One of the basic desires of man is to know of things around him. He wants to understand fully the things of the world. No wonder does a man wish to acquire knowledge by enquiry. He asks so many questions such as why? How? When? He is desirous of finding answers to such questions.

Moreover, in day-to-day life, man confronts numerous problems, for which he wants to find immediate solution. Thus, man asks questions and finds answers. His effort to find answers is the outcome of a man’s thirst for knowledge. This prompts him to find solutions to problems and urges him to do something better or more efficiently.

Such questions and problems crop up from the observation of an event or series of events. Sir Isaac Newton propounded the Law of Gravitation by observing the apples falling from the apple tree. He started asking questions “why do apples regularly fall to the ground instead of floating off into space?” This inquiry led to the discovery of the Law of Gravitation.

Research

The Word ‘Research is derived form the French word, ‘Researcher’ meaning ‘to search back’. A man in his social, economic, educational, political and business life faces many problems.

Definition of research

Some of the important definitions of research by well known authors are given below:

Fred Kerlinger: “Research is an organized enquiry designed and carried out to provide information for solving a problem.”

Francis Rummel: “Research is a careful inquiry of examination to discover new information or relationships and to expand and to verify existing knowledge.”

CHAPTER: 4

“RESEARCH METHODOLOGY”
Robert Ross: “Research is essentially an investigation, a recording and analysis of evidence for the purpose of gaining knowledge.”

According to Professor Glifford Moody, research is a method of discovering truth, through critical thinking. He says, “Research comprises defining and redefining problems; formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and making conclusions; and at last, carefully testing the conclusions to determine whether they fit the formulated hypothesis.” This definition emphasizes three types of research: Firstly, the discovery of facts as in social surveys, secondly the analysis and interpretation of secondary data already collected and finally building up of theory based on primary and secondary data and sometimes on the basis of pure reasoning. In theory building, thinking of the highest order is quite essential; whereas in the survey variety, it is least important. Research of scientific method is nothing but a systematic process and it is composed of several prescribed steps:

- Identification of a research question.
- Formulation of hypothesis or predictions about the question in advance of the study.
- Design of the study to test the hypothesis.
- Observation of variables.
- Examination of relationships between the variables observed and Drawing conclusions about the research questions based on observed relationship.

Classification of Research

Great difficulties beset the classification of research into some universally accepted categories. The distinctions among the different types of studies are not clear-cut; nevertheless the need for formulating appropriate research designs has made the classification of research essential. Different authors have classified research in different ways. One hears different types of research such as action research, descriptive research, exploratory research, historical research, comparative research, theory construction, model building, pure research, applied research, operations research, library research, individual research, group research and so on.
Objectives of the research:

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered yet. Though each research study has its own specific purpose, we may think of research objectives as falling into number of following broad groupings:

- To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formative research studies);
- To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);
- To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);
- To test a hypothesis of a casual relationship between variables (such studies are known as hypothesis-testing research studies).

Present study mainly focuses on the following points to be studied:

- To study the value creation for shareholders in the automobile industry.
- To study the profitability of the companies.
- To study the economic value added of the company.
- To study market value added of the company.

Steps in implementing EVA:

The implementation of EVA is a 4-step process which includes:

(a) measurement
(b) management system
(c) motivation
(d) mindset

(a) Measurement:
Any company that wishes to implement EVA should institutionalize the process of measuring the metric, regularly. This measurement should be carried out after carrying out of the prescribed accounting adjustments.

(b) Management System:

The company should be willing to align its management system to the EVA process. The EVA based management system is the basis on which the company should take decisions related to the choice of strategy, capital allocation, mergers and acquisition, divesting business and goal setting.

(c) Motivation:

The companies should decide to implement EVA only if they are prepared to implement the incentive plan that goes with it. An EVA based incentive system, however, encourages managers to operate in such a way as to maximize the EVA, not just of the operations they oversee but of the company as whole.

(d) Mindset:

The effective implementation of EVA necessitates a change in the culture and mindset of the company. All constituents of the organization need to be taught to focus on one objective-maximizing EVA. This singular focus leaves no room for ambiguity and also it is not difficult for employees to know just what actions of their will create EVA, and what will destroy it.

Types of research:

The basic types of research are as follows:

- **Descriptive vs. Analytical**:

  Descriptive research includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. In social science and business research we quite often use the term *Ex post facto research* for descriptive research studies. The main characteristic of this method is that the researcher has no control over variables; he can only report what is happening. Most *ex post facto studies* also include attempts by researcher to discover causes even when they cannot control the variables. The methods of all kinds, including
comparative and correlational methods. In *analytical research*, on the other hand, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material.

