

Chapter 15

Analysis of Data

A prime responsibility of the educational researcher is that of being able to make either a probability or logical inference covering the tenability of his testable hypothesis. The acceptance or rejection of these hypotheses will ultimately determine what contribution the study makes to the scientific development of a particular area. This is especially true in the analysis for interpretation of data.

The analysis and interpretation of data represent the application of deductive and inductive logic to the research process. The data are often classified by division into, subgroups, and are then analyzed and synthesized in such a way that hypothesis may be verified or rejected. The final result may be a new principle or generalization. Data are examined in terms of comparison between the more homogeneous segments within the group any by comparison with some outside criteria.

Analysis of data includes comparison of the outcomes of the various treatments upon the several groups and the making of a decision as to the achievement of the goals of research. Data relevant to each hypothesis must be assembled in quantitative form and tested to determine whether or not there is a significant difference in the results obtained from the controlled groups. Usually the analysis develops as a comparison between groups however, sometimes the type of data obtainable tends itself better to the existing differences by contrast or by summing up.

It is virtually impossible to complete a scientific analysis without using some form of statistical processing. This may involve depicting differences by complicated inferential statistics such as the analysis of variance, and analysis of covariance technique.

Each statistical method is based upon its own or specific assumptions regarding the sample, population and research conditions. Unless these factors are considered in advance the researcher may find that it is impossible to make valid comparison for purpose of inferences.

NEED FOR ANALYSIS OF DATA OR TREATMENT OF DATA

After administering and scoring research tools scripts, data collected and organized. The collected data are known as 'raw data.' The raw data are meaningless unless certain statistical treatment is given to them. Analysis of data means to make the raw data meaningful or to draw some results from the data after the proper treatment. The 'null hypotheses' are tested with the help of analysis data so to obtain some significant results. Thus, the analysis of data serves the following main functions:

1. To make the raw data meaningful,
2. To test null hypothesis,
3. To obtain the significant results,
4. To draw some inferences or make generalization, and
5. To estimate parameters.

There are two approaches which are employed in analysis of data: Parametric analysis of data and non-parametric analysis of data. The details of these approaches have been discussed in this chapter.

SELECTING THE LEVEL OF DATA

If we are working with variables which do have a quantitative aspect we can use the data collecting process of measurement. In this process we attempt to achieve some quantitative estimate of the variable or, more realistically of the amount of the variable which each of our research subject has. We can aspire to four different levels of measurement – Nominal, Ordinal, Interval and Ratio—and these are listed from the weakest level (nominal) to the strongest level (ratio).

Here is seldom any question In labelling nominal data for nonquantitative data are typically obvious to researcher and reader alike. However, for quantitative data, the distinction between ordinal and interval or ratio data is a critical one and moreover, one which different researchers see differently. Some research specialists or guides advise as a general principle in planning data analysis that the researcher considers the data ordinal, unless he can specifically identify a rationale other than the assignment of consecutive digits to consider them interval data. This rationale may be purely intellectual and based on the processes involved in selecting the various points one scale, or the rationale may be empirical and based on the data collected during pilot work from which the final instrument was derived. But there should be some specific set of reasons or data which can be cited when the researcher departs from treating his numerical data as ordinal data.

ANALYSIS OF DATA

Analysis of data means studying the tabulated material in order to determine inherent facts or meanings. It involves breaking down existing complex factors into simpler parts and putting the parts together in new arrangements for the purpose of interpretation.

A plan of analysis can and should be prepared in advance before the actual collection of material. A preliminary analysis on the skeleton plan should as the investigation proceeds, develop into a complete final analysis enlarged and reworked as and when necessary. This process requires an alert, flexible and open mind. Caution is necessary at every step. In case where a plan of analysis has not been made beforehand. Good. Barr and Scates suggest four helpful modes to get started on analysing the gathered data:

- (i) To think in terms of significant tables that the data permit.
- (ii) To examine carefully the statement of the problem and the earlier analysis and to study the original records of the data.
- (iii) To get away from the data and to think about the problem in layman's terms.
- (iv) To attack the data by making various simple statistical calculations.

In the general process of analysis of research data, statistical method has contributed a great deal. Simple statistical calculation finds a place in almost any research study dealing with large or even small groups of individuals, while complex statistical computations form the basis of many types of research. It may not be out of place, therefore to enumerate some statistical methods of analysis used in educational research.

STATISTICAL ANALYSIS OF DATA

Statistics is the body of mathematical techniques or processes for gathering, describing organising and interpreting numerical data. Since research often yields such quantitative data, statistics is a basic tool of measurement and research. The research worker who uses statistics is concerned with more than the manipulation of data, statistical methods goes back to fundamental purposes of analysis. Research in education may deal with two types of statistical data application.

1. Descriptive Statistical Analysis, and
2. Inferential Statistical Analysis.

1. Descriptive Statistical Analysis

Descriptive statistical analysis is concerned with numerical description of a particular group observed and any similarity to those outside the group can not be taken for granted. The data describe one group and that one group only.

Much simple educational research involves descriptive statistics and provides valuable information about the nature of a particular group or class.

2. Inferential Statistical Analysis

Inferential statistical analysis involves the process of sampling, the selection for study of a small group that is assumed to be related to the large group from which it is drawn. The small group is known as the sample; the large group, the population or universe, A statistics is a measure based on a sample. A statistic computed from a sample may be used to estimate a parameter, the corresponding value in the population which it is selected.

DESCRIPTIVE DATA ANALYSIS

Data collected from tests and experiments often have little meaning or significance until they have been classified or rearranged in a systematic way. This procedure leads to the organisation of materials into few heads.

- (i) Determination of range of the interval between the largest and smallest scores.
- (ii) Decision as to the number and size of the group to be used in classification. Class interval is therefore, helpful for grouping the data in suitable units and the number and size of these class intervals will depend upon the range of scores and the kinds of measures with which one is dealing. The number of class intervals which a given range will yield can be determined approximately by dividing the range by the interval tentatively chosen.

Most commonly used methods of analysis data statistically are:

1. Calculating frequency distribution usually in percentages of items under study.
2. Testing data for normality of distribution skewness and kurtosis.
3. Calculating percentiles and percentile ranks.
4. Calculating measures of central tendency-mean, median and mode and establishing norms.
5. Calculating measures of dispersion-standard deviation mean deviation, quartile deviation and range.
6. Calculating measures of relationship-coefficient of correlation, Reliability and validity by the Rank-difference and Product moment methods.

7. Graphical presentation of data-Frequency polygon curve, Histogram, Cumulative frequency polygon and Ogive etc.

While analyzing their data investigations usually make use of as many of the above simple statistical devices as necessary for the purpose of their study.

INFERENCE DATA ANALYSIS

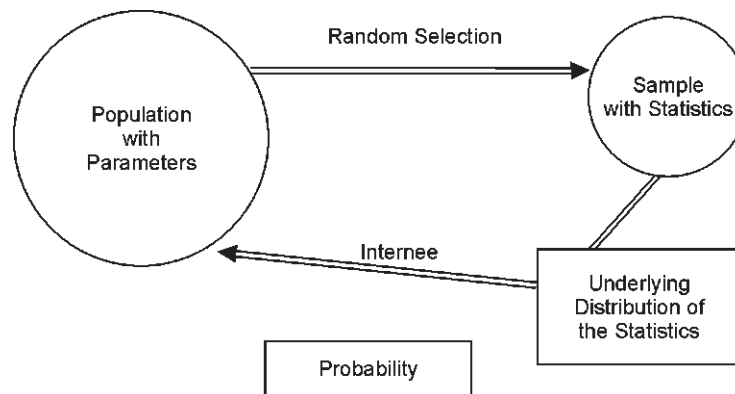
The primary purpose of research is to discover principles' that have universal application. But to study a whole population in order to arrive at generalization would be impracticable if not impossible.

A measured value based upon sample data is statistic. A population value estimated from a statistic is a parameter. A sample is a small proportion of a population selected for analysis. By observing the sample, certain inferences may be made about the population. Samples are not selected haphazardly, but are chosen in a deliberate way so that the influence of chance or probability can be estimated. Several types of sampling procedures are described each one is particularly appropriate in a given set of circumstances.

INFERENCE FROM STATISTICS TO PARAMETERS

The basic ideas of inference are to estimate the parameters with the help of sample statistics which play an extremely important role in educational research. These basic ideals of which the concept of underlying distribution is a part, comprise the foundation for testing hypotheses using statistical techniques.

The chain of reasoning from statistics to parameters is a part of what we call inferential statistics. The inference is from the statistics to the parameters. This chain of reasoning has been illustrated with help of the following diagram:



- (a) We have a population and want to make decisions about measures of the population namely parameters.
- (b) We have a random sample and compute measures of the sample which are termed as statistics.

- (c) The statistics are used to estimate parameters with sample fluctuation.
- (d) We have to obtain the sample statistics which are the facts that we have to infer back to the parameters in the light of the underlying distribution and probability.

We have a population and we want to know something about the descriptive measures of this population, namely the parameters. It is desirable or impossible to measure the entire population, so a random sample is selected from the population. The descriptive measures of the sample are known as statistics and the statistics can be determined. Since the sample is a random sample, we know that the statistics can be employed to estimate the population parameters within fluctuation due to sampling. It is at this point that the underlying distribution of the statistics comes in. If we know the underlying distributions we know how the statistics behaves. The appropriate underlying distribution for a specific statistics has been determined for us by mathematical theory and has been tabulated in table form. Underlying distributions are commonly theoretical distributions.

The parameters are never known for certain unless the entire population is measured and then there is no inference. We look at the statistics and their underlying distributions and from them we reason to tenable conclusions about the parameters.

SELECTING THE STATISTICS

As he plans the analysis of the data the researcher should consider two sections of the research report in which statistics will be relevant. The first of these is the section in which the data producing sample is described and in which may also be compared to the selected sample and to the population. In describing the sample, the basic descriptive statistics of the summary frequency distribution and the appropriate measures of central tendency and variability serve to provide the reader with some insight into the nature of the respondents. Researches are interested in the usual demographic characteristics such as gender, age, occupation and educational level, but in addition anyone project will suggest other descriptive variables about which data should be collected.

