

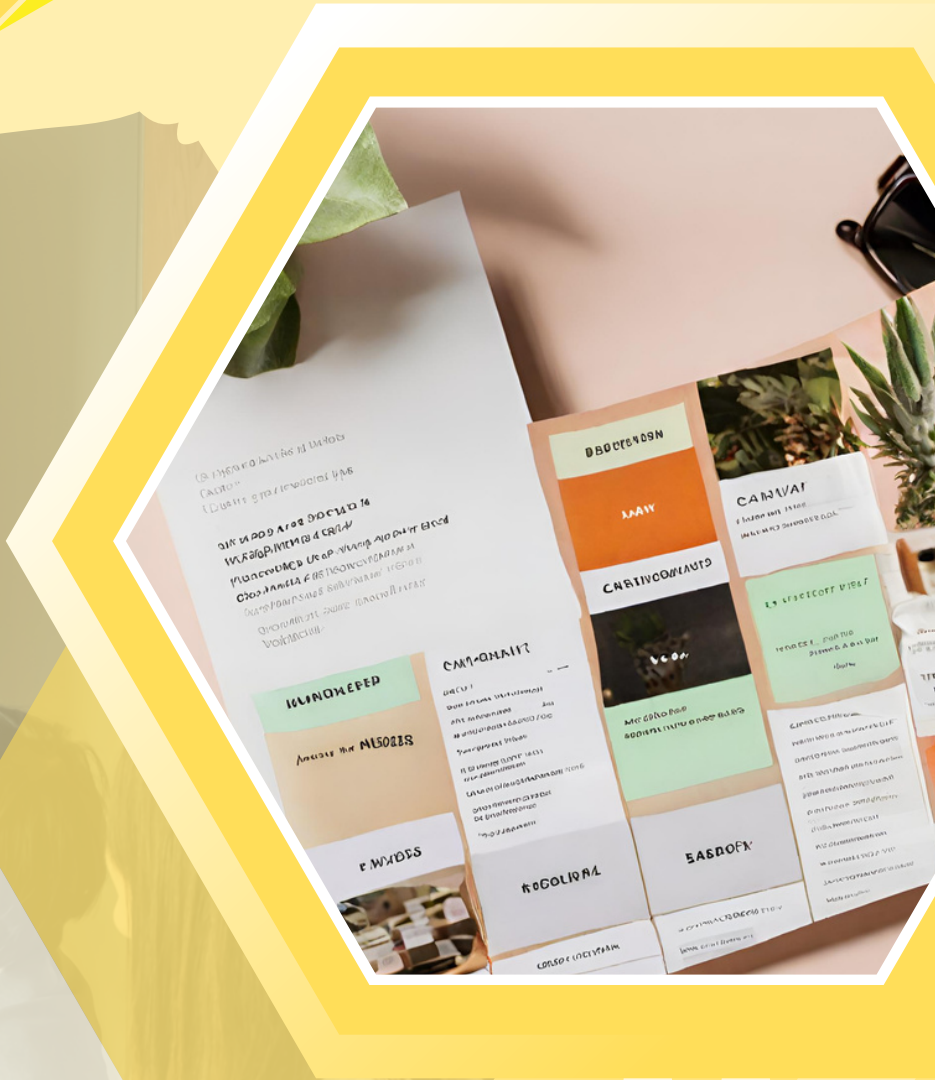
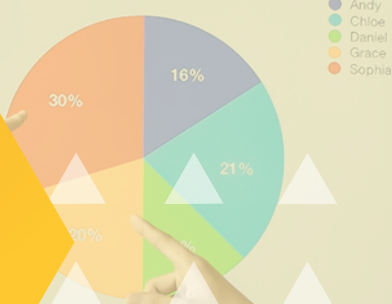
# BUSINESS RESEARCH METHODOLOGY

Results by Salesperson

UNITS SOLD

Salesperson	Units Sold
Andy	10
Chloe	10
Daniel	9
Grace	14
Sophia	21

Pie Chart



***Dr. Punit Kumar Kanujiya***  
***Hargun Sahni***

# Business Research Methodology



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# Business Research Methodology

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## Preface

Welcome to the world of business research, where the pursuit of knowledge intersects with the ever-changing dynamics of commerce. This book, "Business Research Methodology," is crafted to be your guiding companion in navigating the intricate landscape of research in the business realm. Whether you are a novice embarking on your academic journey or a seasoned professional seeking to refine your research skills, this book is designed to empower you with the tools and insights needed to conduct rigorous and meaningful research.