**Applied vs. Fundamental:**

Research can either be applied (or action) research or fundamental (or basic or pure) research. Applied research aims at finding a solution for an immediate problem facing a society or an industrial/business organization, whereas fundamental research is mainly concerned with the formulation of a theory. “Gathering knowledge for knowledge’s sake is termed ‘pure’ or ‘basic’ research. Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research. Similarly, research studies, concerning human behavior, carried on with a view to make generalizations about human behavior, are also examples of fundamental research, but research aimed at certain conclusions (say, a solution) facing a concrete social or business problem is an example of applied research. Research to identify social, economic or political trends that may affect a particular institution or the copy research (research to find out whether certain communications will be read and understood) or the marketing research or evaluation research are examples of applied research. Thus, the certain aim of applied research is to discover a solution for some pressing practical problem, whereas basic research is directed towards finding information that has a broad base of application and thus, adds to the already existing organized body of scientific knowledge.

**Quantitative vs. Qualitative:**

Qualitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behavior (i.e. why people think or do certain things,), we are quite often talk of ‘Motivation Research’, an important type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose. Other techniques of such research are word association tests, sentence completion tests, story completion tests and similar other
projective techniques. Attitude or opinion research i.e., research designed to find out how people feel or what they think about the particular subject or institution is also qualitative research. Qualitative research is specially important in the behavioral sciences where the aim is to discover the underlying motives of human behavior. Through such research we can analyze the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply qualitative research in practice is relatively difficult job and therefore, while doing such research, one should seek guidance from experimental psychologists.

- **Conceptual vs. Empirical:**

Conceptual research is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. One the other hand, empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get at facts firsthand, at their source, and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results. He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth desired information. Such research is thus characterized by the experimenter’s control over the variables under study and his deliberate manipulation of one of them to study its effects. Empirical research is appropriate when proof is sought certain variables in some way. Evidence gathered through experiments or empirical study is today considered to be the most powerful support possible for a given hypothesis.

- **Some other types of research:**

All other types of research are variations of one or more of above stated approaches, based on either the purpose of research, or the time required to accomplish research, or the environment in which research is done, or on the basis of some other similar factor. From the point of view of time, we can think of research either as one-time research or longitudinal research. In the former case the research is confined to a single time-period, where as the letter case the research is carried on over several time periods. Research can be field-
setting research or laboratory research or simulation research, depending upon the environment in which it is to be understood as clinical or diagnostic research. Such research follows case study methods on in depth approaches to reach the basic casual relations. Such studies unusually go deep into the causes of things or events that interest us, using very small samples and very deep probing data gathering service devices. The research may be exploratory or it may be formalized. The objective of exploratory research is the development of hypothesis rather than their testing, where as formalized research studies are those with substantial structure and with specific hypothesis to be tested. Historical research is that which utilizes historical sources like documents, remains etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time. Research can also be classified as conclusion-oriented and decision-oriented. While doing conclusion-oriented research, a researcher is free to pick-up a problem, redesign the inquiry as he proceeds and is conceptualize as he wishes. Decision-oriented research is always for the need of a decision maker and the researcher is in this case is not free to embark upon research according to his own inclination. Operations research is an example of decision oriented research since it is a scientific method of providing executive departments with a quantitative basis for decisions regarding operations under their control.

**Exploratory Study:**

An exploratory study is undertaken when not much is known about the situation at hand, or no information is available on how similar problems or research issues have been solved in the past. In such cases, extensive preliminary work needs to be done to gain familiarity with the phenomena in the situation and understand what is occurring before we develop a model and set up a rigorous design for comprehensive investigation.

Exploratory studies are also necessary when some facts are known, but more information is needed for developing a viable theoretical framework. In sum, exploratory studies are important for obtaining a good grasp of phenomena of interest and advancing knowledge through subsequent theory building and by hypothesis testing.

The research design in the problem is exploratory design. The data are analyzed and based on the data suggestions are given.
Significance of the study:

Research is a foundation of knowledge. Hudson Maxin says, “all progress is born of inquiry. Doubt is better than overconfidence, for it leads to inquiry, and inquiry leads innovation.” which shows the importance of research. Today, the role of research is not limited to any one field, but it is applied in different fields like,

- Economics
- As a base of government policies
- In different industries for decision making
- For solving operation and planning related problems
- In social sciences

Research provides a good guideline for solving problems. For making decisions, for establishing some facts and further more increased amounts of research make progress possible. Research inculcates scientific and inductive thinking and promotes the development of logical habits of thinking.

