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13. Report Writing

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13.1 Introduction:

A detailed account of the research experience from selection and definition of the problem, formulation of hypotheses, gathering, analyzing and interpreting data, testing of hypotheses, making conclusion and suggesting further research in the related problem area is called a research report.

No matter what quality is of the research undertaken, much of the acceptance of the results depends on the way as they are communicated to the relevant audiences. This act of communicating is called report writing. It is the final step in the research process.

A report is simply a statement or description of theirs that have already occurred. It is culmination of the research findings to a specific audience to accomplish given purpose. This presentation can be written or given orally or both.

It is concise and clear communication of findings of the research work. According to Kinner and Taylor-

"A research report can be defined as the presentation of the research findings directed to a specific audience to accomplish specific purposes. "

Its objective is to tell readers the problems investigated, method used to solve the problem, result of the investigation and conclusion inferred from the result. It is to report what was done, why it is done, outcome of the doing and researchers' conclusion.

Guidelines for Report Writing:

a. The research report is design to communicate information for use by decision maker, so obviously it must be tailored to his need.
b. Report should be concise yet complete. It should cover the important points of the project and should exclude the unimportant.
c. The research report must be an objective presentation or the research findings.

13.2 Components:

The basic components of a research report are as follows;

A. **Introduction of The Research Problem:** The researcher will write in it;

   a. What is the problem?
   b. What is its importance?
   c. What is the relation of the problem with previous theory and research,
   d. What are the objectives of the study?
   e. What are the hypotheses?

B. **Description of The Procedure of The Research:** The researcher will write in it;

   a. How did he select the subjects?
   b. How many subjects were used?
   c. How were the subjects assigned to groups?
   d. What was done to the subjects?
   e. How was it done?
   f. When was it done?
   g. How long was it done?
   h. How was the reliability of the measuring instruments measured?
   i. How was the validity of the measuring instruments measured?

C. **Description and Presentation of The Results:** The researcher will write in it;

   a. Which statistical procedures he used to test the hypotheses?
   b. What were the outcomes of those procedures?
   c. What were the subsidiary findings of the research?

D. **Discussion of The Study Findings**: The researcher will write in it;

   a. Why did the results manifest themselves in a particular way?
   b. What did there results signify?
   c. What was the relationship between this research and the previous research upon which it was based?

Features: The following are the essential features of a good research report.

- Clarity

- Conciseness
- Veracity
- No place for figures of speech, lyrical prose and in using anecdotes.
- No lengthy digressions
- Only necessary details
- Absolute uncompromising honesty
- Serious attempt and not a game

Reasons for Writing:

The following are the main reasons on account of which the researcher should write the research report.

a. It is a logical conclusion of doing the research.
b. It enriches the curriculum vitae of the researcher which helps him in appointment and promotion.
c. Writing of the research report is an easy task and it is not that difficult as understood.

13.2 Mode of Communications:

The researcher may use any of the following mode for communicating his research results;

a. **A Research Monograph:** The researcher may publish a research monograph on the basis of his research results through a research journals or a reputed research publisher.ph depends upon the standard of the research work and the reputation of the researcher.
b. **A Research Journal:** The researcher may publish a research paper in a reputed research journal. But this requires that the paper should be acceptable to the Editor of the journal. The prestigious journals send these papers to reviewers who are conversant with the research area in which the research paper has been written.
c. **Presenting in the Meeting of the Association/ Society /Congress**: There are annual conferences of the associations, societies and Congress in each subject area. They provide opportunities to the researchers to present their research results in the form of a research paper before the members of the association or the society or the delegates of the Congress which are followed by the discussions. The journals of those organizations publish these papers in the form of the proceedings of the Association / Society / Congress.