Provided the data are available, the researcher should also employ inferential statistics such as Chi-square or the t-test to determine whether or not his data producing sample differs from his selected sample or population by selecting which analysis he will prefer at his early stage, the researcher structures the kinds of data he will need to produce about the population and can incorporate the search for these data into his data gathering plan.

The second section of the report in which statistical procedures plays role is in the reporting of research results. The selection of these procedures should be well structured by this point if the researcher has stated specific hypotheses and research questions. The necessity to test the hypothesis provides guidance to statistical procedures at the general level, with the decision as to the level of data available providing the key to which specific procedures are to employ. Thus, hypothesis which refers to the expected a relationship between two variables, immediately indicates the need for a correctional analysis. Once the researcher decides that the two variables will yield ordinal data, for example, he can move directly to the specification of the rank order correlation.

The specification of statistical analysis at this stage of the research also enables the researcher to estimate his data analysis cost in both time and money and make whatever arrangements are necessary to reserve time on data-processing facilities.

The elementary and special statistical techniques of analysis are as follows:

Elementary Statistical Techniques of Analysis

Most commonly used statistical techniques of analysis data are:

1. Calculating frequency of distribution in percentages of items under study.
2. Testing data for normality of distribution Skewness Kurtosis and mode.
3. Calculating percentiles and percentile ranks.
4. Calculating measures of central tendency-Mean, Median and Mode and establishing Norms.
5. Calculating measures of dispersion-Standard deviation, Mean deviation, quartile deviation and range.
6. Calculating measures of relationship-Coefficients of Correlation, Reliability by the Rank difference and Product moment method.
7. Graphical presentation of data-Frequency polygon curve, Histogram, Cumulative frequency polygon and Ogive, etc.

While analysis their data investigator usually makes use of as many of the above simple statistical devices as necessary for the purpose for their study. There are some other complicated devices of statistical analysis listed below which researcher use in particular experimental or complex casual-comparative studies and investigations.

Special Statistical Techniques of Analysis

The following are the special statistical techniques of analysis:

1. Test of students ' t ' and analysis of variance for testing significance of differences between statistics especially between Means.
2. Chi-square test for testing null hypothesis.
3. Calculation of Biserial ' r ' and Tetrachoric ' r ' for finding out relationship between different phenomena in complex situations.
4. Calculation of partial and multiple correlation and of Bivariate and Multivariate Regression Equations for findings out casual relationship between various phenomena involved in a situation.
5. Factorial Analysis for the purpose of analysing the composition of certain complex phenomena.
6. Analysis of co-variance for estimating the true effect of the treatment after adjusting the initial effect.

PLANNING FOR DATA ANALYSIS

The next aspect of the data analysis plan is to scan the data gathering instruments in the context of data analysis. During the process of selecting a method and technique and developing an instrument, the researcher is usually so oriented to content and procedure that he ignores the relatively minor issues in instrument development, such as whether or not there is a place for the respondent to indicate his name, age, class, or any other data that will be required for data analysis. After the data are collected and about to be analyzed it is often too late to capture this information. Thus, it is at this point of planning the data analysis that the researcher can profitably refer to the list below of characteristics of the data gathering instrument that will expedite data analysis.

1. There should be a place for name, school, class, age, sex or any other classifying information the researcher will need in data analysis.

2. Every item should be numbered, and every option within an item should be separately numbered or lettered, for ease of data analysis.
3. Options should not overlap on structured questions, that is, if one option is 5-10, the next should begin with 11.
4. It is preferable to have options circled rather than checked. This expedites the analysis of data and also eliminates the possibility that the check below means 'high school' to some respondents rather than 'College' as the researcher intended.
5. The order in which items appear on an instrument reflect the priority of information sought. The researcher must recognize that respondents and observers tire and if they do the items which appear late in the instrument are answered less carefully or omitted entirely.

The order of the items has been planned with the processing of data in mind. If two pieces of data are to be analyzed simultaneously, this analysis can be expedited considerably if they are physically close together on the instrument. If some sub-analysis within the instrument is planned, such as computing the number of items correct on a sub-test or the number of positive responses on an interest inventory, the layout of the instrument should consider the placement of those items on each sub-test.

The instrument should provide the respondent with a way of indicating inability or unwillingness to answer a question, record an observation, or respond to a measure.

The possibility of pre-coding instruments, or printing them on different colour paper as an aid to data analysis should be considered. Instrument used in the pre-and-post administration of any technique should be easily distinguishable and so impossible to confuse.

CONSIDERATIONS FOR STATISTICAL ANALYSIS

There are various statistical techniques for analysing data. To choose an appropriate technique of statistical analysis in the challenging task to a research worker. It has two main functions:

1. Interpretation of results, and
2. Presentation of data.

The major types of tests are employed for analysing data so as to interpret the results. There are:

- (A) Parametric statistics or tests, and
- (B) Non-parametric statistics or tests.

A researcher has to select either of these approaches for analysing his own research data. The following are the criteria for choosing an appropriate statistical approach.

(A) Considerations for Parametric Statistics

This type of statistical analysis may be employed effectively in the following conditions:

1. Probability or representative sample has been employed in the investigation.
2. Variables of the study can be qualified at interval scale.
3. Specific assumptions are fulfilled. The obtained data are normally distributed or not free distribution.
4. The population of the study has been clearly defined.
5. Objectives of the research study.

Under this approach the following statistical techniques are employed :

- (a) To study the descriptive relationship of two or more variables:
- a_1 – Pearson’s product moment method of correlation (two variables)
 - a_2 – Multiple correlation (more than two variables)
 - a_3 – Partial correlation (more than two variables)
 - a_4 – Factor analysis-extracting factors or estimating psychological or factorial validity of tests.
- (b) To analyse the functional relationship of the variables:
- b_1 – Main effect of two treatments ‘ t ’ test
 - b_2 – Main effect of more than two treatments F -test
 - b_3 – Interaction effect of two or more variables-Two or more ways analysis variance techniques
 - b_4 – Gain or loss of more than two treatments-Analysis of covariance and correlated ‘ t ’ test.

(B) Considerations for Non-parametric Statistics

This type of statistical analysis may be used effectively in the following situations:

1. When non-probability sample is selected in the research study.
2. The variables of the study are quantified at any level of measurement, mainly, nominal and ordinal scale. It may be in the discrete form.
3. No assumption is required for this approach.
4. Free distribution of data, may be skewed or may be normally distributed.
5. Objectives of the study.

In this approach the following statistical techniques are generally used :

- (a) To study the relationship of two or more variables:
- a_1 – Spearman Rho correlation in small sample not in large sample for two variables. Data are available at ordinal or internal scale.
 - a_2 – χ^2 and contingency correlation. It is used when two or more variables are taken. The data may be nominal or ordinal scale or interval scale.
 - a_3 – Analysis variance.
- (b) To analyse the difference between two or more groups:
- b_1 – Median test for small test.
 - b_2 – χ^2 test for large sample also for small sample.
 - b_3 – Run test and U -test when data are on ordinal scale.
 - b_4 – Sign test.

BASIS FOR SELECTING A STATISTICAL TECHNIQUES

The main basis for selecting an appropriate statistical test is the nature of data and number of variables included in the investigation. In the behavioural science researches: nominal, ordinal and interval types of data are commonly used. The table provides the basis for selecting a statistical test apart from the above considerations.

Commonly used Measures of Association for Different Types of Variables

<i>Measure of Association to Use</i>	<i>Nature of Variables Involved</i>	<i>Restrictions, Assumptions, or Comments</i>
Pearson product-moment correlation.	2 continuous variables	Linear relationship interval or ratio scales
Rank-order correlation or Kendall's tau	2 continuous variables	Ordinal scales
Tetrachoric correlation	2 continuous variables both of which have been dichotomized	Normal bivariate distribution of the two variables
Correlation ration (Eta coefficient)	1 continuous variable 1 variable, either continuous or a discrete set of categories	Non-linear relationship
Intraclass correlation	1 continuous variable 1 variable, a discrete set of categories	Intent is to ascertain degree of similarity within groups interval or ratio scale
Biserial correlation	1 continuous variable 1 continuous variable which has been dichotomized	Interval or ratio scale
Point biserial correlation	1 continuous variable 1 true dichotomy	Interval or ratio scale
Fourfold point correlation (phi-coefficient)	2 true dichotomies	Nominal or ordinal scale
contingency coefficient	2 sets of unordered categories	Nominal scale
Mahalanobis D2 (from linear discriminant function) or multiple biserial correlation	1 set of unordered categories 1 or more variable of any sort	Intent is to determine degree of similarity among the group on basis of several measures
Partial correlation	3 or more continuous variable	Intent is to find to degree of relationship between any two with the effects of the others held constant
Multiple correlation (from multiple regression)	3 or more continuous variables	Intent is to determine predictability of one variable on basis of several others linear relationships
Kendall's coefficient or concordance	3 or more continuous variables	Intent is to determine the overall amount of agreement ordinal scale
Intraclass correlation	3 or more continuous variables	Estimates average of inter-correlation between pairs.

PRESENTATION OF DATA

The presentation of data is an important aspect of analysing of data. The purpose of presentation of data is to highlight the results and to make data or results more illustrative. The visual presentation of data or results is simple and easy to understand. The graphical and pictorial presentation provide the geometrical image of data. It enables us to comprehend the essential features of the frequency distribution. It also helps in observing the assumptions of the statistical analysis applied for the treatment of data. The presentation of data serves the following functions:

Basic for Selecting a Statistical Test Types and Number of Independent Variables

		<i>Interval</i>		<i>Ordinal</i>		<i>Nominal</i>	
		1	More than 1	1	More than 1	1	More than 1
DEPENDENT VARIABLES	0		Factor Analysis	Transformation of Scale			
	1	Correlation	Multiple Correlation			Analysis of Variance (or t-test)	Analysis of Variance
	More than 1	Multiple Correlation					
	0	Transformation of Scale			Coefficient of concordance (W)		
	1			Spearman Correlation Kendall's Tau (τ)	Sign test, median test U-test Kruskal-Wallis	Friedman's two-way analysis of variance	
	More than 1						
	0					Chi-square	
	1	Analysis of Variance		Sign test, Meidan test U-test Kurskal Wallis		Phi-Coeff. (f) Fisher exact test Chi-square	
	More than 1	Analysis of Variance		Friedma's two-way analysis of variance			

1. Visual or pictorial presentation of data
2. Makes the data to comprehend easily
3. Helps in understanding the nature of the distribution of data
4. The assumptions of statistical analysis can also be observed.