Identification of research problems

Research may be motivated by the desire to know for the sake of knowing or by the desire to solve practical problems. The researcher, who is associated with practical problems, need not identify problems, since he has many problems on hand. But the research, who is associated with academic institutions, has to identify possible problems for investigation.

In simple words problem means a question thrown forward for solution. A problem exists when an individual interact with his environment and finds himself in an indeterminate situation, or in a state of questioning, doubting or uncertainly.

Problems may be classified as conceptual problems, which can be solved by creative thinking, selection and synthesis, logical problems which are solved by deductive methods and empirical problems, which are solved by inductive reasoning based upon observation of phenomena.
In specific problem-solving research, a research is concerned with application of research methods to find satisfactory solution to a pressing problem. In a business there are numerous problems which need solutions. As resources are limited, it is indispensable to identify only the important problems. In the field of academic research also, the researcher will be able to identify several problems but he can screen them out by preliminary selection.

A problem clearly and accurately stated is a problem that is often well on its way to being solved. Before research or fact finding can successfully start, the investigator must know what he problem is and why a solution is wanted. The ‘what’ of a problem is answered by an accurate definition of the situation? The ‘why’ can be established by the determination of the uses to which the findings will be or can be put?

**Formulation of a Problem**

Formulation of a research problem is translating and transforming the selected problem into a scientific research question. A problem well put is half solved. There are seven factors strengthening such careful formulation.

- Proper formulation of the problem provides a sense of direction to the research;
- Proper formulation specifies the scope of research;
- Proper formulation indicates the limitations of the research;
- Proper formulation clarifies the problem;
- Proper formulation establishes the major assumptions;
- Proper formulation expresses the context of the problem; and
- Proper formulation provides economy in research.

The great scientist Dr. Chandrasekhar, who has written his thesis on “How stars are born and what there are made of,” opined that he worked for his personal satisfaction on things generally outside the scientific mainstream.

It is impossible to set forth any rigid formulation of methods or procedures to be followed by all researchers. The researchers, the research undertakings and the conditions and circumstances are not alike. Therefore, it is not possible to follow a formula or standard procedure in all circumstances.
Statement of problem:

Problem definition is the most important research. Problem definition includes stating the problem and identifying the specific components of research problem. The research can be conducted properly only when research problem has been clearly defined.

“Shareholder value creation in the automobile industry in India”

It is a comparative study of Tata motors and Mahindra and Mahindra Ltd.

Research Design

Research Design is the blue print of the proposed study. It represents the overall scheme of the study. “A research design is a logical and systematic planning and it helps directing a piece of research”.

A research design is a pattern or an outline of a research problem's working. It is a statement of only the essential elements of a study, those that provide the basic guidelines for the details of the problem. It comprises a series of prior decisions that are taken for executing a research problem.

A research design serves as bridge between what has been established. i.e. the research objectives and what is to be done, in conduct of study to realize those objectives. If there were no research design, the researcher would have only foggy notion about is to be done.

In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of the data. As such the design includes an outline of what the researcher will do from writing the research hypothesis and its operational implications to the final analysis of data. More explicitly, the design decisions happen to be in respect of:

✓ What is the study about?
✓ Why is the study being made?
✓ Where will the study be carried out?
✓ What type of data is required?
SHAREHOLDER VALUE CREATION IN THE AUTOMOBILE INDUSTRY IN INDIA

- Where can the required data be found?
- What period of time will the study include?
- What will be the sample design?
- What techniques of data collection will be used?
- How will the data be analyzed?

Keeping in view the above stated design decisions; one may split the overall research design into following parts:

- The sampling design which the method of selecting items to be observed for the given study;
- The observational design which relates to the conditions under which the observations are to be made;
- The statistical design which concerns with the question of how many items are to be observed and how the information and data gathered are to be analyzed;
- The operational design which deals with the techniques by which procedures specified in the sampling, statistical and observational designs can be carried out.

From what has been stated above, we can state the important features of research design as under:

- It is a plan that specifies the sources and types of information relevant to the research problem.
- It is a strategy specifying which approach will be used for gathering and analyzing the data.
- It also includes the time and cost budgets since most studies are done under these two constrains.
In brief, research design must, at least, contain-

1. A clear statement of the research problem;
2. Procedures and techniques to be used for gathering information;
3. The population to be studied; and
4. Methods to be used in processing and analyzing data.