Format: The research reports are divided into the following parts;

A. Preliminary Section: It consists of the following:

a. Title Page
b. Preface
c. Table of Contents
d. List of Tables
e. List of figure, maps and illustrations

B. Introduction: It consists of the following:

a. Importance of the problem under investigation.
b. A review of related literature
c. Statement of Hypotheses or relationships being studied
d. Delimitations of the study
e. Assumptions of the study
f. Definition of important terms

C. Methods: It consists of the following;

a. How was the study conducted?
b. From which population was the sample selected?
c. How many subjects were selected?
d. What were the demographic characteristics of the subjects?(male/female, average age)
e. Was there any characteristic which make the sample a typical to the population?
f. How were the subjects assigned to groups?
g. What instructions were given to the subjects?
h. How conditions were controlled?
i. What was the treatment of variables?
j. How, when and on what were subjects measured?
k. What data collection instruments were used?
l. What was the format of items?
m. What was the reliability of the instrument?
n. What was the validity of the instrument?
o. What are the details of the instruments which was prepared by the researcher?

D. Results: It consists of the following

a. What statistical procedure was used to study the hypotheses?
b. What was the probability level of each hypotheses test?
c. What was the probability level of each statistics?
d. What was the attendant degree of freedom?
e. What was the strength of the relationship of the variables?
f. What were the group means and standard deviation?
g. What were principle finding?

E. Discussion: It consists of the following;

a. What were the original purposes of the study?
b. How were these purpose met?
c. Why the obtained occurred?
d. What were the conclusions of the researcher for practice, theory and future research?
e. What is the contribution of the study to the research literature?
f. What are the strengths and weaknesses of the study?

F. **Reference Section:** It consists of the following:

a. Bibliography
b. Appendices: Questionnaires, Copies of letters used, evaluation sheets, checklists etc.

13.4 Research Proposal:

Each researcher has to write a research proposal before he undertakes any research work. For a new researcher it presents a great problem because he does not know the components of any research proposal. Even an experienced research worker is required to write a research proposal if he proposes to obtain financial assistance for a research project from any research organization. In our own country NCERT, UGC, AICTE, ICSSR etc. have developed their own research formats but a few basic components are common to all well-prepared research proposals.

Title of the Proposal:

The first part of any research proposal is its title. If the title is not clearly stated it will not help the researcher in his work. A good title should clearly identify the research proposal and must clearly state about the following:

a. What variables are included in the research proposal?
b. What is the relationship between the different variables?
c. Which is the population to which the results may be generalized? While independent and dependent variables are stated in the research proposal title, which are of experimental nature, the variates and criterion variables are written in non-experimental studies.

One example of each is given below;

Experimental Study:

"The Effect of Lecture Method and Text Book Method on the Academic Achievement in Economics of Class IX Students"

Non-Experimental Study:

"The Relationship between Socio-Economic Status and Academic Achievement in a Foreign Language of Class X Students"

In the experimental study the title of the research proposal is so stated that it shows the effect of independent variable upon dependent variable. This type of title indicates which variable will be manipulated by the research and upon which variable its effect will be observed. In non- experimental study, the title should indicate the relationship between the variate and the criterion variable. In non -experimental study the variables are not manipulated, only relationship between variates and criterion variable is stated. In the above examples, "Lecture method" and "Text Book Method" are independent variable and academic achievement is dependent variable. In the second example the 'Socio-Economic Status' is an example of criterion variable.

The boundaries should be identified for which the research findings may be generalized. They are generally expressed in the terms of 'Target Population'. In the above examples, students of class IX and students of class X are target population in experimental and non-experimental population respectively.

Another requirement for a good, research title is that it should not be too lengthy. Attempts should not be made to answer all questions relating to variables and the population in a title. Fifteen to twenty words are the maximum can be included in a research title.

Some good titles are given below;

a. "A Comparison Between Two Methods of Teaching Algebra-Expository and Discovery-in the Tenth Class in a Recognized Secondary School".
b. "The Effects of Grading on Achievement in Mathematics."
c. "The Relationship between Spelling, Achievement and a Personality Factor".
d. "A Comparison of the Evaluation of Teacher Performance by Principals and Teachers".
e. "A Study of the Effect of Two Seating Arrangements in the in the Foreign Language Achievement of Class VI."

13.5 Research Problem:

The second part of any research proposal is the research problem. It is of special importance on account of its strategic location. The problem should define and delimit the specific area of the proposed research. It should begin with the general background of the problem and end with a specific statement of the problem. The research problem should be so structured that it should begin with a broad base of general problems and explanations. It should be followed by a survey of related research literature. It should end with the problem statement.