Business research is a multifaceted journey that requires a nuanced understanding of methodologies, ethical considerations, and emerging trends. In this volume, we have endeavored to create a comprehensive resource that not only introduces you to the fundamental concepts but also takes you on a practical expedition through the entire research process.

Our approach is rooted in the belief that research is a dynamic and collaborative endeavor. As such, this book is not merely a repository of theoretical knowledge but a hands-on guide filled with real-world examples, case studies, and practical tips garnered from years of collective experience in the field. We understand that each researcher is unique, and every research project comes with its own set of challenges. Therefore, our goal is to provide you with a versatile toolkit that can be adapted to various research scenarios.

Key features of this book include an exploration of both quantitative and qualitative research methods, practical guidance on data collection and analysis, discussions on ethical considerations in business research, and an examination of emerging trends shaping the future of research methodologies. Each chapter is crafted to be accessible yet comprehensive, offering a blend of theoretical foundations and practical applications.

The journey of research is a continuous one, and this book serves as your roadmap. As you embark on this expedition, we invite you to delve into the chapters, engage with the content, and apply the knowledge gained to your own research pursuits. May this book inspire curiosity, fuel innovation, and empower you to make meaningful contributions to the ever-evolving field of business research.

Thank you for choosing "Business Research Methodology" as your companion on this intellectual voyage.

## **Acknowledgement**

In completing this book, we owe a great deal to our erstwhile teachers for their guidance. We also acknowledge my gratitude to the learned contributing authors to this book. We shall be failing in our duty if we do not express my thank to my colleagues for their encouragement and inspiration.

We express our special thanks to all Professors of the Department of Commerce, University of Lucknow, Banaras Hindu University, University of Delhi, Chaudhary Charan Singh University Meerut, Meerut College Meerut, National P.G. College Lucknow and we feel privileged to acknowledge all our colleagues teaching in the different colleges of different Universities for their continuous support and guidance.

We are grateful to our and Research Supervisor Prof. Audhesh Kumar Tripathi, Professor, Department of Commerce, University of Lucknow, and we are also grateful to our College Principal Prof. Devendra Kumar Singh and Prof. Anjali Mittal & our parents and family members, those who always stood by us and especially acknowledge the unparalleled support of our friends without whose help the preparation of the book would not have been reality.

We express our sincere thanks to the publisher for taking great pains in publishing the book.

We shall welcome all suggestions, comments and queries from the readers for the further improvement of the book and it shall thankfully acknowledge and appreciated.

**Dr. Punit Kumar Kanujiya**

**Ms. Hargun Sahni**

## Table of Contents

<b>Preface</b>	<b>IV</b>
<b>Acknowledgement</b>	<b>V</b>
<b>Table of Contents</b>	<b>VII</b>
<b>Title of Chapters</b>	<b>Page No.</b>
<i>Unit – 1</i>	1 – 41
<b>Fundamentals of Business Research Methodology BRM</b>	
<i>Unit – 2</i>	42 – 107
<b>Research Design and Methods</b>	
<i>Unit – 3</i>	108 – 127
<b>Data Types and Data Collection</b>	
<i>Unit – 4</i>	128 - 181
<b>Data Interpretation with Advanced Excel</b>	
<b>Long Questions</b>	182 – 165
<b>Multiple Choice Questions</b>	166 – 189
<b>Answers</b>	190 - 191

**Unit - 1**

**Fundamentals of Business  
Research Methodology BRM**



Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, Research is an art of scientific investigation. Dictionary definition of research is a careful investigation or enquiry especially through search for new facts in any branch of knowledge. Some People consider research as a movement from the known to the unknown.

Research comprises of two words namely 'Re' and 'Search' where 'Re' implies repetitive or iterative process, 'search' denotes making a thorough examination of or looking over carefully in order to find something. Different researchers have defined research in various ways due to its wide scope. But in general, research can be defined as a scientific process where new facts, ideas are established and/or proved in different areas of knowledge. Research aims at adding to the existing stock of knowledge for the betterment of world.

