

**“MAA” OMWATI COLLEGE OF EDUCATION
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Notes

B.P.Ed.- Semester-3rd (2021-22)
RESEARCH AND STATISTICS IN PHYSICAL
EDUCATION

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BPET-112
RESEARCH AND STATISTICS IN PHYSICAL EDUCATION

UNIT-1

Introduction: Research is the process of finding solutions to a problem after a thorough study and analysis of the situational factors. In simple word research is to find our something again and again.

Meaning of Research: Research is the process of Process of collecting/gathering data and information by a scientific or logical procedure that aims to solve a particular scientific problem. The word Research is derived From the Middle French "*recherche*", which means "to go about seeking", the term itself being derived from the Old French term "*recerchier*" a compound word from "re-" + "cerchier", or "sercher", meaning 'search'. In simple we may say that it is from the French word "**CERCHIER**" meaning "**to seek or to search.**" Research is an attempt to solve or gain a solution to a problem.

Definition of Research

- According to V. Redman and A.V.H. Mory,** "*Research is a systematized effort to gain new knowledge.*"
- According to Robert Ross,** "Research is essentially an investigation, a recording and an analysis of evidence for the purpose of gaining knowledge."
- According to James Harvey Robinson,** "Research is but diligent search which enjoys the high flavour or primitive hunting."

- **According to Payton (1979)**, “Research is the process of looking for a specific question in an organized, objective, reliable way.”
- **According to Longman Dictionary of contemporary English (1997)**, “Research as a serious study of a subject that is intended to discover new facts or test ideas.”

Need and importance of Research in Physical Education and Sports

- **Enhances knowledge:** When you research any topic, you get to know detailed information about that topic. The more the knowledge of the topic, the more successful is the research. So, in order to get good output, the student needs to do maximum research.
- **Clarifies confusion:** The research helps in clarifying the complicated facts and figures. If the student has any doubt on the subject, the student must research and study it in detail so as to remove all sorts of confusion and get a proper understanding of the content.
- **To have a proper understanding of the subject:** To understand the subject, one needs to go in depth of the lines. The scanning of the content will never do any good for the students. In order to learn the subject and to know the unknown facts, research, detail study, and full analysis are the must.
- **To learn about the methods and issues:** Proper reading, the finding is the only way by which you can learn about the methods and the current issues. Not just the current issues, rather the previous past issues can also learn in detail through the research. The research includes various methods by which it can be done.
- **Understand the published work:** Research is done through the work already published. The experts and the researchers had already done some of the research and the students are asked to go through that published material to understand the idea and the vision of those researchers.
- **Learn to create a balance between collaborative and individual work:** When the students do research, they get to know how to create a balance between the collaborative and the individual work. Individual work in which the student has to do, while the collaborative work means that work which has already been done by the previous researchers. So, in this manner, the students get to know which points to take into consideration and which points are to be ignored.
- **To know the interest:** The students also get to know their area of interest. Sometimes, the students aspire to become researchers only in their near future which is quite helpful. So, through this, we come to know that the research not only helps with the accomplishment of the work but also helps in understanding what needs to be done in their future.
- **To know how the original study originated:** Research is performed to understand the concept from scratch. Like, if you wish to know from where the concept has originated, then this could be done only through the research work. It can also define as an investigation because the student eventually ends up with expanded research.
- **Understanding the rationale:** By engaging in the process of research, the students

understand the concept in an easier manner as the rationale of the topic knows in a better manner. For example, by preparing the hypothesis, one truly understands the nuances of the research topic. Not just this, the research also helps in being a source of one on mentorship which also plays a vital role in the brain development of the individual.

- **Helps in understanding society:** When one does some research related to society, the human becomes aware and also alert of the good and bad things. In order to know society's norms, policies, code of conduct, one needs to do proper research or it may become difficult to survive in society.
- **Helps in knowing the culture:** Every society has its own culture. In order to understand the culture of a particular society, research about that society needed. If you do not do research or read maximum about any topic, you will fail to know the hidden meanings and the concepts about society's culture and will remain unaware of the same. So, if you are curious to know and learn something new, then the research work will help.
- **For making the right choices for a career:** Research needed in all fields, i.e. it is pervasive. For even the smallest information, one needs to research and understand. For example, if you need to know about careers with greater scope overseas, you will have to research that too. So, this way research is of great importance to everyone, be it a student, a traveler, teacher, professor, researcher himself.
- **Knowing the truth:** If you wish to know the truth about anything like reading, learning, and research is the only way. When you read and research on any topic, you get to know the truth. The real facts and statistics come across which enlightens the person and also increases one's knowledge.
- **Update about the technology:** If there comes any new technology, the human gets to know about that also through the research work. So, basic research is helpful to humans to know what new is coming in the market. Also, it helps in being updated about the present scenario of the society one is living in.
- **Differences between good and bad:** When a person reads the already published material, it builds trust and also enlightens one's mind. The person is able to differentiate between right and wrong which further helps in the decision making process. So, above are the reasons which say why one should do research or what is the importance of research. It is for the whole of mankind, which involves individuals from every group and age. Whatever an individual reads, it somewhere and at some time surely helps as it gets accumulated in the knowledge bank of an individual.
- **It is a systematic analysis:** In education, research is essential as it gives a systematic analysis of the topic. Also, the objectives clearly defined in the research process. One needs to study in a systematic and controlled manner, and this is exactly what the research work provides an individual.
- **Leads to great observations:** In the field of education, the research helps in coming to one conclusion. That conclusion can achieve by observing the facts and figures in depth. So, such in depth knowledge is provided by following various research methods only. In this way, research also assists in leading to greater observations.
- **Results in predictions, theories, and many principles:** The researchers come up with valid predictions, theories, and great results through the observations, hypothesis and research queries. So, this way also helps researchers to come up with great conclusions.

- **Improving practices:** The educational research is important for the students to improve practices and at the same time, it helps in improving those individuals who really wish to bring improvement in those practices. So, this way educational research helps in the overall improvement of the individual. Be it a student or any teacher who is researching on some topic, it is of great help to them. It acts as a lighthouse and empowers the individual.
- **Develops new understanding related to the learning, teaching, etc:** The educators benefited through various research as it helps them in having a better understanding of the subject. Along with this, it develops greater understanding related to teaching, learning and other educational administration. The new knowledge further helps in improving the educational practices of the teachers and professors.

- **Helps in initiating the action:** The research you do should result in performing some action or practice. So, the research should aim to produce the highest result which compliments the study. Also, you should make sure your study ensures the applicable findings so as to match the result. Research helps in performing well and also sheds away all the problems. This way, you are able to understand the role of research which further helps in the decision making process.
- **Helps in decision making:** Good research requires proper time and effort. It prepares the person for taking essential decisions which further necessitates the same from all the participants involved in the process. For better results, the participants need to consider the required consequences and all the risks involved in the whole process.
- **Brings consistency in the work:** When the work is done with full in-depth analysis, it tends to be right and accurate. The process of research help brings consistency in the work, which lessens the flaws and mistakes in the final outcome of the process. The consistency needed in all sorts of work or you might have to end up getting the wrong and inaccurate result. The research takes lots of time and effort, so the researcher has to be specific and sure with the facts so that the end result is clean and without any silly mistakes.
- **Motivates others:** Educational research builds patience because it is a lengthy process. In order to get fruitful results, you need to build patience and only then you will be able to motivate others.

Nature and general Characteristics of Research:

The nature of research is as follows‘

1. Research is always systematic. This implies that the procedure adopted to undertake an investigation follow a certain logical sequence. The different steps cannot be taken in a haphazard way. Some procedures must follow others.
2. It is controlled process. The researcher controlled each and every aspect
3. It strives to be objective and logical, applying every possible test, to validate the procedure employed, the data collected and the conclusion reached.
4. It Emphasizes the development of generalization, principles of theories, that will be helpful in predicting future occurrences.
5. It is sometimes that requires courage
6. It is based upon observable experience.
7. It is carefully recorded and reported.
8. Research requires expertise; the researcher knows what is already known, about the problem and how others have investigated it.
9. Research involves gathering new data from primary sources or using existing data for the new purpose.

10. Research is patient and unhurried activity.

Classification of Research

The classification is as follows

1. Fundamental or basic research: Basic research is an investigation on basic principles and reasons for occurrence of a particular event or process or phenomenon. It is also called theoretical research. Study or investigations of some natural phenomenon or relating to pure science are termed as basic research. Basic researches sometimes may not lead to immediate use or application. It is not concerned with solving any practical problems of immediate interest. But it is original or basic in character. It provides a systematic and deep insight into a problem and facilitates extraction of scientific and logical explanation and conclusion on it. It helps build new frontiers of knowledge. The outcomes of basic research form the basis for many applied research.