Generally the following types graphical presentation are attempted in behavioural researches:

- (a) Bar diagrams and Histogram
- (b) Graphical presentation
- (c) Polygons and curve or Cumulative frequency curve
- (d) Pie diagrams.

A. Parametric Tests

The parametric tests are the tests of the most powerful type and should be used if their basic assumptions are based upon the nature of the population values and the way that sample have been selected:

1. The observations are independent. The selection of one case is in no way dependent upon the selection of any other case,
2. The population values are normally distributed or, if not, the nature of their distribution is known.
3. The population values have equal variances or the ratio of their variances is known.
4. The variables measured are expressed in interval or ratio scales. Nominal or ordinal do not qualify.

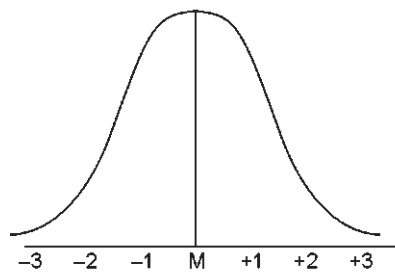


Fig. Normal curve of distribution of Individual scores

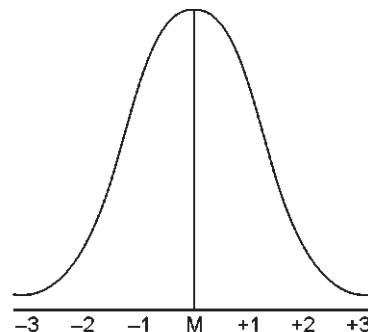


Fig. Normal curve of distribution of sample means

THE CENTRAL LIMIT THEOREM

If a number of equal-sized large samples are selected at random from an infinite population.

1. The means of the samples will be normally distributed.
2. The mean of the sample means will approximate the mean of the population or parameters.

If we selected a number of samples of 100 teachers from the population of teachers in Meerut, the mean ages of the samples, would not be identical. A few would be relatively high, a few relatively low, but most of them would tend to cluster around their own mean. The variation of these sample means is due to what is known as sampling error. The term does not suggest any fault in the sampling process. It merely identifies the chance variations that are inevitable when, a number of randomly selected sample means are computed.

Standard Error of the Mean or SE_{Mn}

The means of randomly selected samples, which are normally distributed, have their own standard deviation known as the standard deviation or standard error of the mean. The standard error of mean of a sample is computed from the formula:

$$SE_{Mn} \text{ or } \sigma M = \frac{S}{\sqrt{N}}$$

Where,

Se_{Mn} = Standard error of mean

S = Standard deviation of sample scores

N = Size of the sample

The standard error of sample means has a smaller value than the standard deviation of the individual scores. This is understandable because in computing the means which are middle score values. The following figures illustrate this relationship.

Note the differences between the range and standard deviation of individual scores and those of sample means.

From the formula $SE_M = S / \sqrt{N}$, it is apparent that as the size of the sample increases, the standard error of means decreases. As the sample N approaches infinity the mean approaches the population and the standard error of mean approaches zero.

$$SE_{Mn} = \frac{S}{\sqrt{N}} = 0$$

As N is reduced in size and approaches one, the standard error of the mean approaches the value of the standard deviation of the individual scores.

$$SE_{Mn} = \frac{S}{\sqrt{N}} = \frac{S}{1} = S$$

This analysis suggests that, other factors being equal statistical inferences based upon small samples have larger margins of error than those based upon larger samples.

The value of the true mean of an infinite population is not known, for it cannot be calculated. But a particular mean calculated from a randomly selected sample can be related to the population mean in the following way. Approximately:

68 per cent of sample means will lie within a range of \pm one SE_{Mn} of the population mean.

95 per cent of sample means will lie within \pm 1.96 SE_{Mn} of the population -mean.

99 per cent of sample means will lie within \pm 2.58 SE_{Mn} of the population mean.

The Standard Error of the Difference between Two Sample Means

The standard error of difference between two independent sample means may be calculated by the following formula:

$$SE_{(M_1 - M_2)} = \sqrt{\left(\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2} \right)}$$

N_1 = number of cases in first sample
 N_2 = number of cases in second sample
 S_1 = standard deviation of first sample
 S_2 = S.D. of second sample.

CRITICAL RATIO (CR OR Z)

Using this value we may calculate the statistical significance of the differences between an experimental and a control means, if the experimental sample group and the control sample group are randomly selected from the same population. When the size of samples is large (more than 30) we may calculate what is known as the critical ratio, (CR) a ratio of the difference between experimental and control means (numerator), and the standard error of the difference between the two means (denominator).

$$CR = \frac{M_1 - M_2}{\sqrt{\left(\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}\right)}}$$

At this point an example might be helpful. Let us assume that an experiment is set up to compare the effectiveness of two methods of teaching reading. Two groups are randomly selected from the same population, one designated as the experimental group is taught by the initial teaching alphabet approach, while the other is taught by the traditional alphabet method. At the end of the year a standardized reading test is administered and the mean scores for each group are computed. The effectiveness of the experimental group method as compared with the effectiveness of the control group method is the issue, with the end of year mean scores of each group, the basis of comparison.

A mere quantitative superiority of the experimental group mean score over the control group mean score is not conclusive proof of its superiority. Since we know that means drawn from same population are not necessarily identical, any difference could possibly be attributed to sampling error. The difference must be greater than that reasonably attributed to sampling error to be statistically significant.

NULL HYPOTHESIS

A null hypothesis states that there is no significant difference between two or more parameters. It is concerned with a judgement as to whether apparent differences are real differences or whether they merely result from sampling error.

The experimenter formulates a null hypothesis, a no difference hypothesis. What he hypothesizes, is that any apparent difference between the mean achievement of the two sample group at the end of the experiment is simply the result of sampling error, as explained by the central limit theorem.

If the difference between the mean achievement of the experimental group and control group is too great to attribute to the normal fluctuations that result from sampling error, he may refute or reject the null hypothesis, saying, in effect, that it is not true that the apparent difference is merely the result of sampling error. These means no longer behave as two random sample means from the same population. Something has happened to, or affected, the experimental group in such a way that it behaves like a sample from a different or changed population. Thus, the researcher may conclude the experimental

treatment not sampling error accounted for the difference in performance. The experimenter is using a statistical test to discount chance or sampling error as a variable.

If the difference between means was not great enough to reject the null hypothesis, the researcher accepts it. He concludes that there was no significant difference and that the sampling error probably explained the apparent difference.

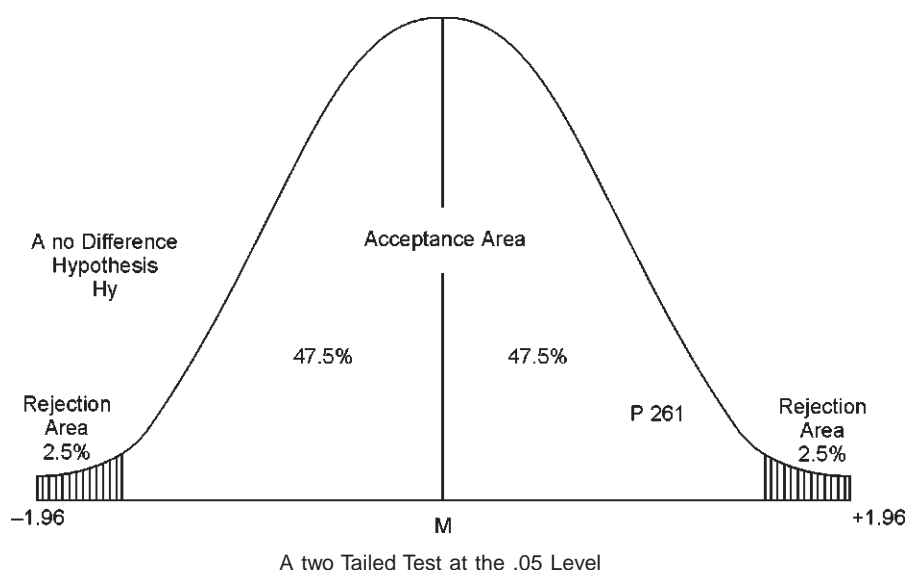
THE LEVEL OF SIGNIFICANCE

The rejection or acceptance of a null hypothesis is based upon some level of significance as a criterion. In psychological and educational circle the 5 per cent level of significance (.05) is often accepted as a standard for rejection. Rejecting the null hypothesis at the 5 per cent level indicates that a difference in means as large as that found between the experimental and control group means would not likely have resulted from sampling error in more than 5 out of 100 replication of the experiment. This suggests 95 per cent likelihood or probability that the difference was due to the experimental variable. A more rigorous test of significant is the 1 per cent level (.01).

When the samples are large (more than 30) the critical ratio is expressed as Z, or probability, score. If the critical ratio value exceeds 2.58, we may conclude that the difference between means is significant at the 1 per cent level. If the critical ratio value is greater than 1.96 but less than 2.58, we may conclude that the difference between means is significant at 5 per cent, but not at 1 per cent level. If the critical ratio is less than 1.96 the null hypothesis must be accepted at the 5 per cent level. .

TWO-TAILED OR NO DIFFERENCE TESTS

If a null hypothesis was established that there was no significant difference between the mean I.Q. scores of basketball letter winners and boys who did not participate, we would be concerned only with a difference. We would not be concerned with the superiority of the letter winner group or that of the non- letter group. In such a case we apply a two tailed test.