The research design is divided into three broad categories:

- Research design in case of descriptive and diagnostic research studies
- Research design in case of experimental research studies
- Research design in case of exploratory research studies

**Research design in case of descriptive and diagnostic research studies:**

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, where as diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are examples of diagnostic research studies. As against this, studies concern with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category. From the point of view of the research design, the descriptive as well as diagnostic studies share common requirements and such we may group together these two types of research studies. In descriptive as well as in diagnostic studies, the researcher must be able to define clearly, what he wants to measure and must find adequate methods for measuring it along a clear cut definition of ‘population’ he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must take enough provision for protection against bias and must maximize reliability, with due concern for the economical completion of the research study. The design in such studies must be rigid and not flexible and must focus on the following:

- Formulating the objective of the study.
SHAREHODER VALUE CREATION IN THE AUTOMOBILE INDUSTRY IN INDIA

- Designing the methods of data collection.
- Selecting the sample.
- Collecting the data.
- Processing and analyzing the data.
- Reporting the findings.

In descriptive and diagnostic one must consider the points mentioned above.

**Research design in case of experimental (hypotheses-testing) research studies:**

Hypothesis-testing research studies are those where the researcher tests the hypotheses of casual relationship between variables. Such studies required procedures that will not only reduce bias and increase reliability, but will permit drawing inferences about causality. Usually experiments meet this requirement. Hence, when we talk of research design in such studies, we often mean the design of experiments.

Professor R.A. Fisher’s name is associated with experimental designs. Beginning of such designs was made by him when he was working at Rothamsted Experimental Station (Centre for Agricultural research in England). As such the study of experimental designs has its origin in agricultural research. Professor Fisher found that by dividing agricultural fields or plots into different blocks and then by conducting experiments in each of this blocks, whatever information is collected and inferences drawn from them, happens to be more reliable. This facts inspired him to develop certain experimental designs for testing hypotheses concerning scientific investigations. Today, the experimental designs are being used in researches relating to phenomena of several disciplines. Since experimental designs originated in the context of agricultural operations, we still use, though in a technical sense, several terms of agriculture in experimental designs.

**Research design in case of exploratory research studies:**

The present research study is exploratory study. Exploratory research studies are also termed as formulative research studies. The main purpose of such studies is that of formulating problem for more precise investigation or of developing the working hypotheses from an operational point of view. The
major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data. Generally, the following three methods in the context of research design for such studies are talked about:

1. The survey of concerning literature;

2. The experience survey;

3. The analysis of ‘insight-stimulating’ examples.

The survey of concerning literature happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis, hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research. It may also be considered whether the already stated hypotheses suggest new hypothesis. In this way the researcher should review and build upon the work already done by others, but in cases where hypotheses have not yet been formulated, his task is to review the available material for deriving the relevant hypotheses from it.

Besides, the bibliographical survey of studies, already made in one’s area of interest may as well be made by researcher for precisely formulating the problem. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he himself working. Sometimes the works of creative writers also provide a fertile ground for hypothesis-formulation and as such may be looked into by the researcher.

Experience survey means the survey of the people who have had practical experience with the problem to be studied. The object of such a survey is to obtain insight into the relationships between variables and new ideas relating to the research problem. for such a survey people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience. The respondents to ensure a representation of different types of experience. The respondents so selected may then be interviewed by the investigator. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not
previously considered. Generally, the experience-collecting interview is likely to be long and may last for few hours. Hence, it is often considered desirable to send a copy of the questions to be discussed to the respondents well in advance. This will also give an opportunity to the respondents for doing some advance thinking over the various issues involved so that, at the time of interview, they may be able to contribute effectively. Thus, an experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis. This survey may as well provide information about the practical possibilities for doing different types of research.

*Analysis of ‘insight-stimulating’ examples is also a fruitful method suggesting hypotheses for research. It is particularly suitable in areas where there is a little experience to serve as a guide. This method consists of the intensive study of selected instances of the phenomenon in which one interested. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted. Attitude of the investigator, the intensity of the study and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.*

Now, what sort of examples are to be selected and studied? There is no clear cut answer to it. Experience indicates that for particular problems certain types of instances are more appropriate than others. One can mention few examples of ‘insight-stimulating’ cases such as the reactions of strangers, the reactions of marginal individuals, the study of individuals who are in transition from one stage to another, the reactions of individuals from different social strata and the like. In general, cases that provide sharp contrasts or have striking features are considered relatively more useful while adopting this method of hypotheses formulation.