Basic research

- Seeks generalization
- Aims at basic processes
- Attempts to explain why things happen
- Tries to get all the facts
- Reports in technical language of the topic

2. Applied research: In an applied research one solves certain problems employing well known and accepted theories and principles. Most of the experimental research, case studies and interdisciplinary research are essentially applied research. Applied research is helpful for basic research. A research, the outcome of which has immediate application is also termed as applied research. Such a research is of practical use to current activity.

Applied research

- Studies individual or specific cases without the objective to generalize
- Aims at any variable which makes the desired difference
- Tries to say how things can be changed
- Tries to correct the facts which are problematic
- Reports in common language

Basic and applied research, further divided into three types of research bearing some characteristics feature as follows:

1. Quantitative research

- It is numerical, non-descriptive, applies statistics or mathematics and uses numbers.
- It is an iterative process whereby evidence is evaluated.
- The results are often presented in tables and graphs.
- It is conclusive.
- It investigates the what, where and when of decision making.

2. Qualitative research

- It is non-numerical, descriptive, applies reasoning and uses words.
- Its aim is to get the meaning, feeling and describe the situation.
- Qualitative data cannot be graphed.

- It is exploratory.
 - It investigates the why and how of decision making.
3. **Mixed research:** Research that involves the mixing of quantitative and qualitative methods or paradigm characteristics. Nature of data is mixture of variables, words and images.

Other types of research

1. **Exploratory Research:** Exploratory research might involve a literature search or conducting focus group interviews. The exploration of new phenomena in this way may help the researcher's need for better understanding, may test the feasibility of a more extensive study, or determine the best methods to be used in a subsequent study. For these reasons, exploratory research is broad in focus and rarely provides definite answers to specific research issues. The objective of exploratory research is to identify key issues and key variables.
2. **Descriptive research:** The descriptive research is directed toward studying "what" and how many off this "what". Thus, it is directed toward answering questions such as, "What is this?"
3. **Explanatory research**
 - Its primary goal is to understand or to explain relationships.
 - It uses correlations to study relationships between dimensions or characteristics off individuals, groups, situations, or events.
 - Explanatory research explains (How the parts of a phenomenon are related to each other).
 - Explanatory research asks the "Why" question.
4. **Longitudinal Research:** Research carried out longitudinally involves data collection at multiple points in time. Longitudinal studies may take the form of:
 - Trend study- looks at population characteristics over time, e.g. organizational absenteeism rates during the course of a year
 - Cohort study- traces a sub-population over time, e.g. absenteeism rates for the sales department;
 - Panel study- traces the same sample over time, e.g. graduate career tracks over the period 1990 – 2000 for the same starting cohort.
5. **Cross-sectional Research:** While longitudinal studies will often be more time consuming and expensive than cross-sectional studies, they are more likely to identify causal relationships between variables. One-shot or cross-sectional studies are those in which data is gathered once, during a period of days, weeks or months. Many cross-sectional studies are exploratory or descriptive in purpose. They are designed to look at how things are now, without any sense of whether there is a history or trend at work.
6. **Action research:** Fact findings to improve the quality of action in the social world

3. Research Problem

Introduction: In simple word research problem is the area or topic in which students want to investigate. A research problem indicates a need for its meaningful investigation. It doesn't state how to do something and a researcher shouldn't present a value question or offer a broad research proposal. A research problem is a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in scholarly literature.

The purpose of a problem statement is to:

1. Introduce the reader to the importance of the topic being studied. The reader is oriented to the significance of the study and the research questions or hypotheses to follow.
2. Places the problem into a particular context that defines the parameters of what is to be investigated.
3. Provides the framework for reporting the results and indicates what is probably necessary to conduct the study and explain how the findings will present this information.

Location and criteria of Selection of Problem: A criterion for selection of research problem depends on the following characteristics.

- Personal Inclination:** The chief motivation in the way of selecting research problem is the personal inclination of the researcher. If a researcher has personal interest in the topic, he would select that problem for his research work.
- Resources Availability:** During the selection, a researcher will see to the resources available. If these resources like money, time, accommodation and transport are available to the selection place, then the selection of the problem is easy.
- Relative Importance:** The importance and the problem also play a vital role in the selection of research problem. If the problem is relatively important, then the researcher tends towards the selection of the problem.
- Researcher Knowledge:** The researcher knowledge should play a vital role in the selection of the research problem. The wisdom and experience of an investigator is required for well collection of the research data. He can bitterly select a problem.
- Practicality:** Practicality is also responsible for the selection. The practical usefulness of the problem is the main motivation for a researcher to attend it.
- Time-lines of the Problem.** Some problems take little time for its solution while others take more time. So, it depends on the time in which we have to complete his research work.
- Data Availability:** If the desired data is available to the researcher, then the problem would be selected.
- Urgency:** Urgency is a pinpoint in the way of the selection of research problem. Urgent problem must be given priority because the immediate solution can benefit the people.
- Feasibility:** Feasibility is also an important factor for the selection of the research problem. The researcher qualification, training and experience should match the problem.
- Area Culture:** The culture of the area for which a researcher conducts his research is also responsible for the selection of research problem.

Characteristic of Research Problem: Any research is a difficult task to achieve and research needs to do a great effort. Selection of research topic is the first step to success.

- Research topic must be very clear and easy to understand. It should not distract people.
- If a topic is well defined is the only way to successful research. The topic should not create doubt and double impression.

- Easy language is a key to success. Use technical words if necessary otherwise focus of simplicity.
- Research title should be according to the rules of titling. There are different rules of titling, a researcher must aware before writing a research title.
- While selecting a research topic current importance of a researcher should also be considered. Topic should not be obsolete and it should have great importance in the current day.
- Reflecting on important issues or needs;
- Basing on factual evidence (it's non-hypothetical);
- Being manageable and relevant;
- Suggesting a testable and meaningful hypothesis (avoiding useless answers).

Formulation of a Research Problem: Formulating your research problem enables you to make a purpose of your study clear to yourself and target readers. Focus your paper on providing relevant data to address it. A problem statement is an effective and essential tool to keep you on track with research and evaluate it. How can you formulate a powerful research problem?

Consider 5 ways to formulate the research problem:

- **Specify your research objectives:** A clear statement that defines all objectives can help you conduct and develop effective and meaningful research. They should be manageable to bring you success. A few goals will help you keep your study relevant. This statement also helps professors evaluation the questions your research project answers and different methods that you use to address them.
- **Review its context or environment:** It's necessary to work hard to define and test all kinds of environmental variables to make your project successful. Why do you need to do that? This step can help you define if the important findings of your study will deliver enough data to be worth considering. Identify specific environmental variables that may potentially affect your research and start formulating effective methods to control all of them.
- **Explore its nature:** Research problems may range from simple to complex, and everything depends on a range of variables and their relationships. Some of them can be directly relevant to specific research questions, while others are completely unimportant for your project. Why should you understand their nature? This knowledge enables you to develop effective solutions. To get a deep understanding of all dimensions, think about focus groups and other relevant details to provide the necessary insight into a particular question.
- **Determine variable relationships:** Scientific, social, and other studies often focus on creating a certain sequence of repeating behaviors over time. What does your project entail? Completing the entire process involves:
 - Identifying the variables that affect possible solutions to your research problem;
 - Deciding on the degree to which you can use and control all of them for study purposes;
 - Determining functional relationships between existing variables;
 - Choose the most critical variables for a solution of your research problem.

During the formulation stage, it's necessary to consider and generate as many potential approaches and variable relationships as you can.

- **Anticipate the possible consequences of alternative approaches:** There are different consequences that each course of action or approach can bring, and that's why you need

to anticipate them. Why communicate possible outcomes? It's a primary goal of any research process.

Research Proposal

Introduction: Most students and beginning researchers do not fully understand what a research proposal means, nor do they understand its importance. A high quality proposal not only promises success for the project, but also impresses the Thesis Jury about the student's potential as a researcher. A research proposal is intended to convince others that the student has a worthwhile research project and that s/he has the competence and the work-plan to complete it. Generally, a research proposal should contain all the key elements involved in the research process. The proposal should have sufficient information to argue that the student has an important research idea, that s/he has a good grasp of the relevant literature and the major issues, and that the methodology is sound. The research proposal provides a coherent and concise outline of the intended research. This allows students to assess the originality of the proposed topic.

Meaning: A research proposal is a document proposing a research project, generally in the sciences or academia, and generally constitutes a request for sponsorship of that research. Proposals are evaluated on the cost and potential impact of the proposed research, and on the soundness of the proposed plan for carrying it out. A research proposal is intended to convince others that the student has a worthwhile research project and that s/he has the competence and the work-plan to complete it.

