significance) as Lickert method
- To find correlation of each items (significance) as Lickert method
- To check and decide the effectiveness of statement (items).
- To decide time-limitation and necessary instruction regarding the tool.
- To know the problems during the administering the tool, and to make solution of that problem.
- To select the items for final try out.

For the present study 600 Graduate students were selected according to variables of the study.

Final Structure of the tool.

In this present study total 600 rating scale administrated on 600 Graduate students. 450 Rating scales selected for the final try out. Collected data for the pre-try out study calculated and Lickert type method applied to the item analysis for the tool. Total score for the each student is calculated and score is given. Collected data were arranged from law score to high score in sequence. (Total no from 1 to 450 is given according to low score to high score). 27% of the students score sheet of Upper level 330 to 450(120) of whole group and 27% of the student score sheet of lower level 1 to 120(120) of whole group is selected for the comparison and ‘Discriminative Value’ and ‘Facility Value’ calculated.

27% of upper level and 27% of lower level of group students were selected for the item analysis by Lickert method. Each item of 27% of upper group and 27% of lower group is calculated Critical Ratio and correlation is find out for the upper level data and lover level data of group is calculated.
Figure: Selection procedure of Item

<table>
<thead>
<tr>
<th>Score</th>
<th>Upper Level</th>
<th>Upper Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>27%</td>
<td>Total 120</td>
</tr>
<tr>
<td>449</td>
<td></td>
<td>27%</td>
</tr>
<tr>
<td>448</td>
<td></td>
<td></td>
</tr>
<tr>
<td>447</td>
<td></td>
<td></td>
</tr>
<tr>
<td>330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Lower Level</td>
<td>Lover Group</td>
</tr>
<tr>
<td>3</td>
<td>27%</td>
<td>Total</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>27%</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(120+120) Total 240</td>
</tr>
</tbody>
</table>

Time limitation of the applied tool

Time is the most important factor of research. In this present research tool of Clerical Aptitude Test (CAT) was used. So, it is very necessary to decide the time limitation for each tool and same as for tool of Clerical Aptitude Test (CAT). For this objective each students were instructed to note down the time, in given rating scale of Clerical Aptitude Test (CAT). Time limitation is decided by the given procedure, which is given in chapter 4.

- Average of time found on each and both tool.
- Method of 90th Percentile.

Time limitation is deciding as the given method, which take long time in comparison to both methods.

3.4 Population of the present study

There are two types of words used for the population interchangeably, one is Population and second one is Universe. A population is defined as the totality of particular characteristics for any specified groups of individuals or objects. So, in this present research all the universes of college students are the considered as the population of the study. In the present research all the college Students considered from university with faculty of master degree of Commerce, BBA and BCA colleges from Gujarat State.
According to John W. Best, population means “A Population of any group of individuals that have one or more characteristics in common that are interest of research.”

Selection of Sample

A sample may be defined as a selected number from the population to represent it. Generally, this selection is done according to some rule or plan. By studying the sample, some inferences may be made about the population. In sampling study’s conclusions derived from the population by just watching a few units or few individuals of the population. So it is necessary to examine the question of the degree of reliance which can be placed on the sample estimates.

Generally three type of sampling technique most used for research. (1) Random sampling (2) Purposive sampling (3) Mixed sampling.

In this present research, colleges were selected by stratified random Sampling. According to Agrawal J.C. “There will be wastage of time, money and energy, if the research is not generalizable to some degree beyond the sample used in the research. By studying the sample of the defined population research aims at making generalizations which can be applied to the population. According to Oxford Advance Learner’s Dictionary, A number of people or things taken from larger group and used in test to provide information about group.”

3.5 Final Try Out Of Test of Tool

Psychological test is just like a measurement scale. Effectiveness of test is depending upon the adequate steps, and carefulness while administering the test. Validity and Reliability of the test depend upon the adequate instruction, information and implementation of necessary steps regarding the way of administering the tool. In this present research, 6000 tool of Clerical Aptitude Test (CAT) and 6000 tool of Clerical Aptitude Test (CAT) Answer sheet and 500 booklets were printed for the final try out, and applied for the selected sample of the study. For the allocation of time of college, telephone, interview of college and reply letter posted to selected colleges. For the development of same kind of environment while administering the tool, researcher has informed and discussed with the principal of colleges.