Research is an academic activity and as such the term should be used in a technical sense. According to Clifford Woody, "research comprises defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organizing and evaluating data, making deductions and reaching conclusions, and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis."

Redman and Mory define research as a "Systematized efforts to gain new knowledge."

According to Emory, "Research can be defined as any organized activity designed and carried out to provide information for solving a problem."

Research is, thus, an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, Comparison and experiment. In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. The systematic approach concerning generalization and the formation of a theory is also research.

As such the term research refers to the systematic method consisting of enunciation the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solution towards the concerned problem or in certain generalizations for some theoretical formation.

**Research is conducted with a purpose to:**

- Identify potential and new customers
- Understand existing customers
- Set pragmatic goals
- Develop productive market strategies
- Address business challenges
- Put together a business expansion plan
- Identify new business opportunities

**OBJECTIVES OF RESEARCH**

Meaning of reasearch: The term research comprises two words "Re" and "Search". Generally "Re" means again and "Search" means to find out. Reasearch is a careful investigation or inquiry especially to search for new facts in any branch of knowledge.

**Example:** Research conducts an issue such as:

1-How the new education policy has evolved after independence? 2-How the COVID -19 disease has impacted the economy.

**OBJECTIVES OF RESEARCH:**

- 1- To discover answers to questions through the application of scientific procedure.
- 2- Main aim of research is to find out the truth which has not been delivered.
- 3- To gain familiarity with a phenomenon or to achieve new insights into it.
- 4- To portray accurately, the characteristics of a particular individual situation or a group.
- 5- To determine the frequency with which something occurs or with which it is associated with something else.
- 6- To test a hypothesis of a casual relationship between variables.
- 7- To generate new knowledge.
- 8- To investigate some existing situation or problems.
- 9- To identify pattern or trends related to the problem.
- 10- To explore and analyse more general issues.

**CHARACTERISTICS OF RESEARCH**

Characteristics of research determines whether a research is free of subjective errors is not. The terms are very commonly used in research and the success of any research depends on these terms. They can be summarized are:

1. Generalized
2. Controlled
3. Rigorous
4. Systematic
5. Reliability
6. Validity & verifiability
7. Empirical
8. Accuracy
9. Credibility
10. Critical

1. **Generalized:** It is the extent to which a research finding can be applied to larger population. The research usually divides the identified population into smaller samples depending on the resources availability at the time of being research is conducted. Now, the sample is taken from the identified populations and then this finding should be applicable to and an entire population. From this analytical information obtained from studying these samples it should be given a fair idea of total population of being follower of particular ideology, belief and social stigma.

For eg. If we want to study the statistics of tourism how many people doing travel in a year and stay at hotel and resort then we divide the India in different zones {east, west, north and south} and take a sample from them according to the monsoon and from these samples we can connect this from an entire population.

2. **Controlled:** The concept of control implies that, in explaining causality in relation to two variables, you set up a research in such a way that minimizes the effect of other factors affecting the relationship. For eg. If we study the two factor variable temperature and

pressure when we increase or decrease the temperature what is the effect is on pressure in this except these two noother external factor affect the research it should we controlled by the researcher.

3. **Rigorous:** A researcher should be careful that whatever the answer to question he found it should be follow a proper procedure and the outcome should be relevant, appropriate and justified.

There should be no doubt with regard to the relevance of research taken by researcher. It also provide an accurate representation of the population studied.

4. **Systematic:** The proper research procedure should be followed by researcher there should be a proper study can be taken carefully drafted to ensure that there is an optimum utilization of resources. If the procedure is not systematic and step by step then the outcome came from this is never relevant and expected. So, proper steps should follow for a logical and expected outcome. For eg. When we go out for a dinner we should follow a procedure like first we expected a soup and starter then main course then we came on the desert what if desert were come before starter and meal this should be unexpected and improper procedure and we don't like it. So procedure should be systematic.

5. **Reliability:** It refers to how consistently a method measures something. If the same results can be consistently achieved by using the same methods under the same circumstances, the measurement is considered reliable. It is difficult to be measured accurately, but now there are instrument which can estimate the reliability of a research. If any research yields, similar results each time it is undertaken with similar population and with similar procedure, it is called to be a reliable research.