Significance of a Research proposal: The **research proposal** is a complex task that requires an understanding of multiple skills. The paper aims to deliver a brief overview of the research you will conduct. The research proposal example explains the main reasons why your research will be useful to the reader and to society in general. A research proposal is a document of usually ten to fifteen pages that informs others of a proposed piece of research. A reason to get the proposal right is that this can save the student time in the long run. Proposals are informative and persuasive writing because they attempt to convince the reader to do something. The goal of the student is not only to persuade the reader to do what is being requested, but also to make the reader believe that the solution is practical and appropriate. Generally speaking, the proposal must assist with the identification of the following:

- The most important is that it helps you to think out the research project you are about to undertake and predict any difficulties that might arise.
- For those who aren't quite sure what their focus will be, the research proposal can be a space to explore options -- perhaps with one proposal for each potential topic(which can then be more easily compared and evaluated than when they are still just ideas in one's head).
- Research proposals can be effective starting places to discuss projects with your professors, too
- A professor who is initially skeptical about a project may be able to imagine it more easily after reading a well written research proposal (this doesn't mean he or she will

approve the topic, especially if there are significant potential difficulties that you haven't considered)

- Once you have begun your research project, a research proposal can help you to remain on track -- and can also remind you why you started this project in the first place!
- Researchers very often begin to lose heart about two thirds of the way into a project when their research hits a snag or when they are having problems developing a thesis, organizing the ideas, or actually starting to write.
- Rereading the initial research proposal, especially "Significance" can reenergize the project or help the researcher to refocus in an effective manner.
- It helps in proper evaluation of the worth, value and feasibility of the proposed research study. – It may provide the following kinds of information about the research study (Gravetter & Forza): – What will be done? – What may be found? – How the planned research study is related to other knowledge in the area?

Sections or Components of a Research Proposal

- **Title page:** Give your project a working title, which may or may not change.
- **Statement of Purpose:** Explain what you hope your research will find or show. State your research question or a series of research questions that you hope to answer.
- **Background:** Explain your interest in an experience with this topic. Describe any previous research you have conducted on this or related topics, any classes you have

taken on this or related topics or any reading you have done in the field. If you have personal experience that has led to you want to do more research, describe that here.

- Significance:** Explain why this topic is worth considering or why this question or series of questions is worth answering. What do you hope to learn from it? How or what will you contribute to the field of knowledge that exists on this topic? What new perspective will you bring? What use might your final paper be for others in the field or in the general public? With whom might you share your findings once the project is complete?
- Methodology:** Describe the kind of research you will conduct this project (library research, internet re-search, interviews, observations, ethnographies, etc.). Explain how you will conduct your research in as much detail as possible. If you will consult other sources (such as a statistician, an ethnographer, or a librarian) explain what role they will serve and how you hope they will enhance your development of an appropriate methodology for this project. Discuss the kinds of sources you hope to consult and the methods you will use to extract and process the information you gather in as much detail as possible. Once the project is underway, you might find you need to revise your methodology or adopt new methods of gathering and processing data.
- Problems:** Describe problems you expect to encounter and how you hope to solve them. For example, texts might be unavailable, necessitating travel to other libraries or use of inter-library loan facilities; the time frame may limit the amount of research or the quality or specificity of research you are able to do; people you had hoped to interview might be unavailable or unwilling to participate. Try to anticipate every major problem and make contingency plans so that the project doesn't become derailed.
- Bibliography:** Make a list of texts you plan to consult. You may modify this list as you conduct your research.

Research Proposal Tips

- Contextualize your research question within literature in your field. Tie your research to major questions in your field.
- Limit the boundaries of your research question so that it is not too broad.
- Cite landmark studies in your field.
- Reference theoretical and empirical contributions of others researchers.
- Develop a coherent and persuasive argument for the proposed research.
- Follow specific proposal guidelines
- Consult professors and other students in your field.
- Proofread

Preparation of Research proposal

- Determine a general topic:** The first step in writing a convincing academic research proposal is to identify a general study topic or subject area to investigate. Usually, this is the easiest step because your research proposal will be tied to the general theme of the course.
- Perform a literature review on the topic:** You should read as much literature on the general topic as possible. Make notes and summarize the purpose and findings of each study relevant to the topic of the eventual research proposal.

- **Identify a gap in the literature:** The purpose of conducting a literature review is to find out what studies have already been done on the subject of your research proposal and then to identify any obvious gaps in the literature. Completing an in-depth literature review will open up new opportunities for you to add to the existing body of knowledge within the general subject area.
- **Identify a problem and frame a purpose statement:** Identify a problem related to the gap in the literature and frame a purpose statement. You should explain why you are investigating this topic, what you propose to do, and why others should be interested in your research.
- **Write an introduction:** The introduction to the proposal should include:
 - A problem statement
 - A brief summary of the literature
 - A concise description of the gap in the literature
 - A purpose statement
- **Determine research hypotheses and/or research questions:** Next, you should craft carefully defined research hypotheses and/or research questions for your study. Research hypotheses determine what you are going to investigate and what you expect to find in your research study.
- **Determine the method of investigation:** The methods section is a very important part of the research proposal. In your methods section, you should outline the procedures you will follow to complete the study you propose. The methods section generally includes:
 - An explanation of the research design
 - Sample size and characteristics of the proposed sample
 - Data collection and analysis procedures
- **Determine the research design:** Outline the research design of your academic research proposal. You should describe two or three possible alternatives for each part of the design.
- **Determine the sample size and the characteristics of the sample:** In this section of your academic paper, you will describe the sample size of your study and the characteristics of the participants in the sample.
- **Determine the data collection and analysis procedures:** In this section, describe how you are going to collect your data. Explain the scheme of analyzing the collected data and reporting the results.

Parts of the Research Proposal: Academic research proposals generally follow a similar research proposal format, but there are some variations. The following outline includes the primary components of a research proposal. Your research proposal will be a variation of the following basic structure.

1. Title Page
2. Abstract
3. Table of Contents
4. Introduction (including Statement of Problem, Purpose of Research, and Significance of Research)

5. Background (including Literature Survey)
6. Description of Proposed Research (including Methods or Approach)
7. Description of Relevant Institutional Resources
8. List of References
9. Personnel
10. Budget

3. Survey of Related Literature

Meaning of Related Literature: Literature means "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed." A review of related literature is the process of collecting, selecting, and reading books, journals, reports, abstracts, and other reference materials. A literature review is a survey of scholarly sources (such as books, journal articles, and theses) related to a specific topic or research question. The following information may be collected:

- It is often written as part of a thesis, dissertation, or research paper, in order to situate your work in relation to existing knowledge. There are several reasons to conduct a literature review at the beginning of a research project: To familiarize yourself with the current state of knowledge on your topic
- To ensure that you're not just repeating what others have already done
- To identify gaps in knowledge and unresolved problems that your research can address
- To develop your theoretical framework and methodology
- To provide an overview of the key findings and debates on the topic
- Background information about the problem and related concepts.
- Theories that explain the existence of the problem and the possible connection between certain factors and the problem
- Data that confirms the existence and seriousness of the problem
- General and specific findings of studies related to the problem
- Recommendations for further study given in related studies

Writing the literature review shows your reader how your work relates to existing research and what new insights it will contribute.

Definitions of Literature and Review Literature: A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. Also, a literature review can be interpreted as a review of an abstract accomplishment.

- According to Wikipedia,** "Literature may consist of texts based on factual information (journalistic or non-fiction), as well as on original imagination, such as polemical works as well as autobiography, and reflective essays as well as belles-lettres. Literature can be classified according to historical periods, genres, and political influences".
- According to Galvan (2005),** literature review is "a process of finding the sources of relevant material for particular topic or subject."
- According to Lawrence & McEvoy (2008),** literature means "it is an evidence based review of relevant reference material."

Need and importance for surveying related literature: It is important for a researcher to have a comprehensive and relevant body of supporting materials to his research work. The related literature and studies are needed for the following reasons:

- It provides insight into the theoretical/conceptual background of the study.
- It provides the rationale of the framework of the study. The theoretical framework for instance, is obtained or conceived through the literature search.
- Reviewing related materials helps the researcher to gather valuable data and ideas that can guide him in his own research.
- It Helps You Avoid Incidental Plagiarism
- It Sharpens Your Research Focus
- Provide foundation of knowledge on topic
- Identify areas of prior scholarship to prevent duplication and give credit to other researchers
- Identify inconstancies: gaps in research, conflicts in previous studies, open questions left from other research
- Identify need for additional research (justifying your research)
- Identify the relationship of works in context of its contribution to the topic and to other works
- Place your own research within the context of existing literature making a case for why further study is needed.
- Researcher can know the special finding from the related literature of his/her research topic.
- The study of literature review is drawn the researcher towards the meaningful correction of his/her research work.
- Researcher can develop his/her own beliefs and thoughts through the study of related literature regarding his/her topic.
- Researcher would be aware with the fact that, what are the different steps taken for the

problem and what are the steps and efforts to be taken and what was the result.