The background of the research should identify the variables of the research problem, discuss the variables which are selected for the research study. Other important variables which are not included in the research study should also be briefly discussed. It should also be made clear that which criteria were used for the selection of the variables. This part of the research proposal should be written in simple language and should also be precised.

The significance of the problem should also be written. It should meet the following requirements;

a. The research proposal is time bound document. Thrust areas of research changes from time to time. Only such areas should be selected which are of crucial importance these days.
b. The research proposal should be related with practical problems. It should provide solution to any existing social / behavioral /educational /institutional/library related problem etc.
c. The research problem should not have small target population, because its result cannot be verified.
d. Target population of any research problem should be related to a popular population.

If the research proposal is to be submitted for financial assistance it should also be seen that what the areas of priority of the funding agency are. Each agency grants financial assistance to those research studies which it considers as central to its area of concern and others as peripheral. The statement of the problem is the last stone in the pyramid of the research problem. It specifies the variates and criterion variables in non-experimental studies and independent and dependent variables in an experimental study, the type of relationship between variables and target population.

Another criterion of a good problem statement is that it can be measured. A research problem in which the relationship between variables cannot be measured empirically cannot be categorized a research problem.

The statement which seeks to answer the question of value-judgment should not be included in research problem. Such questions cannot be answered by a research study. They should be avoided in a research proposal.

Statement of Hypothesis:

The third part of a research proposal is statement of Hypotheses. It is done more sophistically than the statement of problem. The research hypothesis is presented in an affirmative form rather than in the interrogative form. They state what is expected to occur if various conditions are evoked or presumed. The researcher should review the related literature thoroughly before formulating hypotheses.

All the terms which are used in any hypothesis should be carefully defined. The hypothesis should be unambiguous and testable. Since the quantum of achievement is difficult to predict at the time of statement of hypothesis, researchers prefer 'null hypothesis' which assumes that only a chance difference is expected to occur between the groups. A null hypothesis merely states that there is no relationship between the variables. It is expressed in statistical terms; Xa-Xb=0.

Suppose a researcher observed that Mr.X appeared to have better teacher-student relation that Mr.Y. It was observed that Mr.X used to discuss personal problems of the students and find out their solutions while Mr.Y used to have only formal relationship of classroom teaching. The researcher formulated the following problem.

"What are the effects of discussion of personal problems of the students on the teacher-student relationship"?

The problem statement could be written as substantive hypothesis in the following words;

"The discussion of personal problems of the students will have better teacher-student relationship than not having any such discussion."

This hypothesis can be written as null hypothesis in the following form;

"Discussion of personal problems of the students by the teachers with them and no discussion will have no differential effect upon the teacher-student relationship."

The following criteria should be used for the formulation of testable and significant hypothesis;

a. The hypothesis must be clearly stated in operational terms.
b. The hypothesis must be specific and testable.
c. Research problems should be selected which are directly related to previous research or theoretical formulations.

Procedures:

The fourth part of a research proposal is called procedures. It is also called as 'Methodology' and 'Method of Procedure.'. It comprises of the following;

A. Target Population:

It is also called universe. The salient characteristics of the population should be thoroughly described so that it should be definite that what is the target population for which sample is to be drawn and to which the results of the study could be generalized.

B. Sampling Plan:

The method of sampling should be specified in the research proposal. If the sample is not thoroughly analyzed and precisely described, faulty generalizations may be made. The sample should be made the true representative of the population. The sampling plan should also be described in the proposal. It should describe how the units in the target population will be selected and used. A good sampling plan should meet the following criteria;

a. Obtaining or constructing an accurate, current list of the target population units.
b. Method of drawing the sample.
c. Number of subjects or population units to be selected.

C. Research Design:

The research design should indicate how the research setting will be arranged in order to yield the desired data with the least possible contamination/ error by intervening variables. There is no single design that can be applied in all the cases. It depends upon individual researcher to devise his design. The design should ensure the answer of every hypothesis designed in the proposed research work.

A well prepared research design should contain the following characteristics;

a. Specifications of its relationship to each research hypothesis.
b. Description of the methods of proposed control of confounding variables and threats to validity.
c. Description of the design in statistical terms.
d. Identification of the types of interferences that may be made.