Thus, in exploratory or formulative research study which merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only thing essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise and come to the notice of researcher.
Data collection:

Once we define the research problem and once research design has been planned out the study needs to collect proper data for the same. Mainly there are two types of data: Primary data and Secondary data. The primary data are those which are collected a fresh for the first time, and thus happen to be original in character. The secondary data, on the other hand, are those which have already been collected by someone else and which have already been passed through the statistical process. The researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or more method of data collection. The methods for collecting primary data and secondary data differ since primary data are to be originally collected, while in case of secondary data the nature of data collection work is merely compilation.

Dr. A.L. Bowley says that ‘in collection of statistical data common sense is the chief requisite and experience the chief teacher.’ While selecting the method of data collection a researcher should consider the following factors:

- Nature, scope and object of the inquiry.
- Availability of funds.
- Time factor.
- Precision required.

As far as present study is concern, the main source of data collection is based on secondary data, which is collected through:

- Annual reports published by the companies.
- Financial reports of the firm in the automobile industry.
- Data related to the calculation of shareholder value creation by the companies in the automobile industry.

Hypothesis of the study:

In simple terms, hypothesis means an assumption or some preposition to be proved or disproved. But for a researcher hypothesis is a formal question that
he intends to resolve. Thus a hypothesis may be defined as a proposition or a set of propositions set forth an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts.

Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. In fact, many experiments are carried out without the deliberate object of testing hypothesis on the basis of available information and than take decisions on the basis of such testing.

Thus hypothesis testing enables to make probability statements about population parameter(s). The hypothesis may not be proved absolutely, but in practice it is accepted if it has withstood a critical testing.

Hypothesis should possess the following points:

- Hypothesis should be clear and precise.
- Hypothesis should be capable of being tested.
- Hypothesis should state the relationship between variables.
- Hypothesis should consist established facts.
- Hypothesis should be stated as far as possible in most simple terms.
- Hypothesis should be tested within reasonable time.
- Hypothesis should explain what it claims to explain.

**Null hypothesis and alternative hypothesis:**

If we are to compare method A with method B about its superiority and if we processed on assumption that both methods are equally good, then this assumption is termed as Null hypothesis. As against this, we may think that the method A is superior or method B is inferior, we can then stating what is termed as Alternative hypothesis. The null hypothesis is generally symbolized as Ho and the alternative hypothesis as H1.

For the present study-
H0: There would be no significant difference in the shareholder value creation by the Companies in the automobile industry.

H₁: There would be significant difference in the shareholder value creation by the Companies in the automobile industry.

Procedure for testing hypothesis:

- Null hypothesis and alternative hypothesis:
  Alternating hypothesis is usually the one which one wishes to prove and the Null hypothesis is the one which one wishes to disprove. Thus, a Null hypothesis represents all other possibilities.

- The level of significance:
  It is a very important concept in the context of hypothesis testing. It is always some percentage (usually 5%) which should be chosen with great care, though and reason. The 5 percent level of significance means that researcher is willing to take as much as 5 percent risk in rejecting Null hypothesis (Ho).

Tools of analysis:

(A) Economic Value Added Statement:

Economic value Added is a basic and important measurement to judge the performance of the enterprise. It can be prepared by subtracting the weighted average cost of capital from the NOPAT.

(B) Statistical techniques:

- T-test:
  t-test is based on t-distribution and is considered an appropriate test for judging the significance of a sample mean or for judging the significance of the difference between the means of two samples in case of small sample(s). When population variance is not known (in which case we use variance of the sample as an estimate
of the population variance). In case two samples are related, we use paired t-test (what is known as difference test) for judging the significance of the mean difference between two related samples.