- It can save the time and energy with giving authentication of the information which was retrieved with such genuine effort.
- Researcher can know the sources through which the prior research work was done. Researcher can find the perfect information that from which method of gathering information which type of information Researcher can get from the resources of finding facts like questionnaire, personal interview, observation etc.
- From the study of prior research work or literature review Researcher got such useful thoughts, methods, definitions and ideas for our present research.
- Researcher can find that which method and ideas would be fruitful for the present research
- Researcher can know the errors and special facts of the related literature
- Researcher can find new method of theory of work which was founded earlier by someone which may be useful to our research and can help to do our work in proper way.

Literature Sources

- **Books:** books tend to be less up-to-date as it takes longer for a book to be published than for a journal article. Text books are unlikely to be useful for including in your literature review as they are intended for teaching, not for research, but they do offer a good starting point from which to find more detailed sources.
- **Journal articles:** these are good especially for up-to-date information. Bear in mind, though, that it can take up to two years to publish articles. They are frequently used in literature reviews because they offer a relatively concise, up-to-date format for research, and because all reputable journals are refereed (i.e. editors publish only the most relevant and reliable research).
- **Conference proceedings:** these can be useful in providing the latest research, or research that has not been published. They are also helpful in providing information on which people are currently involved in which research areas, and so can be helpful in tracking down other work by the same researchers.
- **Internet:** the fastest-growing source of information is on the Internet. It is impossible to characterize the information available but here are some hints about using electronic sources: 1) bear in mind that anyone can post information on the Internet so the quality may not be reliable, 2) the information you find may be intended for a general audience and so not be suitable for inclusion in your literature review (information for a general audience is usually less detailed) and 3) more and more refereed electronic journals (e-journals) are appearing on the Internet - if they are refereed it means that there is an editorial board that evaluates the work before publishing it in their e-journal, so the quality should be more reliable (depending on the reputation of the journal).
- **Government/corporate reports:** many government departments and corporations commission or carry out research. Their published findings can provide a useful source of information, depending on your field of study.
- **CD-ROMS:** At the moment, few CD-ROMs provide the kind of specialized, detailed information about academic research that you need for your own research since most are

intended for a general audience. However, more and more bibliographies are being put onto CD-ROM for use in academic libraries, so they can be a very valuable tool in searching for the information you need.

- **Magazines:** Magazines intended for a general audience (e.g. Time) are unlikely to be useful in providing the sort of information you need. Specialized magazines may be more useful (for example business magazines for management students) but usually magazines are not useful for your research except as a starting point by providing news or general information about new discoveries, policies, etc. that you can further research in more specialized sources.

Unit-2

Hypothesis

A hypothesis is an assumption, an idea that is proposed for the sake of argument so that it can be tested to see if it might be true. Hypothesis is an assumption that is made on the basis of some evidence. This is the initial point of any investigation that translates the research questions into a prediction. It includes components like variables, population and the relation between the variables. A research hypothesis is a hypothesis that is used to test the relationship between two or more variables.

Types of Hypothesis

There are six forms of hypothesis and they are:

- Simple hypothesis
- Complex hypothesis
- Directional hypothesis
- Non-directional hypothesis
- Null hypothesis
- Associative and casual hypothesis

Simple Hypothesis

It shows a relationship between one dependent variable and a single independent variable. For example – If you eat more vegetables, you will lose weight faster. Here, eating more vegetables is an independent variable, while losing weight is the dependent variable.

Complex Hypothesis

It shows the relationship between two or more dependent variables and two or more independent variables. Eating more vegetables and fruits leads to weight loss, glowing skin, reduces the risk of many diseases such as heart disease, high blood pressure and some cancers.

Directional Hypothesis

It shows how a researcher is intellectual and committed to a particular outcome. The relationship between the variables can also predict its nature. For example- children aged four years eating proper food over a five-year period are having higher IQ levels than children not having a proper meal. This shows the effect and direction of effect.

Non-directional Hypothesis

It is used when there is no theory involved. It is a statement that a relationship exists between two variables, without predicting the exact nature (direction) of the relationship.

Null Hypothesis

It provides the statement which is contrary to the hypothesis. It's a negative statement, and there is no relationship between independent and dependent variables. The symbol is denoted by "HO".

Associative and Causal Hypothesis

Associative hypothesis occurs when there is a change in one variable resulting in a change in the other variable. Whereas, causal hypothesis proposes a cause and effect interaction between two or more variables.

Mainly In Experimental Study We Use These Two Types Of Hypothesis:

1. Null hypothesis
2. Alternative hypothesis (called the experimental hypothesis when the method of investigation is an experiment)

Characteristics of Hypothesis

Following are the characteristics of hypothesis:

- The hypothesis should be clear and precise to consider it to be reliable.
- If the hypothesis is a relational hypothesis, then it should be stating the relationship between variables.
- The hypothesis must be specific and should have scope for conducting more tests.
- The way of explanation of the hypothesis must be very simple and it should also be understood that the simplicity of the hypothesis is not related to its significance.

SAMPLING

Sampling is a process used in statistical analysis in which **a predetermined number of observations are taken from a larger population**. The methodology used to sample from a larger population depends on the type of analysis being performed, but it may include simple random sampling or systematic sampling. Sampling is a technique of selecting individual members or a subset of the population to make statistical inferences from them and estimate characteristics of the whole population. Different sampling methods are widely used by researchers in market research so that they do not need to research the entire population to collect actionable insights.

It is also a time-convenient and a cost-effective method and hence forms the basis of any research design. Sampling techniques can be used in a research survey software for optimum derivation.

For example, if a drug manufacturer would like to research the adverse side effects of a drug on the country's population, it is almost impossible to conduct a research study that involves everyone. In this case, the researcher decides a sample of people from each demographic and then researches them, giving him/her indicative feedback on the drug's behavior.

Types of sampling: sampling methods

Sampling in market research is of two types – probability sampling and non-probability sampling. Let's take a closer look at these two methods of sampling.

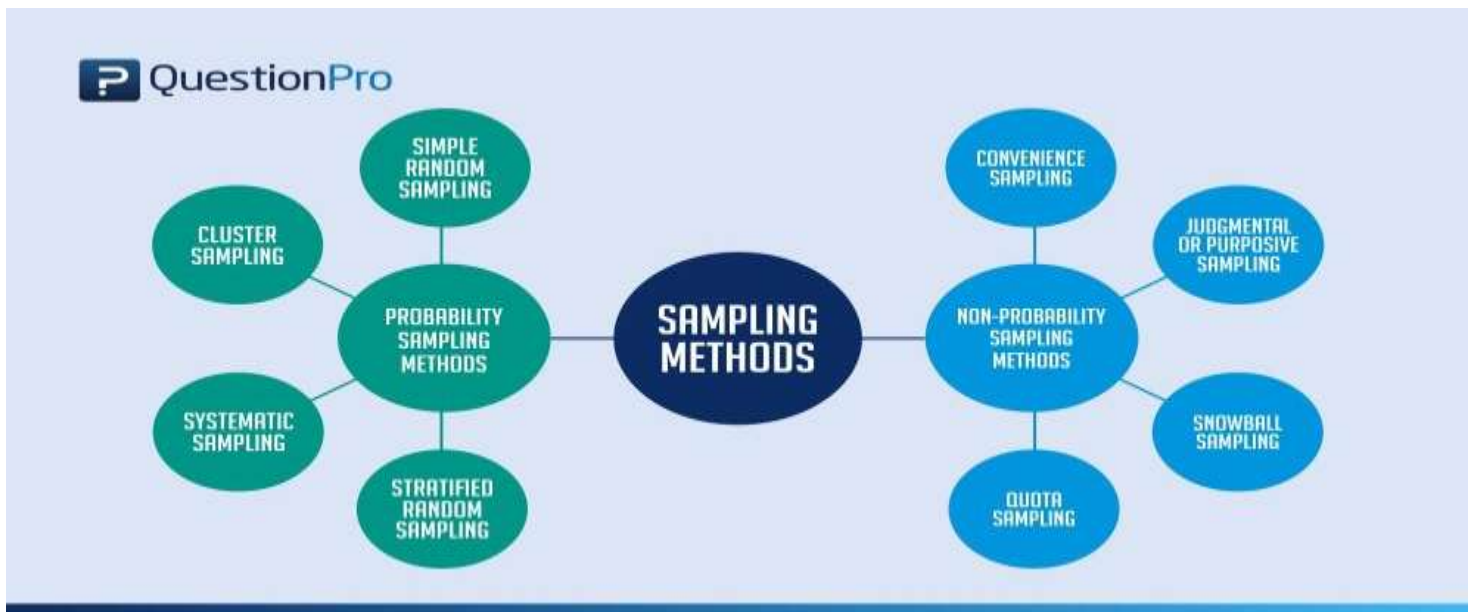
1. **Probability sampling:** Probability sampling is a sampling technique where a researcher sets a selection of a few criteria and chooses members of a population randomly. All the members have an equal opportunity to be a part of the sample with this selection parameter.
2. **Non-probability sampling:** In non-probability sampling, the researcher chooses members for research at random. This sampling method is not a fixed or predefined selection process. This makes it difficult for all elements of a population to have equal opportunities to be included in a sample.