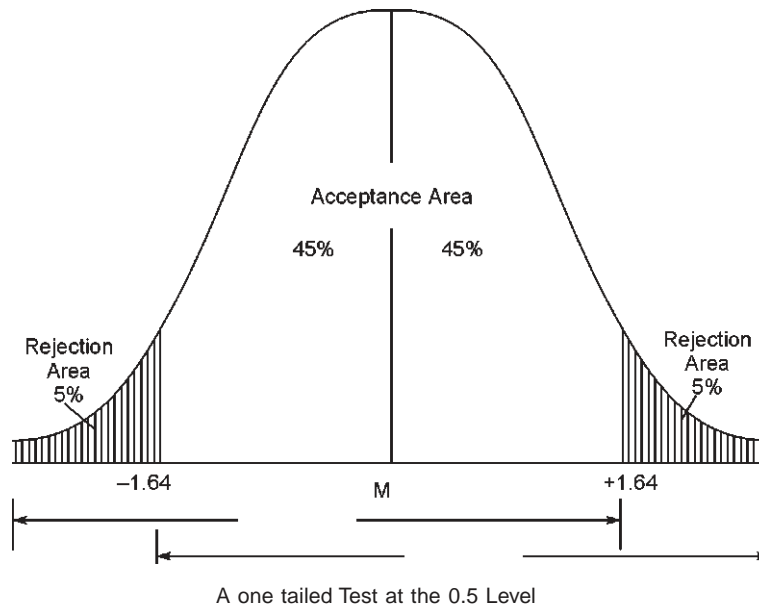


ONE TAILED OR DIRECTIONAL TEST

If we changed the null hypothesis to indicate a test of superiority of a particular group it might be started.

1. Athletes do not have lower I a mean scores than non athletes. or
2. Athletes do not have higher I a mean scores than non athletes.

Each null hypothesis indicates a direction of difference we are concerned with either higher or lower a mean for athlete group. When the researcher is interested in a direction of difference between groups, he uses a one tailed test. It can be noted that when 5 per cent rejection area is at one end or at the other end of the curve, it is not necessary to go out as far on the sigma scale to reach the 5 percent area of rejection.



SIGMA VALUE THAT MUST BE EXCEEDED FOR REJECTION OF HYPOTHESIS

The sigma value exceeds, these table values for the rejection of null hypothesis.

<i>Test</i>	<i>Level of .05</i>	<i>Significance .01</i>
One tailed Test	1.64	2.33
Two tailed Test	1.96	2.58
Probability	.95	.99

THE SIGNIFICANCE OF *R*

To test the significance of a coefficient of correlation we may establish the null hypothesis that $r = 0$ and that any value of r , other than 0, is the possible result of sampling error. We assume that the sample r is one of a number of random samples. To use the z value and the probability table the r is converted

into z value by the formula.

$$z = r\sqrt{N-1}$$

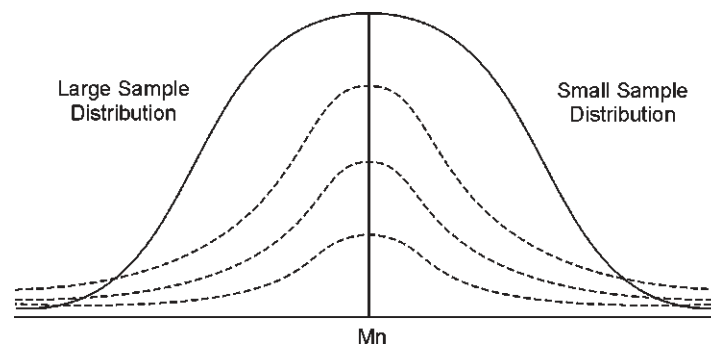
If z value exceeds the table value the hypothesis is rejected and if not then the hypothesis is accepted.

PRACTICAL SIGNIFICANCE

It is also important to note that a finding that is statistically significant may not be a measure of its usefulness in making a practical decision. A test of significance merely indicates there is a genuine relationship, that r is not O . Statistical significance indicates the probability that the finding did not result from sampling error.

STUDENT'S DISTRIBUTION 't'

When small samples, fewer than 30 observations in number, are involved, the t -test is used to determine the statistical significance. The concept of small sample sizes was developed by Gosset. Gosset determined that the distribution curves of small samples were somewhat different from the normal curve. Small sample distributions were observed to be higher at the mean and higher at the tails or ends of distribution.



Distribution of Large and Small sample means

Gosset's distribution, carefully calculated for small samples, is partially reproduced in t-table. The values necessary for rejection of a null hypothesis are higher for small samples at a given level of significance. As the sample size increases, the ' t ' values approaches the size ' z ' values of the normal probability table. To find the appropriate value necessary for rejection of the null hypothesis the number of degrees of freedom should be calculated.

For the test of significance of the difference between two means the number of degrees of freedom would be:

$$(N_1 - 1) + (N_2 - 1) = N_1 + N_2 - 2$$

For a test of significance of a small sample coefficient of correlation the number of degrees of freedom would be $(N - 2)$.

Many 't' tables list values at various degrees of freedom for rejection of the null hypothesis at .05 and the .01 level of significance.

To compute *t*-value for the significance of the difference between two means, when *N* is fewer than 30, the formula is :

$$t = \frac{(M_1 - M_2)}{\sqrt{\frac{(N_1 - 1)S_1^2 + (N_2 - 1)S_2^2}{N_1 + N_2 - 2} \left(\frac{1}{N_1} + \frac{1}{N_2} \right)}}$$

ANALYSIS OF VARIANCE (F) ANOVA TEST

The analysis of variance is a convenient way to determine whether the means of more than two random samples are too different to attribute to sampling error.

It would be possible to use a number of 't' test to determine the significance of the difference five means, two at a time, but it would involve ten separate tests. The number of the necessary pair wise comparisons of 'N' things is determined by the formula:

$$\frac{N(N-1)}{2}$$

An analysis of variance would make this determination possible with a single test, rather than ten.

The question raised by the analysis of variance is whether the sample means differ from their own sample means (within group variance).

If the variation of sample means from the grand mean is greater enough than the variance of the individual scores from their sample means, the samples are different enough to reject a null hypothesis or sampling error explanation. If the among groups variance is not substantially greater than the within group variance, the samples are not significantly different and probably behave as random samples from the same population.

$$F = \frac{\text{Variance among groups}}{\text{Variance within groups}}$$

The significance of the 'f' ratio is found in 'f' tables which indicate the values necessary to reject the null hypothesis at the .05 or the .01 levels.

ANALYSIS OF COVARIANCE

The analysis of covariance represents an extension of analysis of variance, particularly useful when it has not been possible to compare randomly selected samples, a common situation is classroom experiments using available samples.

In such cases a pre-test is administered to each group before the application of the experimental variables. At the end of experimental period a post-test is administered and the gain evaluated by a test of covariance.

B. NON-PARAMETRIC TESTS

Non-parametric, or distribution free tests are used when the nature of the population distribution is not known or when the data are expressed as nominal or ordinal measures. The variables in a non-parametric

tests are usually presented in rank order or discrete values. Discrete data could represent such classifications as high, medium or low, urban or rural or male or female, counting number in each category.

Non-parametric Statistics for the Behavioural Sciences Sidney Siegel

There are many types of non-parametric tests which are most frequently used in the educational research studies. The basis for selecting the non-parametric statistics has been given in the following table:

Level of Measurement	Non-parametric Statistical Test					Non-parametric Measures of Correlation
	One Sample Case	Two Sample Case		K-Sample Cause		
		Related Sample	Independent Sample	Related Sample	Independent Sample	
Nominal	Binominal test χ^2 -one sample test	McNemar test for the significance of changes	Fisher exact probability test χ^2 -test for two independent samples	Cochran q test	χ^2 test for independent samples	Contingency coefficient: c
Ordinal	Kolmogrov Smirnov One-sample test	Sign test Wilcoxon matched pairs signed ranks test	Meidan test, Mann-Whitney u -test	Friedman Two-way analysis of variance	Extension of meidan test	Spearman rank correlation coefficients; r_s
	One-sample runs test		Kolmogro Smirnov two-sample test Wald-Walfowitz runs test Moss test of extreme reactions		Krushkal-Wallis one-way analysis of variance	Kendall rank correlation coefficient; r Kendall partial rank correlation coefficient t_{yx} Kendall coefficient of concordance W
Interval		Walsh test Randomization test for matched	Randomization test for two independent samples			

CHI-SQUARE TEST (χ^2)

The Chi-square test applies only to discrete data (discrete variables are those expressed in frequency counts). The test is based upon the concept of independence the idea is that one variable is not affected by, or related to another.

For example, in a test in which 90 individuals are given a blindfold test in order to determine their selection of the mildest of three brands of cigarettes, the results could be interpreted by the Chi-square test.

If there were no significant differences preference we would expect the individual to choose brand. A, brand B or brand C in about equal proportion. On the basis of a null hypothesis any variation could possibly be attributed to sampling error. We would hypothesize that the choices were independent, or not related to any factor other than probability.

The test would provide a method of testing the difference between actual preferences and choices based upon a probability assumption.

The Chi-square formula:

$$\chi^2 = \sum \left[\frac{(f_o - f_e)^2}{f_e} \right]$$

The differences in preference are greater than would likely result from sampling error.

Spearman Rank Order Coefficient of Correlation (ρ -Rho)

The Spearman rank order coefficient of correlation is a useful non-parametric test. The data are expressed in ranks rather than as scores. The test is useful when the number of ranked pairs is fewer than thirty and when there are few ties in rank.

$$\rho = 1 - \frac{6\sum d^2}{N(N_2 - 1)}$$

To test the significance of ρ (a one tailed test) we may use the '1' table (students distribution) for null hypothesis rejection values. The number of degrees of freedom is $(N - 2)$.

The ρ (rho) is converted to a t value by the formula

$$t_\rho = \frac{\rho\sqrt{(N-2)}}{\sqrt{(1-\rho^2)}}$$

If the '1' value exceeds the table value the hypothesis is rejected. If the '1' value fails to exceed the table values at the .01 and .05 levels of significance, the hypothesis that $P = a$ must be accepted.

THE SIGN TEST

The sign test is sometimes used to evaluate the effect of a type of treatment in a before-after experiment. The sign test is based on the following assumptions;

1. The direction, not the amount of change in scores units is noted.
2. Cases in which there were no changes are disregarded.
3. The probabilities of a gain or loss are equal ($P = .5$). The sign test uses the principles of the standard error of a dichotomous variable; deriving a Z -score by the formula:

$$Z = \frac{O - NP}{\sqrt{NP(1-\rho)}}$$

where 0 = +ve changes

N = + and -ve changes

$P = .5$ (equal probability of a gain or loss)

If Z value exceeds the table value the null hypothesis is rejected and if not exceeded then the null hypothesis is accepted.