6. **Validity and verifiability:** This concept implies that whatever you conclude on the basis of your finding is correct and can be verified by you and others. Validity is based on the strength of a collection of different types of evidence. Validity is the strength with which we can make research conclusions, assumption and propositions true or false. It also ascertain the application of research in finding the solution to an issue in different conditions. The finding of research should be verified by the researcher or anyone else who want to conduct the study.

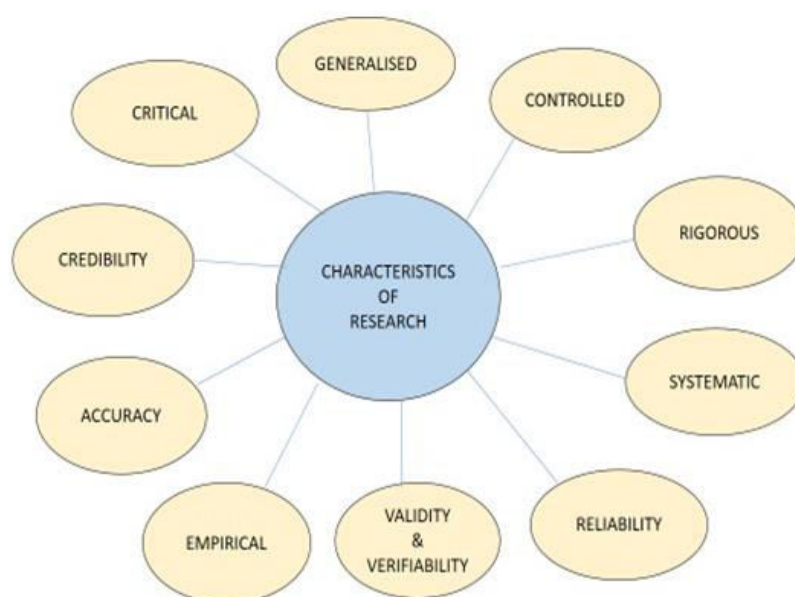
7. **Empirical:** This means that any conclusion drawn are based upon hard evidence gathered from information collected from real life experiences or observations. The processes adopted should be tested for the accuracy and each steps should be in progression. In this at first we first doing observation and taking information. For eg. When we get the information of a brain part then in this we find out that at first there is an outer skin, inner skin then bones and then many other this also we all get this information by observation and taking proper evidence by searching this and at last we get to know the whole information.

8. **Accuracy:** It is also the degree to which each research process, instrument and tool is related to each other. It also measures whether research tools have been selected in best possible manner and research procedures suits research problem or not. Selection of appropriate data collection tools is essential for a research. For eg. Guest comments card in hotels and restaurants is given in a dining outlets gives the guest a chance to be honest comment about the services and food there rather them directly asked them about it through verbally.

9. **Credibility:** It comes with the use of the best source of information and best procedure in research. If you are using second hand information in your research due to any reasons your research might complete in less time but its credibility will be at stake because

secondary data has been manipulated by human being and is therefore not very valid to use in research. When a researcher has less time to complete its research then he can use a certain percentage of secondary data but basing a research completely on secondary data completely this is least credible. When researchers give accurate references in the research the credibility of the research increases but fake references also decrease the credibility of the research.

- 10. Critical:** Critical in research refers to the state of the methods, finding and conclusion of the research. The process of research undertaking and its finding should have full proof of critical reviews so that results will be justice worthy. If the research is containing any drawbacks it would not be called good research. Critical appraisal of research means an act of carefully and systematically examining research and its all finding to judge its reliability, validity, trustworthiness and value are applied in particular field.



Title- Unit 1 Poonam Lodhi Class- M.com 1<sup>st</sup> semester Roll No.-423030

### Topic- Importance of Research

#### Meaning of Research

Research is the creation of new knowledge or the use of existing knowledge in a new creative way so as to generate new concepts, methodologies and understandings. Research is a voyage of discovery of new knowledge. It comprises creating ideas and generating new knowledge that leads to new and improved insights and the development of new materials, devices, products, and processes.