3.6 Scoring Method of Tool

After administering the tool checking and scoring pattern applied to the tool. Information regarding the careful checking of tool is given as follows.

- Respondent have to ( X ) tick mark in only one item of statement from the four alternatives of each items of the test, in the answer sheet. To select only one
clear response for scoring for each item, if there is more than one response on items is rejected.

- Test answer sheets were rejected, which are not properly filled up/is not filled in a proper way/same or particular misleading response in all columns.
- Scoring pattern is follows as under.

### Table No: 3.2
**Scoring Pattern for Clerical Aptitude Test (CAT)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Response</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 marks for each right response</td>
<td>1/0</td>
</tr>
<tr>
<td>B</td>
<td>And zero marks for each wrong answer.</td>
<td>Marks</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.7 Method of Data Analysis

After final try out of the tool, it is very necessary to data analysis to give meaning and implication by implementing the proper technique in simple and understandable manner to justify the information. Following statistical techniques are described as under.

**Statistical Techniques:**

In research work after organization and tabulation of data, statistical calculations are made to visualize the performance and effect of different variables. In the present research work, following statistical calculations were made with the help of scientific calculator and Microsoft Excel.

1. **Measures of Central Tendencies and Measures of dispersion.**

By using the frequency distribution according to the study of the variable, classified group of the applied the Measures of central tendencies like Mean, Median, Mode and measures of dispersion like standard deviation, Q, Q1, Q3, standard error of S.D.

**Mean:**
In statistical calculations, mean is the most common measure of central tendency and may be defined as the value which we get by dividing the total of the values of various given item in a series by the total number of items. It can be worked out as under:

$$\text{Mean} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{N}$$

Or

$$\text{Mean} = \frac{\sum x}{N}$$

Where, $x_1, x_2, x_3 \ldots x_n$ are the given values.

$N$ = Number of individuals

$\sum x = \text{the sum of,}$

$x = \text{represent mean of } x\text{'s.}$

**Standard Deviation:**

Karl Pearson introduced the concept of standard deviation and it is generally denoted by the Greek alphabet ‘$\Sigma$’ (sigma). In the present research work researcher has applied the raw score method of S.D. In this the sum of row score and sum of square of raw scores is used for calculation of S.D. The following formula has been used to calculate the standard deviation of scores obtained through Teachers’ Clerical Aptitude Test (CAT):

$$\text{Standard Deviation} = \sqrt{\frac{\sum d^2}{N}}$$

Where,

$x = \text{Summation of row scores}$

$d^2 = \text{Sum of square difference of row scores from mean}$

$N = \text{Number of students}$

2 **Significance of the study**

To find the significance of null Hypotheses and significance of level $t$-test and F-test is applied for the study.

**T-test:**

$t$- Test is the test for judging the significance of a sample mean or for judging the significance of difference between the means of two samples. The following formula is used to calculate the $t$-value:
\[
t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}
\]

- \( M_1 \) = Mean of the first group
- \( M_2 \) = Mean of the second group
- \( \sigma_1^2 \) = Square of S.D. of first group
- \( \sigma_2^2 \) = Square of S.D. of second group
- \( N_1 \) = Size of the first group
- \( N_2 \) = Size of the second group

The calculated t-values were tested at 0.01 level of significance for significant t-values.

**F-test:**

ANOVA is a procedure for testing the difference among different groups of data for homogeneity. The basic principle of ANOVA (analysis of variance) is to test for difference among the means of the populations by examining the amount of variation between the samples. The ANOVA is used to visualize the significance of difference between mean of three groups. It is the one value, which tells us whether three or more groups under comparison are significantly different, or not. The ANOVA technique involves the following steps:

Correction term \( C = \frac{\sum x^2}{N} \)

\[ x = x_1 + x_2 + x_3 \]
\[ N = N_1 + N_2 + N_3 \]

(A) Total sum of square (SST)
\[
SST = x^2 - C
\]
\[ x^2 = x_1^2 + x_2^2 + x_3^2 \]

(B) Sum of square between the group (SSB)
\[
SS_B = \frac{(\sum x_1)^2}{N_1} + \frac{(\sum x_2)^2}{N_2} + \frac{(\sum x_3)^2}{N_3}
\]

(C) Sum of square within the group (SSW)
\[
SS_W = SST - SS_B
\]

(D) Mean, Sum of square between the group
\( \text{MSS}_B = \frac{SS_b}{K - 1} \)

\( K = \text{Total No. of groups} \)

(E) \ Mean, sum of square within the group MSS\(_W\)
\( \text{MSS}_W = \frac{SS_w}{NK} \)

\( K = \text{Total No. of groups} \)

(F) \ F-value = \frac{\text{MSS}_B}{\text{MSS}_W} \)

(G) \ \text{MSS}_B \div \text{MSS}_W \)

The calculated f-values were tested at 0.01 level of significance for significant f-values.