How to Make Analysis Objective

An investigator-analyses the tabulated material with a view to determining inherent facts or meanings. He breaks down existing complex factors into simpler parts and puts the parts together in new arrangement for the purpose of interpretation. The investigators make analysis objective by:

1. Picking out the essential elements in a problematic situation.
2. Separating similarities from dissimilarities.
3. Giving special attention to exceptions.
4. Arranging data on gently.
5. Making judgements on adequate data.
6. Making his sense of logic on sound principles.
7. Being inventive in the matter of techniques.
8. Disregarding personal attachment to a hypothesis.
9. Having good mathematical ability.
10. Studying data from as many angles as possible to find out new and newer facts.

SIGNIFICANCE

However valid, reliable and adequate the data may be, if they do not serve any worthwhile purpose unless they are carefully edited, systematical classified and tabulated, scientifically analyzed, intelligently interpreted and rationally concluded.

Barr and others point out, "Analysis is an important phase of the classification and summation of data into a summary."

According to A. Wolfe, "The discovery of order in the phenomena of nature, notwithstanding their complexity and apparent confusion is rendered possible by the process of analysis and synthesis which are foundation stone of all scientific methods."

The types of statistical analysis of the data obtained in a research work are limited to the nature of data or to the type of scale of measurement one obtains by the process of quantification. The four scales investigated are: nominal, ordinal, equal interval, and ratio. Non-parametric statistics may be used to analysed data measured by the nominal or ordinal scale. Data measured by either the equal-interval or the ratio scale may be analysed by either non-parametric or parametric methods. Parametric statistics or tests are preferred if all the parametric assumptions are fully met and provided the researcher has great competence in the use of inferential statistics.

REVIEWING ASSUMPTIONS AND LIMITATIONS

In the final aspect of data analysis plan is for the researcher to look back over all the decisions and choices that have been made to identify two things: the final set of assumptions required for the project

to be sensible and the limitations to the conclusions which will hold if the current plans for the project are implemented. In identifying both assumptions and limitations the researcher is concerned with those aspects of the research process over which he has no control or about which he has no information. This includes aspects of the potential respondents, such as why some agreed to participate and others did not, or why after agreeing to participate some failed to complete the data gathering instrument, as well as the frankness of the base who did complete it. It may include aspects of the research approach, such as the availability of data in the historical approach, or the comparability of survey sites in the comparative survey, and often includes aspects of the research method such as the relevance of the time periods selected for observation or whether or not rapport was established in an interview.

Any controlled aspect which the researcher considers critical for the research to make sense must be stated as an assumption. Thus, the frankness of the respondents, the comparability of survey sites, the relevance of observation time periods in most projects would be considered assumptions because it makes no sense to report data from respondent who cannot be considered frank, or to do comparative study in sites or considered comparable, or to report observation data obtained during time periods which can not be considered relevant for the problem under study.

Those controlled aspects which are not critical may be stated as limitations to the conclusions. Thus, a researcher may decide that he can live with the fact that his historical project is limited to sources available.

Having stated the assumptions and limitations, and researcher should scan them as a total set and review them with one thought in mind, the impact on the audience to whom his research is directed. He must appraise the effect of his assumptions and limitations on the acceptance and implementation of his research findings and must be willing, even at this late stage, to revise or expand his research plans if one or more assumptions or limitations seem likely to damage the significance of the research too greatly. The researcher must build into the research atleast an overview of the materials of major significance in other languages. The research planning the comparative survey may conclude that simply saying he assumes that the several argument, and so decide to incorporate into his data gathering plan specific efforts to obtain data to verify comparability.

EXERCISES

1. Explain the phrase 'Analysis of Data' or 'Treatment of Data'. Indicate the need and importance of data analysis.
2. Differentiate between descriptive statistical analysis and inferential statistical analysis.
3. Distinguish between parametric statistics and non-parametric statistics. Indicate their uses in different types of data or researches.
4. Describe the role of statistics and parameters in analysing the data. Illustrate your answer with suitable example.
5. What are the statistical technique which are commonly used in educational research?
6. Enumerate the important considerations for statistical analysis with special references to parametric statistics and non-parametric statistics.
7. Indicate the basis for selecting a statistical technique in analysing data for educational research.

Chapter 16

Research Report

The importance of a research study is to evaluate both scholastically and practically the contents of the written proposal and report of the study. The merit of the problem and its adequacy is examined on the basis of research proposal and the contribution of the study is judged on the basis of research report of thesis of the study. There are various formats of educational research report a researcher must understand its meaning and purpose. The following are the major writings formats of research work.

- 1. Research Proposal or synopsis or outline of a research work or project.**
- 2. Research Report or thesis**
- 3. Research Summary, and**
- 4. Research Abstracts.**

A research proposal deals with problem or topic that is to be investigated. It has a variety of formats which vary in their length. Writing a research proposal or synopsis includes an introductory section: problem hypotheses objectives, assumptions, method of study tools, justification and implications of the study. It is written in present or future tense. It covers four to ten pages. It is submitted for the final approval before starting the actual research work. The preparation of research proposal is significant in the development and pursuit of a research project. It is planning phase of a research work which is produced in the written form to judge its worth.

A research report deals with results of completed research work. After completing a research work, it is generally produced in the written 'form, and is called research report or thesis. A detailed description of research activities are provided in it. It has a variety of formats and vary as to its length. It is written in past tense and in third person. It is the final form of the research work. A research report includes usually the following chapters-Introductory or theoretical background, Review of related literature, Methodology, Data collection, Analysis of data, Discussion of results and findings of the study, Bibliography and Appendices. It is also submitted for evaluating its contributions. It serves the purpose of communicating the results of a research work done.

A research summary is the condensed version of research report. It provides the important aspects of research report or thesis. The purpose of the summary is to facilitate the readers or other scholars to understand about work done at a glance because to go through a research report it is very time consuming and difficult. Therefore, the main features of research report are summarized. It takes the form of research journal article or paper. It is also written in the past tense and covers six to twelve pages.

A research abstract is the condensed version of research summary. The main essence of the research work when reduced to a page or para is called research abstract. It includes title, method, sample and findings of the study. These abstracts are published in the journal as Abstracts.

THE RESEARCH REPORT

The writing of research report is usually the concluding task of the research endeavour. Every thing is combined together during the writing of the report. This is the point at which the research must be essentially reproduced in written form. It is a matter of communicating what was done, what occurred, and what the results mean in a concise, understandable, accurate and logical manner.

This is not the difficult task because the researcher has gone through these tasks which he has to reproduce in the same order. Good research reports are not easily written. The report writing is a skill it must be acquired by the researcher.

Since the written report is an account of research project, the organization of the report follows quite closely the organization of the research project. The writing of the report is usually associated with the close of the research for project, few portions of writing may be done while the research study is in progress. The preliminary drafts of the review of the literature can be written and revised and brought upto-date later. Research procedures can be recorded as the project is conducted and while it is fresh in the researcher's mind. It is difficult to write from memory and avoid serious omissions.

The writer should assemble the available informations before taking to the writing work. Mechanical procedures for presenting foot notes, references, figures, tables and the like should be well in mind. In the interest of efficiency and continuity, relatively lot of time should be reserved for the writing work.

The research report should contain all the necessary data and at the same time it should be brief and to the point. There is usually considerable changing and rewriting before the final draft. The report is also known as thesis or dissertation.

NEED OF RESEARCH REPORT

Writing a research report is very challenging task for the researcher. A good research report requires sufficient-experience and insight about his research activities. A research report is needed due to the following reasons:

- The research must be reported in full and its results should be subjected to a criticism and verification.
- The research work is done for the benefit of human being, therefore, it must be communicable to the general public for the practical use.
- The research should be considered to be the culminating act for reflective thinking. It encourages other persons to take up some problem for further investigation.
- The research report requires the creative thinking of a researcher to review the related studies and discussing the result of the study and also suggest some new problems for further studies.
- The research report is also necessary for giving shape and form to the investigation and solidifying it.
- It is needed for providing a clear picture of research method, sample and techniques used in conducting the research work.
- The research report is meant for popularizing the new contributions in the discipline.

GENERAL FORMAT OF RESEARCH REPORT

A written format of a research work is known as thesis or research report. All such works may differ considerably in scope of treatment and details of presentation. Even then all types of research reports are expected to follow a general uniform, common pattern of format, style and structure. The general format of research report is evolved and it has become a tradition in academic area. A research report or thesis is an organized format of research work done. It is viewed in three major categories:

- A. Preliminaries,
- B. Textual Body, and
- C. References.

Each category has been outlined further as follows:

- A. Preliminary Section
 1. Title page
 2. Preface or acknowledgements
 3. Table of content
 4. List of tables (if any)
 5. List of figures (if any).
- B. Main Body of Report or Textual Body
 1. Introduction
 - (a) Statement of the problem
 - (b) Objectives of the study
 - (c) Hypotheses to be tested
 - (d) Significance of the problem
 - (e) Assumptions and delimitations.
 - (f) Definitions of Important terms used.
 2. Review of related literature.
 3. Design of the study
 - (a) Method and procedure used
 - (b) Tools of research or sources of data
 - (c) Techniques of data collection
 - (d) Description of techniques used.
 3. Analysis and presentation of data
 - (a) Analysis of data
 - (b) Tables and interpretation
 - (c) Figures and interpretation.
 4. Conclusions
 - (a) Discussion of results
 - (b) Main Findings and inferences
 - (c) Implication of the findings and limitations
 - (d) Suggestions for further studies.

C. Reference Section

1. Bibliography
2. Appendices (if any)
3. Index or glossary (if any).

The detailed explanation of each aspect is given here

A. PRELIMINARY SECTION

As the preliminaries form a significant part of the whole thesis report, due care should be taken in preparing them. If the specifications are already laid down by some colleges or universities they should be observed. However, a general standard pattern suggested here in each case will be helpful for a researcher.