In this blog, we discuss the various probability and non-probability sampling methods that you can implement in any market research study.

Types of probability sampling with examples:

Probability sampling is a sampling technique in which researchers choose samples from a larger population using a method based on the theory of probability. This sampling method considers every member of the population and forms samples based on a fixed process.

For example, in a population of 1000 members, every member will have a 1/1000 chance of being selected to be a part of a sample. Probability sampling eliminates bias in the population and gives all members a fair chance to be included in the sample.



There are four types of probability sampling techniques:

- Simple random sampling: One of the best probability sampling techniques that helps in saving time and resources, is the Simple Random Sampling method. It is a reliable method of obtaining information where every

single member of a population is chosen randomly, merely by chance. Each individual has the same probability of being chosen to be a part of a sample.

For example, in an organization of 500 employees, if the HR team decides on conducting team building activities, it is highly likely that they would prefer picking chits out of a bowl. In this case, each of the 500 employees has an equal opportunity of being selected.

- **Cluster sampling:** Cluster sampling is a method where the researchers divide the entire population into sections or clusters that represent a population. Clusters are identified and included in a sample based on demographic parameters like age, sex, location, etc. This makes it very simple for a survey creator to derive effective inference from the feedback.

For example, if the United States government wishes to evaluate the number of immigrants living in the Mainland US, they can divide it into clusters based on states such as California, Texas, Florida, Massachusetts, Colorado, Hawaii, etc. This way of conducting a survey will be more effective as the results will be organized into states and provide insightful immigration data.

- **Systematic sampling:** Researchers use the systematic sampling method to choose the sample members of a population at regular intervals. It requires the selection of a starting point for the sample and sample size that can be repeated at regular intervals. This type of sampling method has a predefined range, and hence this sampling technique is the least time-consuming.

For example, a researcher intends to collect a systematic sample of 500 people in a population of 5000. He/she numbers each element of the population from 1-5000 and will choose every 10th individual to be a part of the sample (Total population/ Sample Size = $5000/500 = 10$).

- **Stratified random sampling:** Stratified random sampling is a method in which the researcher divides the population into smaller groups that don't overlap but represent the entire population. While sampling, these groups can be organized and then draw a sample from each group separately.

For example, a researcher looking to analyze the characteristics of people belonging to different annual income divisions will create strata (groups) according to the annual family income. Eg – less than \$20,000, \$21,000 – \$30,000, \$31,000 to \$40,000, \$41,000 to \$50,000, etc. By doing this, the researcher concludes the characteristics of people belonging to different income groups. Marketers can analyze which income groups to target and which ones to eliminate to create a roadmap that would bear fruitful results.

Uses of probability sampling

There are multiple uses of probability sampling:

- **Reduce Sample Bias:** Using the probability sampling method, the bias in the sample derived from a population is negligible to non-existent. The selection of the sample mainly depicts the understanding and the inference of the researcher. Probability sampling leads to higher quality data collection as the sample appropriately represents the population.
- **Diverse Population:** When the population is vast and diverse, it is essential to have adequate representation so that the data is not skewed towards one demographic. For example, if Square would like to understand the people that could make their point-of-sale devices, a survey conducted from a sample of people across the US from different industries and socio-economic backgrounds helps.
- **Create an Accurate Sample:** Probability sampling helps the researchers plan and create an accurate sample. This helps to obtain well-defined data.

Types of non-probability sampling with examples

The non-probability method is a sampling method that involves a collection of feedback based on a researcher or statistician's sample selection capabilities and not on a fixed selection process. In most situations, the output of a survey conducted with a non-probable sample leads to skewed results, which may not represent the desired target population. But, there are situations such as the preliminary stages of research or cost constraints for conducting research, where non-probability sampling will be much more useful than the other type.

Four types of non-probability sampling explain the purpose of this sampling method in a better manner:

- **Convenience sampling:** This method is dependent on the ease of access to subjects such as surveying customers at a mall or passers-by on a busy street. It is usually termed as convenience sampling, because of the researcher's ease of carrying it out and getting in touch with the subjects. Researchers have nearly no authority to select the sample elements, and it's purely done based on proximity and not representativeness. This non-probability sampling method is used when there are time and cost limitations in collecting feedback. In situations where there are resource limitations such as the initial stages of research, convenience sampling is used.
For example, startups and NGOs usually conduct convenience sampling at a mall to distribute leaflets of upcoming events or promotion of a cause – they do that by standing at the mall entrance and giving out pamphlets randomly.
- **Judgmental or purposive sampling:** Judgmental or purposive samples are formed by the discretion of the researcher. Researchers purely consider the purpose of the study, along with the understanding of the target audience. For instance, when researchers want to understand the thought process of people interested in studying for their master's degree. The selection criteria will be: "Are you interested in doing your masters in ...?" and those who respond with a "No" are excluded from the sample.
- **Snowball sampling:** Snowball sampling is a sampling method that researchers apply when the subjects are difficult to trace. For example, it will be extremely challenging to survey shelterless people or illegal immigrants. In such cases, using the snowball theory, researchers can track a few categories to interview and derive results. Researchers also implement this sampling method in situations where the topic is highly sensitive and not openly discussed—for example, surveys to gather information about HIV Aids. Not many victims will readily respond to the questions. Still, researchers can contact people they might know or volunteers associated with the cause to get in touch with the victims and collect information.
- **Quota sampling:** In Quota sampling, the selection of members in this sampling technique happens based on a pre-set standard. In this case, as a sample is formed based on specific attributes, the created sample will have the same qualities found in the total population. It is a rapid method of collecting samples.

3.DATA COLLECTION TOOL

QUESTIONNAIRE

A questionnaire is a **research instrument consisting of a series of questions for the purpose of gathering information from respondents**. Questionnaires can be thought of as a kind of written interview. They can be carried out face to face, by telephone, computer or post.

Purpose Of Questionnaire

The main purpose of a questionnaire is to extract data from the respondents.

It's a relatively inexpensive, quick, and efficient way of collecting large amount data even when the researcher isn't present to collect those responses first hand.

But an important factor to note is that a questionnaire isn't the process of analyzing the responses. The process is surveying.

Survey vs Questionnaire

A questionnaire just a set of questions used to gather statistically useful information from the respondents. It's often considered as an important tool used in the survey process.

A survey, on the other hand, is a process which includes using a questionnaire to ask the questions, collect responses, and analyse them to get to a result. Analyzing and appraising are important aspects of a survey which makes it different from a questionnaire.

Questionnaire types

A questionnaire is a very useful tool to gather first-hand information from a large audience. It can be categorized into two types –

Descriptive Questionnaire

A descriptive questionnaire is developed to capture or document the extent of a particular topic or issue within a population of interest, that is, **what exists at the moment**. Questions in this questionnaire are usually focused on how many people participate in a certain behavior or hold a particular opinion.

An example of a descriptive questionnaire would be a questionnaire to calculate the percentage of people who vote and people who don't.

Analytical Questionnaire

An analytical questionnaire is developed to explore and explain relationships between particular concepts, that is, **why certain situations exist**. Analytical questionnaires usually examine two or more variables and are used in theory building and hypothesis testing.

An example of an analytical questionnaire would be a questionnaire to examine the interrelationship of lifestyle with TV viewing habit.

Types Of Questions In A Questionnaire

Now, both descriptive and analytical questionnaires include a set of questions that also be categorized into two types. These are –

Open-Ended Questions (Unstructured)

These include qualitative questions which are more open and allow the target audience to voice their feelings and notions openly. Such questions record more data as they don't have a predetermined set of responses and the respondents express their opinions in a free-flowing manner.

Not having options to choose from results in avoiding bias and getting actual answers from the respondents.

Qualitative questions, however, prove to be hard from the researcher's side as different respondents usually have different opinions and it becomes hard to process the qualitative data.

Open-ended questions are usually used

- At the time of the interview
- To collect data about the personal lives of the respondents like beliefs, family relations, motivations, etc.
- To ask questions to get opinions or views about an aspect.

Examples of such open-ended questions are –

- Suggest your opinion to reduce plastic pollution in urban cities.
- How can we reduce the men-women pay gap?

Close-ended questions (structured)

Structured questions have multiple options as answers and ask the respondents to choose either one or more than one option as an answer. Close-ended questions are used to conduct quantitative research.

Such questions are definite and are usually prepared well in advance so as to get as many responses and information from the respondents.

Open-ended questions are usually used –

- To get feedback on a product, service, policy, etc.
- To collect data that can easily be structured into options.

Examples of such close-ended questions are –

- How do you rate the services of your library?
- How much satisfaction do you get from your job?

Importance of Questionnaire

Questions are considered to be of vital importance for research, feedback, and control. A survey without a questionnaire is as incomplete as a dish without ingredients.