**Skew ness:**

Generally most of the psychological behaviour and its frequency distribution follows non probable curve. If it is not in this manner it is skewed. So, it is very necessary to study the skew ness and kurtosis of the selected frequency of score.

Skew ness (SK) = \frac{3(Mean – Median)}{S.D.} \)

Skew ness (SK) = \frac{Q_{90} + P_{10}}{2} \)

Critical Ratio of the Significance of Skew ness.

C.R. = \frac{SK}{\sigma SK} \)

Where, \( \sigma SK = \frac{0.5185}{\sqrt{N}} \)

(Significance of the level is 0.01 for C.R.of S.K.>2.58)

If, mode<median < mean, then curve is Positive Skewed (to the right)

And mean<median<mode, then curve is Negatively Skewed (to the left)

**Kurtosis:**

Another type is kurtosis of curve

\( Ku = \frac{Q}{P_{90} – P_{10}} \)

Where, \( Q= \text{Quartile deviation} \)
\( P_{90}= 90^{\text{th}} \text{Percentile} \)
\( P_{10}= 10^{\text{th}} \text{Percentile} \)
C.R. of Kurtosis = \( \frac{Ku - 0.2632}{\sigma Ku} \)

Where, \( \sigma Ku = \frac{0.2778}{\sqrt{N}} \)

(Significance of the level is 0.01 for C.R. of Ku>2.58)

If, value of Kurtosis, \( Ku = 0.263 \) then curve is Meso Kurtosis

\( Ku > 0.263 \) then curve is Plato Kurtosis

\( Ku < 0.263 \) then curve is Lepto Kurtosis

**Percentile Rank:**

\[ \text{Percentile Rank} = PR = 100 - \left( \frac{100R - 50}{N} \right) \]

**3.8 Reliability and validity of tool**

Reliability and validity of tool of Clerical Aptitude Test (CAT) are as follows. Correlation formula is given as follows. \(^1^1\)

\[ \text{Correlation} : r = \frac{\sum x_i y_i - CxCy}{N \sigma_x \sigma_y} \]

Correlation : \( r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} \)

**Types of Reliability:** \(^1^2\)

1. Test-Retest Method
2. Parallel test method
3. Split Half Method
4. Method of Rational equivalence

Test-Retest method, parallel test method and Split half method used for the present study. The sample selected for the study of Reliability is as follows:

**Spearman Brown Formula:** \(^1^3\)

\[ \text{Split-half Correlation} = \frac{\frac{1}{n} \sum 1 - r}{\frac{1}{n} + \frac{1}{n}} \]

Where, \( r \) = reliability of whole test
\[ r_{\text{I/II}} = \text{reliability of Half test} \]

**Rullon Formula:** \(^{14}\)

\[
rtt = \left[ 1 - \frac{\sigma d^2}{\sigma t^2} \right]
\]

- \( rtt \) = Reliability of test
- \( d \) = Difference between score on odd and even items
- \( \sigma d \) = S.D. of difference between score on odd and even items
- \( \sigma t \) = S.D. of total Score

**Flanegan formula:** \(^{15}\)

\[
Rtt = 2 \left[ 1 - \left( \frac{\sigma_1^2 + \sigma_2^2}{\sigma t^2} \right) \right]
\]

- \( \sigma_1 \) = S.D. of Odd items
- \( \sigma_2 \) = S.D. of Even items
- \( \sigma t \) = S.D. of All score items

### 3.9 Validity of tool: \(^{16}\)

Validity of the Clerical Aptitude Test (CAT) for Graduate students is described as under.

According to R. L. Thorndike: “A measurement procedure is valid in so far as it correlates with some measurement of success in the job for which it is being used as predictor.” \(^{17}\)

Above statement generalize the validity of measurement tool. Further the definition of validity is given as under.