1. Title Page

This is the first page of a thesis or a dissertation. It includes:

- (a) Title of thesis.
- (b) Name of the candidate.
- (c) Purpose or relationship of the thesis to the course or degree requirement.
- (d) College and/or department in which the candidate has been admitted for the degree.
- (e) Name of the university to which it is submitted.
- (f) Month and year of submission or acceptance.

The title should be accurate, concise and clearly printed in capital letters. It should convey the main theme of the problem investigated and if possible one should give a clue about the method or type of research involved. A specimen of title page has been presented here.

2. Preface or Acknowledgement

A preface is different from introduction. It is a brief account of the purport or the origin and the utility of the study for which the thesis is presented. It also includes the acknowledgement to the persons and sources that have been helpful to the investigator. If the researcher does not want to mention anything about the study on this page except acknowledging debt to others, it will be desirable to use the title simple and restrained without flattery and effusive recognition for help by the family members and others. The preface should not be too long with too many details about the research work or its organization, which can appear in introduction. The word PREFACE or ACKNOWLEDGEMENT should be typed in capital letters. It should be written in an impressive way.

3. Table of Contents

This section lists all the main chapter headings and the essential sub-heading in each with the appropriate page numbers against each. The listing of main chapters is generally preceded by some preliminaries like preface or acknowledgement, list of tables, list of figures, abstract or synopsis and their respective pages in small Roman numbers and followed at the end by appendices, and Indexes.

Contents should neither be too detailed nor too sketchy the table of contents should serve an important purpose in providing an outline of the contents of the report. The capitalized title 'Contents' should be the central heading of the page and the capitalized word 'CHAPTER' and 'PAGE' should-

lead to the numbers of chapters and those of pages respectively on the left and right margins. An example' has' been given in the tabular of form.

4. List of Tables

The table of contents is followed by the list of tables on a separate page. This list of tables consists of the titles or captions of the tables included "in the thesis along with the page number where these can be located. It has been illustrated here.

The capitalized title 'LIST OF TABLES' should be the central heading of the page and the capital words 'TABLE' and 'PAGE' should lead to the numbers and those of pages respectively at left and right margins.

5. List of Figures and Illustrations

If any charts graphs or any other illustrations are used in the thesis, a list of figures on a separate page is prepared in the same form as the list of tables except that they are numbered with Arabic numbers. An example has been given here for this -purpose.

Table of Contents

CONTENTS

Preface
List of Tables
List of Figures
I. INTRODUCTION
(a) Statement of Problem
(b) Objectives
(c) Hypotheses
(d) Assumptions and Limitations
II. REVIEW OF LITERATURE
III. DESIGN OF RESEARCH
(a) Method of Sample
(b) Procedure and Technique
(c) Statistical Technique
IV. ANALYSIS OF DATA
V. CONCLUSIONS
Bibliography
Appendix

LIST OF TABLES

Table	Page
1. Sample Structure	20
2. Distribution of Academic Qualification	22
3. Distribution of Aptitude Scores	23
4. Regression Weights	28

Similarly list-of figures is prepared. The page number of figures is given facing the page number of the report.

(B) MAIN BODY OF REPORT OR TEXTUAL BODY

The text of the thesis is the most important section in the organization of research report. The quality of worth of thesis is mainly examined. It is the original production of the researcher. The report of the main body serves the function of demonstrating the competence of the researcher. If any sentence, paragraph, concept fails to serve the single function within a given section or chapter, it is irrelevant. The subject matter of any chapter should be relevant to that point. Generally the main body of the research reports consists of five or six chapters.

Chapter

- I. Introduction or Theoretical Frame Work
- II. Review of Related Literature
- III. Design or Methodology
- IV. Data Collection or Administration of Tools and Scoring.
- V. Analysis and Interpretation of Data.
- VI. Conclusions and Suggestions for the Further Researches.

Chapter 1. Introduction or Theoretical Frame Work

The main purpose of this chapter is to indicate the need and scope of the study. It consists essentially of the statement of research inquiry. It is reported in past tense form of work completed. The problem objectives, hypotheses, assumptions and delimitations of the study are reported precisely.

If an introduction is required, the researcher should make certain that it is an introduction that generates an interest and appropriate mental set which introductions are regarded as capable of producing. It must be long enough to do its jobs and nothing more.

Chapter 2. Review of Related Literature

This chapter is essential in most of the research studies. It presents the comprehensive development of the problem background. It indicates what has already been studied by others, which has a bearing upon the present study.

The review of literature stresses two aspects: the first is the consideration of the subject-matter and it is likely more important than the other. The second is related to methodology and design. The review chapter is devoted to the development of the problem statement or the object of the inquiry. The review is utilized to retain a direct relevancy to the study in hand. It is the balancing chapter of the research report.

Chapter 3. Design or Methodology of Research

This chapter indicates the line of approach of the study. The first aspect deals with the method, population and sample of the study and second part provides the tools and techniques employed in the research. It also presents the procedure of the study. The whole plan of the study is discussed in detail under this chapter.

Administration of tools and scoring procedure are reported systematically. The data organization and presentation should be given in this section. It may be reported in a separate chapter of the report.

Chapter 4. Analysis and Interpretation of the Data

In this chapter analysis and results are reported so as to draw the inferences of the study. The analysis of data are presented in tabular form and in figures or pictorial presentation. The results are interpreted at length. This chapter provides the original work or contribution by the researcher. The communicative accuracy is required in this chapter. The text must be developed to ensure an effective ordering of the evidences.

Chapter 5. Conclusions and Suggestions

This is most important chapter of the report. It requires the creative and reflective aspect of the researcher. The results are discussed to make them more meaningful comparison of the results with the evidence in the review section should be woven into the text whenever such a discussion can serve to clarify the points being reported. This is the final chapter of a report, thus findings of the study are summarized and suggestions for the further studies are also given. The implications and delimitations of the findings are also mentioned in this section. The main thrust in the section is the answer of the question or solution of the problem. The validity of the findings should be mentioned.

(C) REFERENCE SECTION

This is the third section of a research report. It consists of generally the bibliography and appendice. It is also essential to include glossary and index for the convenience of the readers. The bibliography, appendix, glossary and index all these are written on a separate page - in the centre with capital letters.

1. Bibliography

The bibliography is a list of the printed sources utilized in the research work. The publications used for information-yield but not quoted in the report may also be included in the bibliography. The format of the bibliography depend on the footnote style. If the foot-notes reference in the text are numbered to refer to the source in the bibliography, the entries must be numerically listed in the order of appearance in the text. The various format manuals include information on form for the bibliography. If the list of sources is too large the bibliography should be categorized in the following sections:

Books, monographs, documents and reports, periodicals and journals, essay and articles, unpublished thesis and material and newspapers.

If selected sources are reported the words 'Selected Bibliography' should be written. In writing bibliography the surname is written first than initials, year of publication, title of the book, publishers name, place and total number of pages. The following are the examples of writing bibliography:

- (i) Example for single author:
Best, John. W (1977) 'Research in Education', 3rd ed., New Jersey : Prentice-Hall Inc. Englewood Cliffs, 403 pp.
- (ii) Example for two authors: The only difference is that second author's name is written differently i.e. initial first and surname at the end in a usual manner.
McGrath, J.H. and D. Gene Watts on (1970) 'Research Methods and Designs for Education' Pennsylvania: International Text-Book Company, 222 pp.

- (iii) Example for three or more authors:
Selltiz, Claire et al. (1959) ‘Research Method in Social Relations’, New York: Holt, Rinehart and Winston, 424 pp.
- (iv) Example for editor as author:
Buros, Oscar K. ed. (1965) ‘The Sixth Mental Measurement’, Yearbook: Highland Park, N.J. : Gryphon Press 1163 pp.
- (v) Example for author not given:
Author’s Guide (1955) Englewood Cliffs, N.J. Prentice Hall, 121 pp.
- (vi) Example for publication of an association, Agency or Society:
National Society for the study of Education (1955), ‘Modern Philosophies of Education’ 54th Yearbook, Part-I, The University of Chicago Press, Chicago 37 pp.
Or
‘Modern Philosophies of Education’ (1955), National Society for the Study of Education, 54th Yearbook Part-I, Chicago: The Chicago University Press 374 pp.
- (vii) Example for unpublished thesis:
Sharma, R.A. (1972), ‘Some Predictors of Teacher Effectiveness’ Unpublished” Ph.D. Thesis Submitted to Meerut University, 320 pp.
- (viii) Article in an Encyclopaedia and Hand Book.
Barr, A.S. (1944), ‘Criteria of Teacher-Effectiveness’ Ebel’s Encyclopaedia of Educational Research, 742 p.
Smith, B.O. (1964), ‘Relationship of Teaching and Learning’, Gage, Hand Book of Research in Teaching, 426 p.
- (ix) Example for Journals and Periodicals:
Bar, A.S. (1940), ‘The Measurement and Prediction of Teaching Efficiency,’ Review of Educational Research, Vol. 10, No. 4, pp. 185-190.
Leeds, C.H. (1969), Predictive Validity of MTAII’, The Journal of Teacher Education, Vol. 20 NO.1.
- (x) A chapter written by an author other than the editor:
Maccoby E.E. (1954), ‘The Interview: A Tool of Social Science’, Chapter 12, in the Hand Book of Social Psychology, Addison, Wesley Cambridge Mass.
- (xi) Quotations primary source cannot be located:
Kelley, E.P. (1950), ‘Education for what is Real’, As cited by Edward A. Krug, ‘Curriculum Planning’, New York: Harper and Row Publishers, 55 pp.
The place of publication may be written before the home of publishers e.g. New York: Harper and Row Publishers, 55 pp.

A bibliography reference is written in the following manner and arranged alphabetically to facilitate the readers:

- Name of the author with the last name first and initials afterwards.
- The year of publication is given in bracket after the name of the author and authors.
- Title of the book or the work is written, underlined and followed by a full stop (.)
- Place of Publication followed by a colon (:).

- Name of the publishing agency and publishers and followed by comma (,).
- Total pages of the book are given.

The above sequence is employed in preparing bibliographical references. It is also used for giving footnotes reference with a little deviation. In footnote the name of the author with the Initials first followed by surname or last name is given. The specific page number of the work or the book is given not the total pages. Other things remain the same as mentioned in the bibliography. The bibliography pages are also written in Arabic figure in the sequence of main body of the report.