Research is a scientific approach to answering a research question, solving a research problem, or generating new knowledge through the systematic and orderly collection, organization, and analysis of data to make research findings useful in decisionmaking.

Research comprises “creative and systematic work” undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications. It is to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. A research project may also be an expansion on past work in the field. For ex- a school research

project, they can be used to develop further a student's research prowess to prepare them for future jobs or reports. Test validity of instruments, procedures, or experiments, research may replicate elements of prior projects or the project as a whole.

### **Characteristics of Research**

- 1 The research should focus on priority problems.
- 2 The research should be systematic. It emphasizes that a researcher should employ a structured procedure.
- 3 The research should be logical. Without manipulating ideas logically, the scientific researcher cannot make much progress in an investigation.
- 4 The research should be reductive.
- 5 The research should be replicable.
- 6 The research should be generative.
- 7 The research should be action-oriented.
- 8 The research should follow an integrated multidisciplinary approach, research approaches from more than one discipline are needed.
- 9 The research should be participatory, involving all parties.

### **TYPES OF RESEARCH**

#### **1 Basic Research**

Basic research is mostly conducted to enhance knowledge. It covers fundamental aspects of research is knowledge expansion.

#### **2 Applied Research**

Applied research focuses on analyzing and solving real-life problems. This type of research refers to study that helps solve practical problems using scientific methods.

#### **3 Problem Oriented research**

As the name suggests, problem-oriented research is conducted to understand the exact nature of the problem to find out relevant solutions.

#### **4 Problem Solving Research**

This type of research is conducted by companies to understand and resolve their own problems. The problem-solving research uses applied research to find solutions to the existing problems.

#### **5 Qualitative Research**

Qualitative research is a process that is about inquiry that helps in-depth understanding of the problems or issues in their natural settings. This is a non- statistical research method.

#### **6 Quantitative Research**

Quantitative research involves a larger population as more no. of people means more data. In this manner, more data can be analyzed to obtain accurate results.

### **IMPORTANCE OF RESEARCH**

#### **1 Research expands our knowledge base-**

The most obvious reason to do research is that we learn more. Research allows us to build on any personal experience we have with the subject. The process of research opens up new opportunities for learning and growth.

**2 Research Gives you the Latest Information-**

Research encourages us to find the most recent information available. In certain fields, especially scientific ones, there's always new information and discoveries being made. Staying updated prevents you from falling behind and giving info that's inaccurate or doesn't paint the whole picture. With the latest info, we will be better equipped to talk about a subject and build on ideas.

**3 Research helps us to know what we're up against-**

In business, we will have competition. Researching our competitors and what they are up to helps us formulate your plans and strategies. We can figure out what sets we apart. In other types of research might identify diseases, classify symptoms, and come up with ways to tackle them.

**4 Research builds our credibility-**

People will take what we have to say more seriously when they can tell us are informed. Doing research gives us a solid foundation on which we can build our ideas and opinions. We can speak with confidence about what we know is accurate. When we're done the research, it's much harder for someone to poke holes in what we're saying. We research should be focused on the best sources. When our research is good, though, people are more likely to pay attention.

**5 Research helps us narrow our scope-**

When we're circling a topic for the first time, we might not be exactly sure where to start. Most of the time, the amount of work ahead of us is overwhelming. Whether we're writing a paper or formulating a business plan, it's important to narrow the scope at some point. Research helps us to identify the most unique and/or important themes that fit best with the project and its goals.

**6 Research teaches us better discernment-**

Doing a lot of research helps us sift through low-quality information. The more research we do on a topic, the better we will get at discerning what's accurate and what's not. We will also get better at discerning the gray areas where information may be technically correct but used to draw questionable conclusions.

**7 Research introduces us to new ideas-**

We may already have opinions and ideas about a topic and ideas about a topic when we start researching. More we research, the more viewpoints we will come across. This encourages us to entertain new ideas and perhaps take a closer look at ours. We might change our mind about something or, at least, figure out how to position our ideas as the best ones.

**8 Research helps with problem-solving-**

Whether it's personal or professional problem, it helps to look outside oneself for help. Depending on what issue is, our research can focus on what others have done before.

We might just need more information, so we can make an informed plan of attack and an informed decision. When we know we've collected good information, we will feel much more confident in our solution.