D. Stimulus Materials:

It should also be specified in the research proposal that what stimulus materials will be used in the study. Kinds and ways of stimuli should be described. Most commonly used stimuli are printed instructional materials. Instructional materials should include the following elements;

a. Title
b. Author/Editor
c. Publisher

d. Year of publication
e. Intended population
f. Time required for administration
g. Cost of material

E. Response Measures:

The researcher should specify clearly what raw data are required by the research design and how they will be collected. Each instrument should be described including the following items of information:

a. Title
b. Author/Editor
c. Publisher
d. Population
e. Forms
f. Test Objectives
g. Description of test ,items, scoring procedures
h. Traits represented in score
i. Predictive / Concurrent validity
j. Reliability data
k. Normative data
l. Internal consistency of tests
m. Time required for administration
n. Cost of material
o. Data of publication

F. Data Collection Methods:

The research proposal should identify the schedules and procedures to be used for acquiring the data and recording it accurately. If they are lengthy, they should be placed in an appendix and reference be given in the body of the proposal.

G. Data Analysis:

The researcher should specify how the data will be ordered and reduced to relate directly to the research problem. The statistical procedure to be used in the analysis of data they should be described. It will be done hypothesis wise or not, it should be indicated in the research proposal.

If a complex design or obscure statistical test is to be used, it should be indicated in the proposal.

If the research proposal is to be submitted to a Funding agency, the following information should also be provided in the research proposal;

Logistics: It consists of the following;

a. Time Schedule
b. Personnel
c. Facilities, equipment and supplies
d. Travel expenses
e. Publication costs and other direct costs
f. Budget forms

The researcher should identify the funding agency such as; UGC, ICSSR, NCERT, SCERT, Universities

The researcher should also obtain the research format from the funding agency and prepare research proposal on the guidelines provided by the funding agency.

Organization/Format/Main Body of Report:

a. **Title page:** The title page appears first. It should indicate the subject, data to the report is prepared, for whom prepared and by whom prepared. If the research report is confidential the name of those individuals to receive report should be specified on the title page.
b. **Table of contents:** If the report is lengthy or it is divided into numerous parts, it is usually describe to have table of content. Table of contents list the sequence of topic covered in the report long with page reference. Its purpose is to aid the readers in findings the particular section in report. If the report includes numerous chart, graphs, and figures they should be listed immediately following the table of content by page number.
c. **Management/executive summary**: Most decision maker requires that the research report contains one or two page management summary. Most executives choose to read only this summary. It provides the executives with the key research findings which bear on the decision problem. It contains objective of the research project, conclusion and specific recommendation for action.
d. **Foreword**: This serves to introduce the readers to the research project. It should give background of the problems like how and when it comes to existence, importance of the problem, various dimensional of the problem and whether any previous research was done which is pertinent to the specific project being reported.
e. **Statement of objectives**: The specific objectives of the report need to be set forth clearly. The readers must know exactly what the report covers.
f. **Methodology:** It describes the research procedure.

This includes the following:

a. **Research design:** It can be exploratory or conclusive the researcher should describe the particular design used.
b. **Data collection method:** The researcher must explain the data collection method used. Data can be collected from primary or secondary source with various methods.
c. **Sampling:** It should specify universe, sampling units, sampling size, sampling procedure employed.
d. **Fieldwork:** It should describe fieldwork activities such as description of the number, type of field workers used, how they were selected, trained and supervised and how their work was verified.

e. **Analysis and interpretation:** It should include logically unfolding of information. It requires the organization of the data into a logical flow of information for decision making purposes.
f. **Limitations** every research project has weakness which needs to be communicating in a clear and concise manner. This helps readers to form more accurate interpretations of the result than they would otherwise do.
g. **Findings** Findings are the results of the study. It is an organized narrative of the results. This section makes up the bulk of the report. Summary table and graphics methods of presentation should be used liberally.
h. **Conclusions and recommendations** it must flow logically form the presentations of the findings. Conclusions should clearly link the research findings with the information needs and based on these linkage recommendations for action can be formulated.
i. **Appendix** The purpose of the appendix is to provide a place for material which is not absolutely essential to the body of the report. This material is typically more specialized and complex or too detailed than presented in the main report and it is design to serve the needs of the technically oriented readers. The appendix typically contains the following materials: copies of data collection forms: details of sampling plan; tables not included in findings; bibliography.