2. Appendix

An appendix is the important reference materials category. It includes the material which can not be logically included in the main body or textual body of the research report or the relevant materials too unwieldy to include in the main body. The appendix usually includes: tools of research, statistical tables and sometime raw-data (when data were processed through computer). Even the material of minor importance e.g. forms, letters, reminders, interview sheets, blank questionnaires, charts, tables, lengthy questions, report of cases (if follow-up or case studies have been conducted). The tools and other material should be placed first and tables at the end and page numbers should be assigned in Roman Numbers (i, ii, xxi). The appendix serves the function of providing greater clarity and authenticity for the readers or consumers of the thesis. The items of the appendix are very essential for a good research report.

3. Index and Glossary

When a research report is published in index, must be given. The index includes authors and subjects and topics or words in alphabetical order.

In the report glossary should be provided. It includes the meanings or definitions of some words and terms 'used in the research report. Some notations symbols or abbreviations should be explained what actually they mean or indicate in the study.

MECHANICS OF REPORT WRITING

A research report writing is a highly technical activity. It includes various mechanics for a smooth flow of the thesis. The mechanical aspect has been standardized which must be followed by researcher in preparing a thesis. Such mechanics involve the following issues:

- (a) Footnotes and references,
- (b) Style of writing,
- (c) Headings,
- (d) Tables,
- (e) Figures,
- (f) Pagination,
- (g) Proof reading, and
- (h) Binding and submission.

(a) Footnotes

Sometimes it is desirable to quote some authoritative views or statements from written works of others in the research report. It may be necessary from various purposes viz. to review the related literature, to support to give the rationale for one's viewpoint.

Each quotation must have a footnote or reference indicating the sources from which it is borrowed. All these sources and authority be acknowledged both for intellectual honesty and for validity of one's research.

Footnotes serve a number of purposes. They enable the researcher to substantiate his presentation by quotations or citations of other authorities, to give credit to sources of material that he has reported and to provide the reader with specific sources that he may use to verify the authenticity and accuracy of material quoted. The citation or quoted statements are written in single-spaced whereas the text is written double-spaced.

The footnotes are placed at the bottom of the page" and are separated from the text by a three cms horizontal line drawn from the left margin. Footnotes are numbered consecutively within a chapter.

The recent approach is that references are given in the place of footnotes. The reference of quoted material is inserted in parentheses at the end of the sentence. For example, (4 : 72) indicates that the statement refers to the bibliography listing number 4, page 72. Another procedure is that all the references are placed on one page at the end of the chapter in the sequence of quoted statements.

Method of Writing Footnotes: Usually the footnotes are given at bottom of the page at the end of the text according to the number of quotations provided on it. The following examples illustrate the style of writing footnotes:

1. Single author

John W. Best. (1977), 'Research in Education' 3rd ed. New Jersey: Prentice-Hall, Inc., Englewood Cliff, 84 p.

2. Two authors:

J.H. MC. Grath and D. Gene Wattson (1970), 'Research Methods and Designs for Education', Pennsylvania International Text-book Company, 124 p.

It may be noted from the examples of footnotes and bibliography that the author's last name or surname is written first in bibliography while last name or surname is given in usual way or in the last. Second difference between these two can be gathered regarding page-total number pages of the book are written in bibliography and specific page number of the book is recorded on the foot-notes where the quotation has been given in the book. In this way eleven types of bibliography have been illustrated in this chapter, with this difference eleven types of footnotes can also be written.

To avoid repetition and making economy of time and space some abbreviations are used in writing the footnotes references. Usually following three types of abbreviations are employed.

Ibid—In consecutive reference to the same work the Latin abbreviation *Ibid* (Indicates same page as earlier footnote), *Ibid* p. 36 (same work, but a different page 36) is used.

Op. Ci.—When a reference to the same work is not used in consecutive but after some other references, the Latin abbreviation *op. cit.* (indicates the work already cited in the report). The surname of the author and *op. cit.* is used. If the page number of the book is different, in this situation *op. cit.* and page number along the surname is used. The examples are as follows:

Chaube, *op. cit.* (the work cited).

Chaube, op. cit. page 48 (the work cited on page 48).

Loc. Ci. – When a second but non-consecutive reference follows, referring to the same work and same page, the Latin abbreviation Loc-cit (previously cited) may be used. The authors surname along Loc. cit must be included. An example is given below:

Chaturvedi, Loc. cit (previously cited on page 48).

(b) Style of Preparing Thesis

The research report should be written in a style that it is creative, clear and concise. Therefore the following considerations should be kept in view in writing a research report.

1. The research must be reported in full and its results are subjected to criticism and verification.
2. A research report is always written in third person i.e. he, she or the investigator. I, we, you, my, our and us should not be used.
3. It is prepared and written in past tense and present-perfect tense because it is reported usually after completion of the work.
4. The scientific language is used rather than literary language. The British-English pattern is followed in writing a research report. The spellings of the words are employed of the British English.
5. It is typed printed/cyclostyled on 11" 9" size (thesis size) sunlit bond papers. There should be left a margin of 1-1/2" right margin one inch top and bottom margin should be 1-1/4" in each. The same machine of typing must be used for typing research report.
6. The presentation of matter should be in floating sequence. There should be consistency in the form and content organization.
7. An appropriate and proper format of research report should be used.
8. The footnotes, references, tables, figures, heading, subheading and bibliography should be provided in its standard form.
9. It should be typed in double space, quotations or citation should be given in single space. A word should not be split in two aspects due to the shortage of space in a line. A table, figure and diagram should always be given on a single page. If table size is large, a large size paper should be used. It should not continue on the next page.
10. A typist with great experience and proficiency should be employed for preparing thesis or dissertation, because it is the responsibility of the researcher that a thesis should be typed in proper form. The correction of major errors is not the responsibility of the typist.
11. Good research reports are not written hurriedly. Even an expert and experienced researcher revises many times before he submits a manuscript for typing. Typographical standards for the thesis or dissertation are more exacting. Therefore, every typist cannot prepare a thesis, there are the experts for typing thesis, who should be employed for typing thesis.

(c) Headings

Generally a research report is divided into chapters, each chapter begins from a new page. The title of a chapter is called the chapter heading. The word 'CHAPTER' is written in capital letters, in the centre of the page and title is placed three spaces of the chapter. The following is the example:

CHAPTER IV. IDENTIFICATION OF TEACHING SKILLS

(Chapter Heading)

Major Heading: A chapter of the report is divided into major heads. The major heading is written in capital letters at the centre of the page. An example is as follows:

STIMULUS VARIATION SKILL

(Major Heading)

Major Heading: A major heading is sometimes divided into sub headings which are known as minor heading. It starts with left margin of a page in lower-upper letters. A paragraph starts two spaces below. An example is given below:

Components of Stimulus Variation Skill: (Minor Heading)

Paragraph Heading: If the minor heading is further divided, the paragraph is used. It must be indented five spaces and underlined. A full stop and dash is marked after such a heading. The written matter starts on the same line. The following is an example:

Change in Voice: There is a modulation in the voice of effective teachers. (Paragraph heading).

These headings are also specified by using the numbers. For the Main headings 1, 2, 3, 4...so on are assigned in a chapter. The minor headings or sub-heading are shown in decimal numbers e.g. 2.1, 2.2, 2.3, it indicates that 1, 2, 3 are the minor headings of second main heading. Similarly paragraph headings are indicated in further decimal numbers e.g. 2.1.1, 2.1.2, 2.1.3 last numbers, 1, 2, 3 are paragraph headings of first minor heading of second major heading.

(d) Tables

A table is used for presenting statistical data. It enables the readers to comprehend and interpret data quickly and to understand significant aspects at a glance.

The work 'TABLE' is followed by the serial Roman number which is placed at the centre two spaces above the title of the table. The title of the table is written in capital letters at the centre of the page. The statistical data are presented in vertical columns and horizontal row, according to some classification of subject matter. An example has been given below:

TABLE - XII
STRUCTURE OF SAMPLE SUBJECTS
With Regard To Sex and Age

<i>Years</i>	<i>Boys</i>	<i>Girls</i>	<i>Total</i>
25	10	6	16
22	12	8	20
—	—	—	—
—	—	—	—
—	—	—	—

(e) Figures

A figure is a device that presents statistical data in pictorial or visual form. The figure is used to a variety of graphs, charts, maps, sketches, diagrams and drawings. It helps to understand the aspects of data clearly and easily. One idea or fact should be presented in each figure. The description of the figure must be given in the textual body. 'FIGURE' should be written in the centre of the page at the top of the figure. The title of the figure should be written in capital letters two spaces below the figure. The scale of the figure must be given. An example has been provided here.

FIGURE-12
GROWTH OF LITERACY IN INDIA
In Millions (During 1950-80)

The bar diagram and graphical presentations (Polygons and Histogram) are commonly used in educational research reports.

(f) Pagination

Assigning page numbers of the report is very essential. The title page or initial page of any section does not have a page number typed on it, but a number is allotted to it in the series of pages. Page numbers are typed in the upper right hand corner, one inch below the top edge of the page.

The small or lower Roman numerals (i, ii, iii, iv,) are assigned for the pages of preliminary section. The serial Arabic nos. 1, 2, 3, 4.....so on are assigned for the pages of textual body or main body of the report i.e. Chapter I to last and Bibliography. The lower Roman numerals are assigned for the pages of appendices and index. The correct pagination depends upon the final edited copy or typed copy.

(g) Proof Reading

A research report should not have errors. It requires that final typed copies must be checked carefully. All types of errors should be deleted before submission. Thus, proof reading of final typed copies should be done two or three times. The following are the some practical suggestions with regard to the technique of corrections:

- Generally four or five copies are prepared for the final report. The last typed copy should be taken for correction purpose.
- The last typed copy should be read thoroughly, the errors should be recorded on a separate page indicating page number, para number, line number and kind of error. It should be corrected with help of black refill.
- The addition or deletion or more than one word or sentence or line is required for the correction, it should be made by the typist on the same machine.
- With the help of the proper on which errors have been noted down, correction of minor errors can be made quickly and easily in the remaining three or four typed copies of the report.