A questionnaire is an effective tool to measure the attitudes, beliefs, behavior, preference, opinion, and intentions of a relatively large number of people with respect to one or more than one specific subjects.

Questionnaire Advantages And Disadvantages

Designing and using a questionnaire has its own perks and cons. The advantages of questionnaires include –

- Inexpensive way of collecting data.
- Generates a large amount of data.
- Usually has an easy-to-understand and easy-to-respond design which makes it easy to understand and respond to.
- The responses can be easily quantified. It can also be used to compare and contrast other research.
- It's easy to analyse the results of a questionnaire.
- The qualitative and quantitative data collected from a questionnaire helps the surveyor to create new strategies and learn about the trends in the audience.
- Questionnaires often let its respondents maintain their anonymity.
- It's not always necessary to have a personal touch while getting the responses from the respondents.

However, questionnaires have many disadvantages too, like –

- Respondents are sometimes dishonest while answering the questions.
- When it comes to open-end questions, it becomes difficult to understand and interpret the responses.
- A questionnaire isn't a perfect tool to know about the feelings and emotions of the respondents.
- Lack of personalization demotivate the respondents and many don't even respond to it.

INTERVIEW

a meeting at which somebody is asked questions to find out if he/she is suitable for a job, course of study, etc. An interview is a **procedure designed to obtain information from a person through oral responses to oral inquiries**. An interview is a face-to-face conversation between the interviewer and the interviewee, where the interviewer seeks replies from the interviewee for choosing a potential human resource.

Types of Interview

There are several types of the interview;

1. Unstructured (Nondirective) Interview.
2. Structured (Directive) Interview.
3. Situational Interview.
4. Behavioral Interview.
5. Job-related Interview.
6. Stress Interview.
7. Panel Interview (Board Interview).
8. One-On-One Interview.
9. Mass Interview (Group Interview),
10. Phone Interview

Unstructured (Nondirective) Interview

In unstructured interviews, there is generally no set format to follow so that the interview can take various directions. The lack of structure allows the interviewer to ask follow-up questions and pursue points of interest as they develop.

An unstructured interview is an interview where probing, open-ended questions are asked. It involves a procedure where different questions may be asked to different applicants.

Structured (Directive) Interview

In structured interviews, the interviewer lists the questions and acceptable responses in advance and may even rate and score possible answers for appropriateness.

An interview consisting of a series of job-related questions asked consistently of each applicant for a particular job is known as a structured interview.

A structured interview typically contains four types of questions.

- **Situational questions:** Pose a hypothetical job situation to determine what the applicant would do in that situation.
- **Job knowledge questions:** Probe the applicant's job-related knowledge.
- **Job-sample simulation questions:** Involve situations where an applicant may be required to perform a sample task from the job.
- **Worker requirements questions:** Seek to determine the applicant's willingness to conform to the job requirements.

Situational Interview

In a situational interview, you ask the candidate what his or her behavior would be in a given situation. Candidates are interviewed about what actions they would take in various job-related situations. Situational interviews ask interviewees to describe how they would react to a hypothetical situation today or tomorrow.

Behavioral Interview

In a behavioral interview, you ask applicants to describe how they reacted to actual situations in the past.

Candidates are asked what actions they have taken in prior job situations similar to situations they may encounter on the job. The interviewers are then scored using a scoring guide constructed by job experts.

This structured interview uses questions designed to probe the candidate's past behavior in specific situations. This technique involves asking all interviewees standardized questions about how they handled past situations similar to situations they may encounter on the job.

The interviewer may also ask discretionary probing questions for details of the situation, the interviewee's behavior, and the outcome. The interviewee's responses are then scored with behaviorally anchored rating scales.

Job-related Interview

In a job-related interview, the interviewer asks applicants questions about relevant past experiences.

It is a series of job-related questions that focus on relevant past job-related behaviors. The questions here don't revolve around hypothetical or actual situations or scenarios.

Instead, the interviewer asks job-related questions such as, "Which courses did you like best in business school?"

Stress Interview

In a stress interview, the interviewer seeks to make the applicant uncomfortable with occasionally rude questions. The aim is supposedly to spot sensitive applicants and those with low or high stress tolerance.

Stress interviews may help unearth hypersensitive applicants who might overreact to mild criticism with anger and abuse. It intentionally creates anxiety to determine how an applicant will react to stress on the job.

Panel Interview (Board Interview)

A panel interview, also known as a board interview, is an interview conducted by a team of interviewers, who interview each candidate and then combine their ratings into a final score.

One-On-One Interview

In a one-on-one interview, one interviewer meets one candidate. In a typical employment interview, the applicant meets one-on-one with an interviewer. As the interview may be a highly emotional occasion for the applicant, meeting alone with the interviewer is often less threatening.

Mass Interview (Group Interview)

The mass/group interview is a relatively new technique in the west and almost unknown. It is a procedure for the discovery of leadership.

Several job applicants are placed in a leaderless discussion, and interviewers sit in the background to observe and evaluate the performance of the candidates.

In a mass/group interview, a panel interviews several candidates simultaneously. The panel poses a problem and then watches to see which candidate takes the lead in formulating an answer.

Phone Interview

Employers do some interviews entirely by These can actually be more accurate than face-to-face interviews for judging an applicant's conscientiousness, intelligence, and interpersonal skills.

Here, neither party needs to worry about appearance or handshakes, so each can focus on substantive answers. Or perhaps candidates – somewhat surprised by an unexpected call from the recruiter – give more spontaneous answers.

OBSERVATION

It is an act or instance of noticing or perceiving. It is an act or instance of regarding attentively or watching.

TYPES OF OBSERVATION

Naturalistic observation

With naturalistic observation, observation occurs directly in the environment where the phenomenon occurs. The observations are made as unobtrusively as possible with the researcher not directly interacting with the participants in any way.

Participant observation

With participant observation, researchers actively participate in the study itself. In addition to observing behaviors, a researcher might conduct interviews, take notes, look at documents, and take photographs.

Structured observation

With structured observation, researchers do not observe in the natural setting, but instead in a lab or a simulated environment. A structured observation is meant to observe a specific, limited set of behaviors. This method is less natural, but enables less variables to be at play.

UNIT-3

Meaning of Statistics: The Word statistics have been derived from Latin word “Status” or the Italian word “Statista”, meaning of these words is “Political State” or a Government. Shakespeare used a word Statist in his drama Hamlet (1602). In the past, the statistics was used by rulers. Statistics is a branch of mathematics dealing with data collection, organization, analysis, interpretation and presentation. In addition to being the name of a field of study, the word "statistics" also refers to numbers that are used to describe data or relationships. Statistics is a form of mathematical analysis that uses quantified models, representations and synopses for a given set of experimental data or real-life studies. The word statistics has the following important meanings:-

- Statistics refers to numerical facts. For example, the numerical facts regarding birth and death, school attendance, employment market etc. etc.
- It also signifies the method of dealing with numerical facts. Thus, statistics is the science of collecting, summarizing, analyzing and interpreting numerical facts.
- Again, statistics refers to the summarized figures of numerical facts like percentages, averages, means, medians, standard deviation etc. In general, we can say statistics is that branch of knowledge which helps us in scientific collection, presentation, analysis and interpretation of numerical facts.
- Numerous methods of collecting, editing, classifying, tabulating and presenting facts using graphs and diagrams

Definitions of Statistics: The following are some of the definitions of Statistics:-

- **According to Merriam Webster dictionary**, “Classified facts representing the conditions of a people in a state especially the facts that can be stated in numbers or any other tabular or classified arrangements.”
- **According to Sir Arthur Lyon Bowley**, “Numerical statements of facts in any department of inquiry placed in relation to each other”.
- **According to Prof. Horace Secrist**, “Statistics are aggregates of facts affected to a market extent by multiplicity of causes, numerically expressed, enumerated or estimated according to a reasonable standards of accuracy, collected in a systematic manner for a pre-determined purpose and placed in relation to each other”
- **According to Croxten and Cowden**, “Statistics may be defined as a science of collection, presentation, analysis, and interpretation of numerical data”.
- **According to Selligman** “Statistics is the science which deals with the methods of collecting, classifying, presenting , comparing and interpreting numerical data collected to throw some light on any sphere of enquiry”.

Characterstics/Nature of statistics

- **Statistics are aggregate of facts:** Single or unrelated items are not considered as statistics
- **Statistics are affected by multiplicity of causes:** In statistics the collected information

are greatly influenced by a number of factors and forces working together.