According to E.S. Marvin “Validity as the extent to which a test measures what it purports to measure” \(^{18}\)

Ghiselli refers the validity as to extent to which a test or a set of operations measures what it supposes to measure.

According to Freeman:- “An index of validity shows the extent to which test measures, what it purpose to measure, when compared with accepted criteria”. \(^{19}\)
According to Marvin the Validity of the Scale – The Validity is the degree to which a Scale yields consistent score when the attitude is measured a number of items.

3.10 Types of Validity:

Types of Validity are given as under:

1. External
   (i) Factorial
   Statically
   (ii) Empirical
   (a) Predictive
   (b) Concurrent
   Functional
2. Internal
   (i) Face Validity
   Or
   (ii) Logical
   Operational
   (iii) Content / Curricular
   (iv) Construct / Congruent
   (v) Factorial

Factorial Validity of Tool:

According to Anatasi: “The factorial Validity of a test is the correlation between the test and the factor common to a group of test or other measures of behavior” The statistical method called factor analysis, the inter correlation of a large number of test are examined and if possible accounted for in terms of a much smaller number of more general “factors” or trait categories.

“The main purpose of factor analysis is to economies or minimizes or reduces a large number of inter-related to variables into a small numbers of independent variables by discovering common factors using the technique of correlation. This is known as ‘principle of parsimony’

Main Factor Analytic Methods: 20

Generally factor analytic methods are used by co-variance of matrices. The main two method are classified as under

1. Hollinger’s Bi-Factor method
2. Multiple Factor theory

Burt (i) Simple summation method
Thurston (ii) Group centroid method
Hotelling (iii) Principal Component method
Thompson (iv) Principle factor method
Kelley (v) Principal Axes method
Lawely(vi) Maximum Like hood method
In this present study Simple method and Group Centroid method of Thurston is used to check Factorial Validity of Tool of Clerical Aptitude Test (CAT).

3.11 Criterion for validity of a Test:

1. Age
2. Rating & Judgments
3. Work
4. Correlation with standard / familiar test
5. Educational achievement

In this present study correlation with standard test of Intelligence of K.G. Desai, familiar test of Clerical Aptitude Test (CAT) and Educational test of achievement of Percentage of students attaining their Graduate college.

Tests are used for the criterion validity of tool of Clerical Aptitude Test (CAT).

Norms of the Testing Tool of Clerical Aptitude Test (CAT)

Psychological tool are one kind of measurement scale, which is becomes helpful to interpretation and generalization of data with regards to behaviour like power, attitude, perception, reaction of one individual with comparison to mean, S.D. and measures of central tendencies, so that can forms a norms for a particular test/tool.

Meaning of Norms:

The meaning of norms is:” By norms we meant specimens of work which represent the commonest type of work for the whole group in question.”

According to C.V. Good stated that -A standardized test is that for which content has been selected and checked empirically for which norms have been established: for which uniform methods of administration and Scoring have been developed and which may be scored with a relative high degree of objective.

According to L.J. Cronback stated that -The procedure, scoring and evaluation of of a standardized test, everything is definite so that it may be used at different occasions. In such a test, the Table of norms and the possible score of representative students of any group is known.

According to Greene, H.A.: “The matter of securing norms that facilitate the interpretation of the test result is undoubtedly the most important phase of standardization…. Without norms test score cannot be interpreted.”

From the above definitions, it can be said that without norms test scores cannot be interpreted. Percentile Norms provides a basis for interpreting the score of an individual in terms of his standing in some particular group.” Percentile norms of
group of Commerce, BBA and BCA Stream on the Clerical Aptitude Test (CAT) Scale are as follows.

**Types of Norms:**

Four main types of norms are as follows.

1. Age Norms
2. Grade Norms
3. Percentile or Centiles Norms
4. Standard Score Norms
   - T-score norms
   - Stanine-score norms
   - Deviation I.Q. norms

In this present research, percentile / centiles are found on the raw score of the tool. According to Sinha “Percentile is the point on the Scale below which a fixed percentage of a distribution falls.”

**3.12 Summary**

Present chapter is designed for the plan for try out the final preparation of tool, statistical technique used for the study, and frame work of the whole calculation of the research.