Presentation of Diagram:

Diagram refers to charts, graphs or schemes that explain thesis. They are basically pictorial presentation. They facilitate understanding of complex problems. It also facilitates presentation of data that are already collected in time of research objectives. Diagrammatic representation of information has now become a popular way to communicate findings to readers.

Methods of Diagrammatic Presentation:

a. **Bar chart:** It depicts the magnitude of the data by length of various bars which have been laid with reference to horizontal or vertical scale. They can be bilateral or two way which show both positive and negative characteristics of data.
b. **Pie Chart:** It is a circle divided into sections such that the size of each section corresponding to a portion of the total. It permits quick and easy understandings of relative percentage or division of the whole.
c. **Line or Circle or Sector Charts:** It depicts change in quantitative data over time. Bar chart shows only the total amount for a time period only whereas line charts shows variations within each time period. A line chart is preferred over a bar chart in the following situations.

- When the data involves a long time period
- When several series are compared on the same chart
- When emphasis is on the movement rather than the actual amount
- When trends of frequency distribution are presented.

d. **Scatter Diagram:** It is used to examine the relationship between two variables such as price and scales; incomes and expenses; production and cost; manpower and cost; and so on.

e. **Time Series Graphs:** It shows the behavior of some variables overt time.

Construction of Tables:

The research data can be presented in tabular form. A table is systematic method of presenting statistical data in vertical column and horizontal rows. Tables enable the reader to comprehend and interpret masses of data rapidly and to significantly details and relations at a glance. Tabulation involves arrangement of data in the form of tables.

Types of Tables

a. **Simple table:** It is often called marginal table. It consists of a count of the number of response that occurs in each of the data categories that comprise a variable. It is one dimension or Univariate table. It makes no difference how many categories any single variable has. Such tables commonly occur in newspapers, government publications etc.
b. **Two Way or Bi-Variates Table:** It is two dimensional tables with two variables. The variables are interrelated. Table showing the male and female population is an example.
c. **Three-Way Table:** It indicates three mutually related and interlinked attributes of phenomenon. The male category of a population can be classified as poor, middle income and rich. It tells the relation among three variables at a time.
d. **Multiple Tables:** It gives information about four or more mutually related attributes.

13.6 Bibliography:

A bibliography is a list of published works. However, by common use both published and unpublished materials are listed in bibliography. It is added at the end of research report. It is always arranged alphabetically. If the bibliography is extensive, it can be divided into books, periodically, newspaper, reports and public documents.

Rules for preparing bibliography:

For a book with one author - Kotler, P (1998). Marketing management: Analysis, planning, implementation and control. New Delhi: PHI Note:

a. Use surname of the author first followed by middle name or two initials. Use the name of institutions or agency if there is no author name.
b. Place the parenthesis immediately after the name to enter the year of publication.
c. Name the books in italic if computer printed, and use underline if it is typed.
d. Give the place of publication and name of publisher.
e. In case of two or more works by the same author, the author's name is not to be repeated; a short horizontal line followed by a period should take the place of author's name
f. If there are two or more works by one author, arrange them chronologically, most recent last.
g. Use double space between the entries. The second line of an entry should be single spaced.

For a book with two authors- Kotler, P and Armstrong (2005), Principle of marketing, New Delhi

For an edited book - Blois, Keith (Ed.) (2000). The oxford text book of marketing, New York: Oxford University Press Line.

For a corporate or institutional author - Nepal Red Cross (1991). Fire representative training manual. Kathmandu: NRC

For a newspaper article - The Rising Nepal. April 15, 1997. P3. Col4

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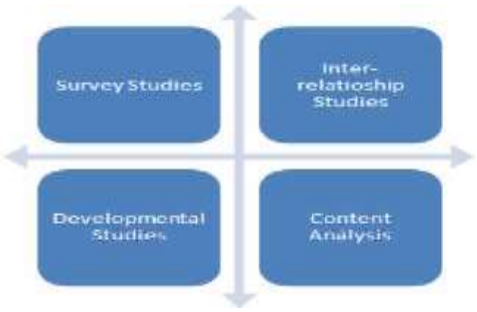
Descriptive method is divided into four parts. They are;



The Survey Studies: They are of following types;

The Inter-relationship Studies are of following types;

The Developmental Studies are of the following types;

The Content Analysis deals with the nature utility and procedure of content analysis. The important problems in this area are as follows;

a. Developing and modifying curriculum.
b. Developing a standardized test in any subject.
c. Differentiating aspects of different writing styles.