**9 Research helps us reach people-**

Research is used to help raise awareness of issues like climate change, racial discrimination, gender inequality, and more. Without hard facts, it's very difficult to prove that climate change is getting worse or that gender inequality isn't progressing as quickly as it should.

The public needs to know what the facts are, so they have a clear idea of what "getting worse" or "not progressing" actually means.

## 10 Research encourages curiosity-

The research process rewards curiosity. When we're committed to learning, we're always in a place of growth. Curiosity is also good for our health. Studies show curiosity is associated with higher levels of positivity, better satisfaction with life, and lower anxiety.

## CONCLUSIONS

The conclusions of a research paper is where we wrap up our ideas and leave the reader with a strong final impression. It has several key goals: Restate the problem statement addressed in the paper or findings. Suggest the key takeaways from our paper.

## TYPES OF RESEARCH

### Meaning of Research

Research is the careful consideration of study regarding a particular concern or research problem using scientific methods. According to the American sociologist Earl Robert Babbie, "research is a systematic inquiry to describe, explain, predict, and control the observed phenomenon. It involves inductive and deductive methods." Fundamental and applied research are the two main research categories. Most research types can be traced back to being fundamental or applied, depending on the study's goals.

### 1. Fundamental research:

Fundamental also known as basic or theoretical, research is designed to help researchers better understand certain phenomena in the world. It looks at how things work but does not seek to find how to make them work better. This research attempts to broaden your understanding and expand scientific theories and explanations.

**Example:** A company studies how different product placements affect product sales. This study provides information and is knowledge-based.

### 2. Applied research:

Applied research is designed to identify solutions to specific problems or find answers to particular questions. It offers knowledge that is applicable and implementable.

#### Types of applied research include:

- **Technological:** This research looks for ways to improve efficiency in products, processes and production.
- **Scientific:** This research measures certain variables to predict behaviors, outcomes and impact.

**Example:** A student working on a doctorate in education studies ways to increase student involvement in the classroom. This research focuses on a defined problem and is solution-based.

### 3. Actual research:

Action research refers to examining actions, assessing their effectiveness in bringing about the desired outcome and choosing a course of action based on those results. It is typically used in educational settings for teachers and principals to perform a type of self-assessment and course correction.

**Example:** A teacher collects data about their methods of teaching fifth-grade math. At the end of the first school quarter, they discovered only 33% of students demonstrated proficiency in the concepts. As a result, the teacher implements new methods for the second quarter.

### 4. Causal research:

Causal research, also called explanatory research, seeks to determine cause-and-effect relationships between variables. It identifies how much one variable may cause a change in the

other. Causal research is important for evaluating current processes and procedures and determining if and how changes should take place.

**Example:** A business studies employee retention rates before and after instituting a work-from-home policy after six months of employment to see if the approach increases employee retention.

### 5. Comparative research:

Comparative research identifies similarities and differences between two individuals, subjects or groups.

**Example:** A business owner reviews new hire training documentation and discovers that new employees receive much of the same information at orientation and in their initial departmental training. The owner incorporates materials into one session to allow more time for department-specific training.

### 6. Fixed research:

Fixed research involves procedures determined ahead of time, such as how often testing will take place, where it will take place, the number of subjects and their types. The research depends on precise conditions and compliance with predetermined protocols to reduce variables. Experimentation is often fixed research.

**Example:** A researcher wants to test how different labels affect consumers' ratings of a sports drink. Participants are given the same drink with various labels at the same time and take a survey about taste and overall impressions. The timing of providing each drink and the subsequent surveys are critical to the study's validity.

### 7. Flexible research:

Flexible research allows procedures to change throughout the course of the experiment.

The different types of flexible research include:

- **Case studies:** Case studies are in-depth analyses and observations about a specific individual or subject.
- **Ethnographic studies:** Ethnographic studies are in-depth analyses and observations of a group of people.
- **Grounded theory studies:** Grounded theory studies are designed to develop theories based on carefully collected and analyzed data.

**Example:** A physician uses a case study methodology to follow a patient through symptoms, treatment and recovery.

### 8. Experimental Research:

This study involves objective, systematic, controlled investigation for purpose of predicting and controlling the phenomena. It also includes examining the probability and causality among variables.