**t-test: paired for two sample for means**: This analysis for tool and its formula a paired two sample student’s t-test to determine whether a sample’s mean are distinct. This t-test form does not assume that the variances of both populations are equal. You can use a paired test when there is a natural pairing of observations in the samples, such as when sample group is tested twice-before and after an experiment. The statistical hypothesis for the “t” test is stated as Null hypothesis concerning differences. There is no significant difference in achievement between group 1 and group 2 on the welding test.

\[
t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}
\]

\[
t = \frac{\text{difference between means}}{\text{variance} \over \text{sample size}}
\]

Where, \( \bar{x}_1 \) = mean of sample 1

\( \bar{x}_2 \) = mean of sample 2

\( n_1 \) = number of subjects in sample 1

\( n_2 \) = number of subjects in sample 2

\[
s_1^2 = \frac{e(X_1 - \bar{x}_1)}{n_1}
\]

\[
s_2^2 = \frac{e(X_2 - \bar{x}_2)}{n_2}
\]
• Mean (u) or (X) Arithmetical mean:
  A number having an intermediate value between several other numbers in a group from which it was derived and of which it expressed the average value. It is the simple average formed by adding the numbers together and dividing by the number of numbers in the group.

\[
\bar{x} = \frac{\sum x}{n}
\]

• Beta:

Beta measure the systematic risk, it shows how prices of securities respond to the market forces. Beta is calculated by relating the return on a security with return for market. Market will have beta1. If beta is greater than 1 the stock is said to be riskier than market and vice-versa. If the value of beta is zero then the risk is same as of the market. Negative beta is rare.

• Karl Pearson’s correlation coefficient:
  Karl Pearson’s coefficient of correlation is the best measure for representing the relationship between the two variables. The degree and direction of relationship between the variables can be obtained by it. Karl Pearson is the most accurate and it is very widely used. By this method the amount of relationship between two variables can be numerically measured. The formula for finding out correlation coefficient is-

\[
r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}
\]
Limitations of the study:

The major limitations of the study are as followings:

- The study is undertaken for a particular period of time. So findings can not be applicable for a very long period of time.

- The data is taken from the secondary source and hence it is taken to be the authenticate resource.

- The data taken for analysis may affect the results of the study.

- Limitations of correlation might affect the results of the study.

- Statistical tests have their own limitation which might affect the conclusions.
The role of computer in research work:

At present computers are widely used for different purposes. Performing calculations almost at the speed of light, the computer has become one of the most useful research tools in the modern times. Computers are ideally suited for data analysis concerning large research projects. Researchers are essentially concerned with huge storage of data, their faster retrieval when required and processing of data with the aid of various techniques. In all this operations, computers are of great help. Their use, apart expediting the research work, has reduced human drudgery and added to the quality of research actively. Researchers in economic and other social sciences have found, by now, electronic computers to constitute an indispensable part of their research equipment. The computers can perform many statistical calculations easily and quickly. Computation of means, standard deviations, correlation coefficients, t-tests, analysis of variance, analysis of covariance, multiple regression, factor analysis and various nonparametric analysis are just a few of programs and subprograms that are available at almost all computer centers. Similarly canned programs for linear programming, multivariate analysis, monte carlo simulation etc.. are also available in the market. In brief, software packages are readily available for the various simple and complicated analytical and quantitative techniques of which researcher generally make use of. The only work a researcher has to do is to feed in the data he/she gathered after loading the operating system and particular software package on the computer. The output or to say the result, will be ready within the seconds or minutes depending upon the quantum of the work.

Techniques involving trial and error process are quite frequently employed in research methodology. This involves lot of calculations and work of repetitive nature. Computer is the best suited for such techniques, thus reducing the drudgery of researchers on the one hand and producing the final result rapidly on the other. Thus, different scenarios are made available to researchers by computers in to time which otherwise might have taken days or even months.

The storage facility which the computers provide is of immense help to a researcher for he can make use of stored up data whenever he requires doing so.

Thus, computers do facilitate the research work. Innumerable data can be processed and analyzed with greater ease and speed. Moreover, the results obtained are generally correct and reliable. Not only this, even the design, pictorial graphing and report are being developed with the help of computers. Hence, researchers should be given computer education and be trained in the
line so that they can use computers for their research work but, one need to be aware about the limitations of computer-based analysis:

- Computerized analysis requires setting up of an elaborate system of monitoring, collection and feeding of data. All these require time, effort and money. Hence, computer based analysis may not prove economical in case of small projects.

- Various items of detail which are not being specifically fed to computer may get lost of sight.

- The computer does not think; it can only execute the instructions of a thinking person. If poor data or faulty programs are introduced into the computer, the data analysis would not be worthwhile.

But, the above mention limitations do not reduce the importance of the computer in research study. Even though it obviously has some limitations but, undoubtedly today, educational, commercial, industrial, administrative, transport, medical, social, financial and several other organizations are increasingly depending upon the help of computers to some degree or the other.