13.7 Characteristics of Survey Method:

a. Social survey is confined to the study of specific current problems of society e.g. poverty, unemployment etc.
b. A survey research is planned collection of data for prediction of relations between the variables.
c. Survey is concerned with large or widely dispersed group of peoples contrasted with the lab experiments.
d. Under this method observation, interviews, attitude scales, projective techniques, small scale experiments etc. are used to collect data.
e. The facts collected here may form the basis of further social researches.

Planning a Survey Method:

The following are the steps which are involved in survey methods;

a. Select a problem.
b. Preliminary or pilot study should be done.
c. General and Specific objectives of the study are to be framed.
d. It should be determined that for which of the variables, identified in the problem whether; adequate techniques for data collection are available, and if not then is it possible for the researcher to design them.
e. Population should be identified and representative sample should be selected.
f. Data collection design should be prepared.
g. The data should be collected.
h. The data should be analyzed.
i. The report should be prepared which should have descriptive past, comparative or evaluative past and findings.

Merits of Survey Methods:

a. Direct and close contact between researcher and respondents.
b. Great objectivity.
c. Testing the validity of theories.
d. Formulation and testing of hypothesis.
e. Social surveys are based on actual observation.
f. It has universal application.

Limitations:

a. Survey method is costly, time consuming and wasteful in certain cases where the objectives are limited.
b. The survey method is unsuitable if the numbers of persons to be surveyed are very large or if they spread over a large geographical area.
c. In this method personal bias may vitiate the result.
d. It lacks the flexibility.
e. In this method, it is very difficult to verify the accuracy of the data collection.
f. Only useful for current problems.
g. It does not permit more comprehensive and dynamic study of the society but deals with the problems of immediate importance only.
h. Under this method most of the surveys are conducted on sample basis. If the sample is not carefully planned, inferences drawn may be inaccurate and misleading.

Experimental Method:

It may be defined as the study of the relationships among variables-those manipulated and those measured. It simply enables the researcher to improve the conditions under which the researcher observes and thus to arrive at a more precise results. It enables him to relate a

Pre-test	Independent Variable	Post-test
T1	X	T2

Since there is no control group in this research design it cannot be checked whether the obtained result is due to treatment or extraneous variables.

Design No.2: Two Group, Static Design

Group	Independent Variable	Post-test
Experimental		T2
Control		T2

In this design, the two groups are assigned but neither on the basis of randomization nor matching. There is no pre-test so the researcher cannot measure the difference on account of treatment. In this design, comparison is made on the basis of post-test, in experimental group and control group.

True-Experimental Designs:

In these designs, the researcher attempts to control the effects of history, maturation, testing, measuring instruments etc.

Design No.3: Two groups, Randomized Subject, Post –test only Design

Randomly assigned Group i	Independent Variable	! Post-test
Experimental i		i T2
Control |		i T2

In this design, there is provision of randomization of subjects to the two groups, it assures the equivalence of groups and since there is no provision of pre-test there is probability of interaction effect. However, the use of the designs restricts the external validity of the experiment. There are some situations which do not permit selection of subjects at random.

Design No.4: Two groups, Randomized Matched Subjects, Post-test only Design

Randomly assigned group after matching	Independent Variable	Post-test
Experimental		T2
Control		T2

This design is the most useful where small groups are to be used. In this design the subjects are randomly assigned to two groups after matching, it ensures strengths to design.

But it is very difficult to match the subjects with precision because it reduces the sizes of the sample. In some cases it is not possible to match one or more potential subjects. If some subjects are to be reduced for this purpose, a bias is introduced in the sample.