- **Statistics are numerical facts:** Only numerical data constitute statistics.
- **Statistics are enumerated or estimated with a reasonable standard of accuracy:** While enumerating or estimating data, a reasonable degree of accuracy must be achieved.
- **Statistics are collected in a systematic manner:** Data should be collected by proper planning by utilizing tool/s developed by trained personnel
- **Statistics are collected for a predetermined purpose:** It is necessary to define the objective of enquiry, before collecting the statistics. The objective of enquiry must be specific and well defined.
- **Statistics should be comparable:** Only comparable data will have some meaning. For statistical analysis, the data should be comparable with respect to time, place group, etc.
- **Statistics are aggregates of facts:** only aggregate of fact is statistics rather than individual facts. For example individual weight of a person is not statistics because it cannot be compared and this figure is unrelated.
- **Statistics are numerically expressed:** All statistics are numerically expressed. Qualitative expressions, like beauty, honesty, health, intelligence are not statistics unless they are assigned numerical equivalent. However, qualitative expressions can be ranked according to the quality of their attributes.
- **Statistics are affected to a marked extent by multiplicity of causes:** Statistics (facts and figures) are affected by many factors simultaneously. For example, data related to training of athletes are affected by weather, diet, training program etc.
- **Statistics are enumerated or estimated according to reasonable standard of accuracy:** Statistics are numerical statements which can either be enumerated or estimated by the experienced observers. Sometimes when actual measurements of figures is not possible in a particular field of inquiry, then method of estimation is applied. For example, it's easy to count 40 students of a class but, when it comes to number of people watching a match in the stadium then we can only use the estimation method.
- **Statistics should be collected in a systematic manner:** Statistics should be collected in a systematically in a planned way. Data collected in an unsystematic manner would lead to misleading conclusions.

- **Statistics should be collected for a predetermined purpose:** Before collecting the data, purpose of their collection should be well-defined and specified, otherwise it would not serve any purpose, rather it would lead to wrong conclusions.
- **Statistics should be placed in relation to each other:** Data should be placed in such a way that it can be compared. For example, height of students of different sections of a college.
- It is a systematic study of any subject
- It takes a fact and tries to establish the relationship between cause and effect
- Also, the laws of science are universal in nature
- “Statistics is the science of measurement of the social organism regarded as a whole in all its manifestations.” —**Dr. Bowley**

Scope of Statistics: Statistical applications have a wide scope. Some of the major ones are given below:

- **Policy planning:** To finalize a policy, it requires some data from previous or expected environment that the policy can be effectively utilized with maximum favorable results. For example, in an organization the previous sales data are analyzed to develop future strategies in the field to obtain maximum benefit in terms of product sale.
- **Management:** Statistics is very useful tool in an organization to view various aspects of work and wellbeing of the employees as well as keeping an eye on the progress trend of the organization.
- **Behavioral and Social Sciences:** In social sciences where both types(quantitative and qualitative) of information are used, statistics helps there searchers to alter the information in a comprehensive way to explain and predict the patterns of behavior/ trend. Where the characteristics of the population being studied are normally distributed, the best and statistically important decision about variables being investigated is possible by using parametric statistics or nonparametric statistics to explain the pattern of activities.
- **Education:** If education is intended to be well dispersed and effective in the interest of the population, the characteristics of students, instructor’s contents and infrastructure are very important to understand and again statistics enable these characteristics being analyzed in context of needs of the nation. Once the parameters of all components are analyzed, areas needing more emphasis become obvious.
- **Commerce and Accounts:** Where money matters are involved, it is essential to take extra care to manage the funds properly enabling efforts in various sectors. The cost and benefit analysis helps to decide putting money and regulating it for maximum benefit at minimum cost.
- **Industries:** Statistics is a basic tool to handle daily matters not only in big organizations but also in small industries. It is required, at each level, to keep data with care and look at them in different perspectives to mitigate the expenditure and enable each employee to have his/ her share in the benefit. Psychologists/ personnel officers dealing with selection and training in industries also use statistical tools to differentiate among employees.

- **Pure sciences and Mathematics:** Statistical tools are also instrumental to have precise measures in pure sciences and to see differences on different occasions in various conditions. Statistics itself is a branch of mathematics which helps them understand differences among properties of various applications in mathematics.

- the individual to find out the best applicable solution to a problem situation and it is possible because of statistics. During problem solving statistics helps the person analyses his/ her pattern of response and the correct solution thereby minimizing the error factor.

Importance of Statistics: -:

- It helps in collecting data either numerically or otherwise
- It also helps us in classification, organisation and summarization.
- It also helps us in drawing general conclusions.
- Statistics also help in the task of evaluation and measurement.
- It helps us in the construction and standardization of test as well as using them properly.
- It helps the teacher to know the individual differences of the students, comparing the suitability of one method or technique with another, making predictions for the future etc.
- Last but not least, statistics also helps in research work in many ways.
- Everybody watches weather forecasting. Have you ever think how do you get that information? There are some computers models build on statistical concepts. These computer models compare prior weather with the current weather and predict future weather.
- Statistics mostly used by the researcher. They use their statistical skills to collect the relevant data. Otherwise, it results in a loss of money, time and data.
- What do you understand by insurance? Everybody has some kind of insurance, whether it is medical, home or any other insurance. Based on an individual application some businesses use statistical models to calculate the risk of giving insurance.
- In financial market also statistic plays a great role. Statistics are the key of how traders and businessmen invest and make money.
- Statistics play a big role in the medical field. Before any drugs prescribed, scientist must show a statistically valid rate of effectiveness. Statistics are behind all the study of medical.
- Statistical concepts are used in quality testing. Companies make many products on a daily basis and every company should make sure that they sold the best quality items. But companies cannot test all the products, so they use statistics sample.
- In everyday life we make many predictions. For examples, we keep the alarm for the morning when we don't know that we will be alive in the morning or not. Here we use statistics basics to make predictions.
- Doctors predict disease on based on statistics concepts. Suppose a survey shows that 75%-80% people have cancer and not able to find the reason. When the statistics become involved, then you can have a better idea of how the cancer may affect your body or is smoking is the major reason for it.
- News reporter makes a prediction of winner for elections based on political campaigns. Here statistics play a strong part in who will be your governments.

- Statistics data allow us to collect the information around the world. The internet is a device which help us to collect the information. The fundamental behind the internet is based on statistics and mathematics concepts.

Types of Statistics: After knowing the concept and definition of statistics, let us know the various types of statistics. Though various bases have been adopted to classify statistics, following are the two major ways of classifying statistics:

- (i) On the basis of function and
- (ii) On the basis of distribution.

On the Basis of Functions: As statistics has some particular procedures to deal with its subject matter or data, three types of statistics have been described.

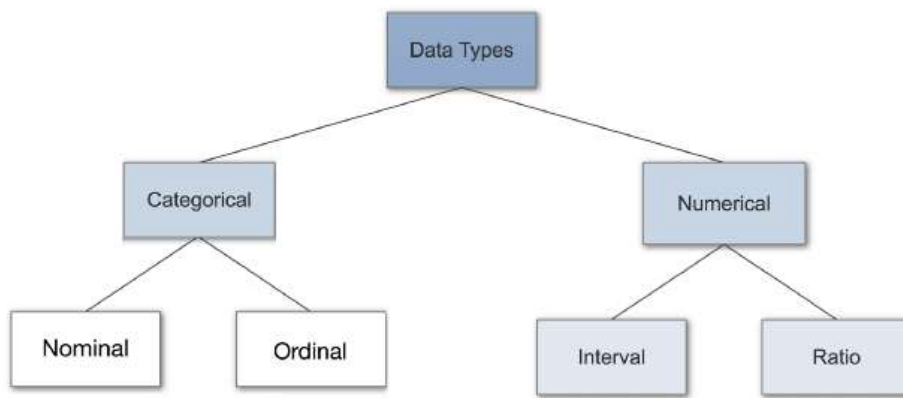
- **Descriptive statistics:** The branch which deals with descriptions of obtained data is known as descriptive statistics. On the basis of these descriptions a particular group of population is defined for corresponding characteristics. The descriptive statistics include classification, tabulation measures of central tendency and variability. These measures enable the researchers to know about the tendency of data or the scores, which further enhance the ease in description of the phenomena.
- **Correlational statistics:** The obtained data are disclosed for their inter correlations in this type of statistics. It includes various types of techniques to compute the correlations among data. Correlational statistics also provide description about sample or population for their further analyses to explore the significance of their differences.

Inferential statistics: **Inferential statistics deals with the drawing of conclusions about large group of individuals (population) on the basis of observations of few participants from them or about the events which are yet to occur on the basis of past events. It provides tools to compute the probabilities of future behavior of the subjects.**

2.Data

Data are individual pieces of factual information recorded and used for the purpose of analysis. It is the raw information from which statistics are created. Statistics are the results of data analysis - its interpretation and presentation.

TYPES OF DATA



Qualitative or Categorical Data

Qualitative data, also known as the categorical data, describes the data that fits into the categories. Qualitative data are not numerical. The categorical information involves categorical variables that describe the features such as a person's gender, home town etc. Categorical measures are defined in terms of natural language specifications, but not in terms of numbers.