(h) Binding and Submission

It is the last activity for preparing research report. Before giving to the binder it should be arranged properly and systematically and the serial number of pages are checked carefully. It should be given to

an expert binder who has the experience of binding research thesis. Some universities require three copies of the thesis five copies of the abstract or summary and three copies of synopsis. These should also be prepared. A great precaution must be taken in printing the topic or title of the thesis that it must be the photo-state form of the topic which was approved by research degree committee. The covering page must be the same as inner cover given in preliminary section.

After binding the thesis it should be submitted to the university for evaluation purpose. Researcher should ascertain the date of submission and other requirement e.g. certificate of the supervisor, evaluation fees etc. For the post-graduate dissertation, student should plan that he would be able to submit to college or university in time. He must obtain the receipt of the submission of his thesis.

EVALUATION OF A RESEARCH REPORT

The evaluation of a research report is a valuable exercise for the student of educational research. Using a pattern such as the one suggested, the critical analysis of the many aspects of another researcher's report helps the student to develop competency in his own research and reporting skills. The evaluation aspect is much more useful even to a guide or supervisor for instructing his research scholars in preparing a research report.

The following questions are suggested relating to the various aspects of research report as a possible structure for the analysis:

1. The Title

- (a) Is it clear and concise?
- (b) Does it promise no more than the study can provide?

2. The Problem

- (a) Is it clearly stated?
- (b) Is it properly delimited?
- (c) Is its significance recognized?
- (d) Are specific questions raised and hypotheses are clearly stated?
- (e) Are the assumptions and limitations stated?
- (f) Are important terms defined?

3. Review of Related Literature

- (a) Is it adequately covered?
- (b) Are important findings-noted?
- (c) Is it well organized?
- (d) Is an effective summary provided?
- (e) Is the researcher commented adequately? Has he justified that his study is related to the studies and has the deviations from earlier studies.

4. Methodology used for conducting the study:

- (a) Is the research design described in detail ?
- (b) Is the method adequate?
- (c) Is the population defined properly?
- (d) Is the sample described?
- (c) Are the relevant variables recognized?

- (f) Are appropriate controls provided?
- (g) Are data collecting tools appropriate?
- (h) Are validity and reliability established?
- (i) Is the statistical treatment appropriate?

5. Data Analysis

- (a) Is appropriate use made of tables and figures?
- (b) Is the textual discussion clear and concise?
- (c) Is the analysis of data relationships logical and perceptive?
- (d) Is the statistical analysis accurately interpreted?

6. Conclusions and Suggestions

- (a) Are the results discussed at length adequately?
- (b) Are the inferences stated appropriately?
- (c) Are the limitations of the findings enumerated clearly?
- (d) Are the applications of the findings suggested adequately?
- (e) Are some suggestions for further studies proposed appropriately?

Apart from these aspects of research report, its literary presentation should be worth for publications. There should be minimum or no typing errors. The researcher should have the confidence aware of the limitations of his study.

WRITING RESEARCH ABSTRACT

A well written abstract is a great service to every one who is going through the research process. Abstracts are main method which is used to communicate research findings and contributions to the works of the field studied. Generally a researcher has to prepare an abstract after completing his research thesis or report. There are two procedures in this regard:

- The abstract is provided in the main body of the research report in the form of last chapter of the thesis.
- The abstract or summary of the report is prepared separately in a booklet form.

Most of the universities require some copies of the abstract at the time of a submission of a thesis for evaluation purpose. It facilitates the examiners or experts to evaluate a research thesis properly.

Need of an Abstract

The following are the main advantages of a research abstract:

1. Generally research reports are voluminous and hence these require time and energy to go through them. An abstract provides the awareness of the research work at a glance. It facilitates the readers and other research works to comprehend it easily and quickly. It means to communicate a research contribution in the field.
2. The experts or examiners make use of the abstract in evaluating research thesis. 'It communicates the work done by researcher and review same of the aspects wherever they require further clarifications.

The abstracts are used by other researchers of the field to review the studies conducted in this area. It is an economical device far reviewing the related studies.

The research papers are prepared with the help of the abstract. These papers are published in research journals and papers to disseminate the knowledge in the area.

The research organizations universities and institutes can register the research abstracts for financial assistance. The research thesis is approved for publication and the basis of reviewing abstract and financial assistance is granted for its publication.

In a particular field of research 'Research Abstract' is prepared. The Survey of Educational Research in India by such is prepared by collecting these abstracts from Indian Universities and faculty of education.

Format of Abstract

A summary of a research report or thesis is prepared in the form of abstract. It provides the brief description of main points of research report. The main theme is given in the abstract of a research work. Its size varies from 4 to 12 pages, but there is no hard and fast rule in this regard. It should be able to communicate the whole work comprehensively. There are two formats for preparing abstract:

First Type Format: Includes main points and theme of research work in brief. It includes the following points: Introduction, main body of the text and conclusions. The introduction part covers the problem, adjectives, hypothesis and theoretical aspect. The main body of the text includes method sample techniques, tools used results. The last part of abstract provides the conclusions of the study in the statement form along with their implications in the field. This type of format is used in scientific studies in the discipline of education.

Second Type Format: Includes the summary of the chapters of the research report. The main theme of each chapter is given in this type of format of abstract. This format is used in philosophical, historical and descriptive type of research in the area of education.

Usually a research abstract consists of three main parts:

- Introduction,
- Main Body of the report, and
- Conclusions.

The introductory part emphasizes the significance of the problem, objectives and hypotheses (if any) of the study. The main body includes methods, sampling, techniques, tools and results of the study. The last part provides contributions or conclusions of the study. The implication of the findings are also highlighted at the end. The structure of the report is also given and most important references are also written in the form of bibliography. The abstract is written in past tense and in the third person.

Characteristics of a Good Abstract

A good abstract has the following characteristics:

1. It is economical device to communicate the contributions of a research work.
2. A good abstract is written in simple and clear language. The words and terms used should have single meaning.
3. An abstract disseminates the new knowledge in field studied.
4. It avoids the repetition of research studies.
5. It helps the researcher to review the related study in an economical way from time, money and energy point of view. A good abstract brings the name of researcher in the field through a significant contributions.

7. The specialist or experts give their comments and suggestions for further investigation.
8. A good abstract provides the basis for preparing research papers.

It is the media and method to popularize a research contributions and to provide its implications for improving in a particular area of education.

WRITING RESEARCH PAPERS

Research is a critical, disciplined, inquiry into a problem. A research paper is a presentation of the result of such a critical inquiry. Writing a research paper involves certain procedures which, is followed in proper sequence, might avoid waste of time, energy and resources.

The writer of a research article has to rely on two kinds of source of information called as primary and secondary on the basis of the evaluation of their trust worthiness. Similarly, he has to be extremely cautious in the discrimination between facts and opinions though both are important elements in his arguments and chain of reasoning. A 'fact' is anything which is known to exist or which is accepted as true. There is no need to substantiate well known facts like the birth dates of contemporary leaders or events. A research paper has to present a number of opinions as expressed by others or researcher himself. It is necessary to document those opinions of others by pin- pointing their sources so that anyone if in doubt can "verify any of them. It is a sound policy and good convention to keep facts separated from opinions, especially the author's own, in a research paper. Any mixture of them there will lower the credibility of the paper as a scholarly piece of writing.

Format of A Research Paper

There is no fixed format 1 for writing a research paper. Each individual has to develop his own approach. But a broad guideline can be evolved on the basis of experiences of many researchers. An outline of the research paper should be prepared before details are written down. A good outline will help in the proper structuring or designing of a research paper. It will involve all the relevant points in an effective sequence which will provide direction to the flow of writing research paper. Before an outline is prepared, it will be necessary to make a list of all the points and to determine their status either as major, or supplementary materials. A working outline can be prepared by combining these points in a paper sequence.

The format of research paper usually includes three main points: An introduction, the main body of text and conclusions. It is possible to make a good beginning with a relevant quotation which is not too familiar. It should attract attention and arouse curiosity. A paper may begin by a good summary of the research paper or research work done on the topic in the past. It should be objective survey in very brief. The important references to the sources used for this survey will enable the writer to demonstrate familiarity with the key concepts, theories, latest developments in research and prevailing controversies.

The introduction is also a place where the central problem is clearly stated. The central theme should be brought into focus along with its significance.

The main body of the paper should be developed to the report of the research work to the presentation of arguments based on the work of exploration, discoveries experiments, analysis, synthesis or all those activities which constituted the research and led to the conclusions. A research paper will have constructive and critical sides. The constructive paper should follow in order to prove how the research reported in the paper fills the void.

But another approach is equally welcome in which the contribution of the research is presented first. Its significance is highlighted by critical refutation of the claims of the rival theories. In any case, what the researcher has done should be brought into focus. The views of the researcher should be supported by references statistics and other form of evidences.

The paper should have a conclusion in which the quintessence of the work is reiterated preceded by a recapitulation of the main arguments or statements of the research work. The first draft of a paper may not be the most satisfactory though it may look so at the time of writing. Most experienced writers set aside the first draft for a few days, at least for a few hours. This process helps in a more impersonal critical and objective reappraisal. Any paper improves with revision or rewriting and the research paper is no exception. It will help the writer if he imagines himself addressing the most renowned scholars in the field while writing the paper in the first place and later in its finalization.

Advantages of a Research Paper

A research paper has the following main advantages:

1. The new contribution in the specific area is disseminated among other research scholars.
2. The repetition can be avoided others will not take up the same problem.
3. It saves the time energy and money in the research area.
4. A research worker is also known through the research papers that he is working in a particular field.
5. The experts of the area may comment or suggest for the researcher to design further study.
6. The research-worker learns and gains experience for writing good research paper.

EXERCISES

1. Explain the following terms used in a research.
 - (a) Research proposal or synopsis or outline of a research project,
 - (b) Research report, or thesis or dissertation,
 - (c) Research summary, and
 - (d) Research abstracts.
2. What do you understand by research report or thesis? Indicate its need and importance in the research work.
3. Indicate the general format of research report and mention its specific category of each major section of report.
4. Differentiate between bibliography and footnotes or references. Illustrate your answer with examples.
5. Point out the mechanics of report writing and illustrate your answer with examples.