Design No.5: Randomly groups Pretest, Posttest design

Randomly assigned	Pre- test	Independent Variable	Post test
Experimental group	T1 E	Experimental group	T2 E
Control group	T1 C	Control group	T 2 C

In this design additional check is provided for the equality of Experimental group and control group because there is provision of pretest. The nature of the design is such that it controls most of the extraneous variables. However, the design has certain limitations. Firstly, interaction between pre-test and treatment may sensitize subjects which may affect the results. Secondly, interaction of experimental variable with other factor limits its generalization. Thirdly, experimental procedure may affect normalcy.

Design No.6: The Randomized Solomon Three Group Design

Randomly assigned	Pre-test	Independent Variable	Post -test
Experimental group(E)	T1 E		No Pre-test
Control group 1(C_1)	T1 E		T2 C1
Control group 2 (C_2)	No Pre-test		—1 n

In this design check is provided for the equality of Experimental group and control group because there is provision of pre-test. The nature of the design is such that it controls most of the extraneous variables. The provision of the second control group ensures control interaction effect of Pre-test and treatment.

Design No.7: The Randomized Solomon Four Group Design

Randomly assigned	Pre-test	Independent Variable	Post-test
Experimental group(E)	T1 E		T2 E
Control group 1(Q)	T1 C1		T2 C1
Control group 2 (C_2)	No Pre-test		T2 C2
	No Pre-test		T2 C3

In this stage check is provided for equality of Experimental group and control group, because there is provision of pre-test.

The nature of the design is such that it controls most of the extraneous variables. The provision of the second control ensures control interaction effect of pretest and treatment. The design controls any possible contemporary effects between pre-test and post-test. The result in this design provides greater confidence. However, this design is such that it is difficult to conduct in practical situation. There is a difficulty of statistical application in this design.

Factorial Design:

This design enables the experimenter to evaluate or manipulate two or more experimenter to evaluate or manipulate two or more variables simultaneously in order to study the effects of number of independent factors singly as well as the effects due to interactions with one another. Design No.8: Single Factorial Design of 2 2

There are two independent variables and each of the independent variables has two values. The first independent variable which is manipulated and has two values is called the experimental variable. The second independent variable which is divided into levels may be called control variable. In this design the impact of more than one variable can be studied simultaneously. In this not only the significance of difference of different levels is studied but interaction effect can also be studied. However, if too many variables and too many levels are studied, the experiment and statistical analysis becomes too difficult to manage.

Steps of Experimental Research Methods:

The procedures of the experimental method are to be executed under the following steps;

a. **Identifying, Defining and Delimiting the Problem:** The problem that can be verified or refuted by the experimental data should be selected first. The variables to be investigated are defined in operational terms.
b. **Reviewing the Literature:** After selecting the problem, the related literature and experiments should be reviewed and the method of approach or experimental design to be pursued should be planned or outlined.
c. **Formulating the Hypothesis and Deducing Their Consequences:** The problem has to be converted into a hypothesis that can be verified or refuted by experimental method.
d. **Drawing Up the Experimental Design:** This section should place primary emphasis on the question of control, randomization, replication, place of the experiment, duration of the experiment, selecting or constructing and validating instruments to measure the outcomes of the experiment and conducting pilot for trial run tests to perfect instrument.
e. **Defining the Population:** It is necessary to define the population precisely so that there can be no question about population to which the conclusions are to apply. It may consist of selecting a sample of subjects to represent a given population and pairing of subjects to secure homogeneity.
f. **Administration of Test / Carrying Out the Study:** It is necessary to insist on close adherence to plans and experimental design. This will involve controlling variable or non-experimental factors, applying the experimental factors and keeping the careful record of steps in the procedure.
g. Measuring the outcomes / Collection of Data: Careful consideration must be given to the selection of the criterion on the basis of which the results are measured.
h. **Analyzing and Interpreting the Outcomes:** The result pertaining to the factors under study should be clearly noted. The analysis of data demands expert use of statistical procedures. Only then the analysis becomes the basis for valid interpretation.
i. **Drawing the Conclusions:** The conclusions of the study must be restricted to the population actually covered; care must be taken not to over ganaralize the results. The result also pertains to the conditions under which they were derived. Care must be taken to restrict the conclusions to the conditions actually present in the experiment.
j. **Reporting the Results:** The study must be reported in sufficient details.