Sometimes categorical data can hold numerical values (quantitative value), but those values do not have mathematical sense. Examples of the categorical data are birthdate, favourite sport, school postcode. Here, the birthdate and school postcode hold the quantitative value, but it does not give numerical meaning.

Nominal Data

Nominal data is one of the types of qualitative information which helps to label the variables without providing the numerical value. Nominal data is also called the nominal scale. It cannot be ordered and measured. But sometimes, the data can be qualitative and quantitative. Examples of nominal data are letters, symbols, words, gender etc.

Are you married?

Yes

No

What languages do you speak?

Englisch

French

German

Spanish

Ordinal Data

Ordinal data/variable is a type of data which follows a natural order. The significant feature of the nominal data is that the difference between the data values is not determined. This variable is mostly found in surveys, finance, economics, questionnaires, and so on.

What Is Your Educational Background?

- 1 - Elementary
- 2 - High School
- 3 - Undergraduate
- 4 - Graduate

Quantitative or Numerical Data

Quantitative data is also known as numerical data which represents the numerical value (i.e., how much, how often, how many). Numerical data gives information about the quantities of a specific thing. Some examples of numerical data are height, length, size, weight, and so on. The quantitative data can be classified into two different types based on the data sets. The two different classifications of numerical data are discrete data and continuous data.

Discrete Data

Discrete data can take only discrete values. Discrete information contains only a finite number of possible values. Those values cannot be subdivided meaningfully. Here, things can be counted in the whole numbers.

Example: Number of students in the class

Continuous Data

Continuous data is data that can be calculated. It has an infinite number of probable values that can be selected within a given specific range.

Example: Temperature range

3. The Normal Probability Curve (N.P.C.) is **symmetrical about the ordinate of the central point of the curve**. It implies that the size, shape and slope of the curve on one side of the curve is identical to that of the other. That is, the normal curve has a bilateral symmetry.

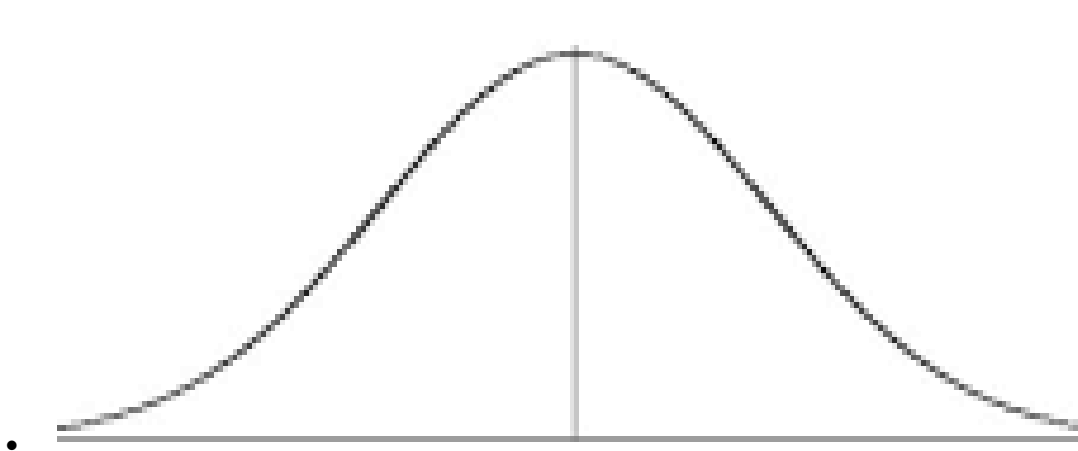
A normal probability curve shows the theoretical shape of a normally distributed histogram. The shape of the normal probability curve is based on two parameters: mean (average) and standard deviation (sigma). It is based upon the law of probability discovered by **French mathematician Abraham Demoiver** (1667 – 1754).

USES

- To determine the percentage of cases (in a normal distribution) within given limits or scores.
- To determine the percentage of cases that are above or below a given score or reference point.
- To determine the limits of scores which include a given percentage of cases.

Properties of a normal distribution

- The mean, mode and median are all equal.



- The curve is symmetric at the center (i.e. around the mean, μ).
- Exactly half of the values are to the left of center and exactly half the values are to the right.
- The total area under the curve is 1.

UNIT 4

MEASURE OF CENTRAL TENDENCY

A measure of central tendency is a single value that attempts to describe a set of data by identifying the central position within that set of data. As such, measures of central tendency are sometimes called measures of central location. They are also classed as summary statistics. The mean (often called the average) is most likely the measure of central tendency that you are most familiar with, but there are others, such as the median and the mode.

The mean, median and mode are all valid measures of central tendency, but under different conditions, some measures of central tendency become more appropriate to use than others. In the following sections, we will look at the mean, mode and median, and learn how to calculate them and under what conditions they are most appropriate to be used.

Mean

In the most layman terms, Mean is defined as the sum of all the observations divided by the total number of observations. The above definition is of Arithmetic Mean, one of the many types of Mean. In detail, the types of mean are explained although most of them are out of scope for elementary Statistics-

1- Arithmetic Mean

Arithmetic Mean is the average of all the observations. Generally, if the mean is mentioned without any adjective, it is assumed to be Arithmetic Mean.

Example- We have a set of observations- $x=1,3,5,7,9,1,3,5,7,9$. The Arithmetic Mean is computed as (x/n) where n is the number of observations which is equal to 5 in this case. Thus $x=25$ in this case and $n=5$ so the mean comes out to be 5

Median

The median is the middle score for a set of data that has been arranged in order of magnitude. The median is less affected by outliers and skewed data. In order to calculate the median, suppose we have the data below:

65	55	89	56	35	14	56	55	87	45	92
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We first need to rearrange that data into order of magnitude (smallest first):

14	35	45	55	55	56	56	65	87	89	92
----	----	----	----	----	----	----	----	----	----	----

Our median mark is the middle mark - in this case, 56 (highlighted in bold). It is the middle mark because there are 5 scores before it and 5 scores after it. This works fine when you have an odd number of scores, but what happens when you have an even number of scores? What if you had only 10 scores? Well, you simply have to take the middle two scores and average the result. So, if we look at the example below:

65	55	89	56	35	14	56	55	87	45
----	----	----	----	----	----	----	----	----	----

We again rearrange that data into order of magnitude (smallest first):

14	35	45	55	55	56	56	65	87	89
----	----	----	----	----	----	----	----	----	----

Only now we have to take the 5th and 6th score in our data set and average them to get a median of 55.5.

Mode

The mode is the most frequent score in our data set. On a histogram it represents the highest bar in a bar chart or histogram. You can, therefore, sometimes consider the mode as being the most popular option. An example of a mode is presented below:

20 30 40 40 60 12 40

so the score repeated maximum number of time will be taken as mode. It is 40

2. Measure of variability

Variability is most commonly measured with the following descriptive statistics: **Range**: the difference between the highest and lowest values. **Interquartile range**: the range of the middle half of a distribution. **Standard deviation**: average distance from the mean.

THERE ARE THREE MEASURE OF VARIABILITY

To learn how to compute three measures of the variability of a data set: **the range, the variance, and the standard deviation**

3. CORRELATION

In statistics, correlation or dependence is any statistical relationship, whether causal or not, between two random variables or bivariate data. In the broadest sense correlation is any statistical association, though it commonly refers to the degree to which a pair of variables are linearly related

TYPES

- A **positive correlation** is a relationship between two variables in which both variables move in the same direction. Therefore, when one variable increases as the other variable increases, or one variable decreases while the other decreases. An example of positive correlation would be height and weight. Taller people tend to be heavier.
- A **negative correlation** is a relationship between two variables in which an increase in one variable is associated with a decrease in the other. An example of negative correlation would be height above sea level and temperature. As you climb the mountain (increase in height) it gets colder (decrease in temperature).
- A **zero correlation** exists when there is no relationship between two variables. For example there is no relationship between the amount of tea drunk and level of intelligence.

The correlation coefficient that indicates the strength of the relationship between two variables can be found using the following formula:

$$r_{xy} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

Where:

- r_{xy} – the correlation coefficient of the linear relationship between the variables x and y
- x_i – the values of the x-variable in a sample

- \bar{x} – the mean of the values of the x-variable
- y_i – the values of the y-variable in a sample
- \bar{y} – the mean of the values of the y-variable

In order to calculate the correlation coefficient using the formula above, you must undertake the following steps:

1. Obtain a data sample with the values of x-variable and y-variable.
2. Calculate the means (averages) \bar{x} for the x-variable and \bar{y} for the y-variable.
3. For the x-variable, subtract the mean from each value of the x-variable (let's call this new variable "a"). Do the same for the y-variable (let's call this variable "b").
4. Multiply each a-value by the corresponding b-value and find the sum of these multiplications (the final value is the numerator in the formula).
5. Square each a-value and calculate the sum of the result
6. Find the square root of the value obtained in the previous step (this is the denominator in the formula).
7. Divide the value obtained in **step 4** by the value obtained in **step 7**.