#### Advantages-

- Best in establishing the cause and effect relationships
- Artificiality
- Feasibility
- Unethical
- Variables-

There will be two variables- Dependent and Independent.



**9. Exploratory Research:**

This type of research will be conducted for a problem that has not been clearly defined. It helps to determine the best research design, data collection method and selection of subjects. It is quite informal relying on the secondary research.

**For Example:** Online marketing and exploring through different sites.

**10. Policy research:**

Policy research examines the effects of current government or social policies or predicts the potential effects of proposed policies related to the distribution of resources.

**Policy Researchers Often Work Within Government Agencies and Conduct the Following Types Of Studies:**

- Cost analysis
- Cost-benefit analysis
- Program evaluation
- Needs analysis

**Example:** An agency may research how a policy for vaccine distribution will affect residents in rural areas. The outcome may change where the government sets up free shot clinics.

**Criteria of Good Research:-**

A research in order to qualify as a good research must indeed possess the following criteria:-

1. **Defined** = The purpose of the research should be clear. Objectives be defined properly. The concepts used should be common and practical.
2. **Detailed** = The research procedure used should be described in detail. It is to be ensured that another researcher gets enough scope to repeat the research enabling him for further advancement, keeping in continuation and pace with what has already been achieved.
3. **Planned** = The research should be planned in a systematic manner. The procedural design of the research should be planned carefully. This is done in order to ascertain and yield results that are as objective as possible.
4. **Clarity** = The researcher should be unbiased and clear. He is required to report with complete frankness, flaws in procedural design, and estimate their effects upon the findings.
5. **Adequate** = The analysis of data should be sufficiently adequate to reveal its significance and the method of analysis used should be appropriate.
6. **Confined** = The conclusions drawn should be confined only to those justified by the data of the research and limited to those for which the data provides an adequate basis.
7. **Experienced Researcher** = Greater confidence of the research is guaranteed in case the researcher is experienced, has a good reputation in research and is a person of integrity.

**In other words, we can state the qualities of a good research as under:-**

**A. Good Research Is Systematic:**

It means that the research is structured with specific steps. Those specific steps are to be taken in a specified sequence. The research should be in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusion. What the main focus is, rule of thumb should be ruled out as it works upon merely by guesses.

**B. Good Research Is Logical:**

This implies that the research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole, whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise. The research should be logical and not abrupt, and not based on intuition or rule of thumb of the researcher. In fact the logical reasoning makes research more meaningful in the context of decision making.

**C. Good Research Is Empirical:**

It implies that the research is related basically to one or more aspects of a real situation. A good research deals with concrete data that provides a basis for external validity to research results. Generally, it deals with practical problems and tries to provide for various solutions and suggests for ways to deal with it.

**D. Good Research Is Applicable:**

This characteristic allows the research results to be verified by replicating the study and thereby building a sound basis for decisions. It can also be used for further studies.

**Research: Theory and Fact**

The word "research" comes from an old French word that means searching and searching again. So, when we talk about research, we're essentially talking about looking for information and trying to improve our understanding of a specific topic. Think of research as a way of finding out new things or solving problems in a very organized and scientific way. It's like going on a journey to discover something you didn't know before.

**In research, there are three main steps:**

- **Data Collection:** This means collecting information by observing, measuring, and recording things.
- **Data Analysis:** After we collect all this information, we organize it and try to figure out what it means. We look for patterns and make general conclusions from it.
- **Report Writing:** This is like telling a story about what we found during our research. We write a report to share our discoveries with others.

So, research is like a systematic adventure where we search for new knowledge and share what we've learned with others. It's a way of finding answers and making informed decisions.

**What is theory?**

A social theory is essentially a system of interconnected ideas that organizes our understanding of the social world. These theories are constantly evolving as people discuss how society operates. Often, people use theories without explicitly labelling them as such. For example, when someone suggests that a lack of education leads to poverty or that a decline in traditional moral values causes higher crime rates, they are expressing theories. However, these layman theories tend to be less structured, not formally developed, and challenging to test with empirical evidence. In comparison, academic social theories are more complex. It's important to note that a theory is distinct from speculation or a hypothesis. A theory remains speculative until it is substantiated. When evidence supports a theory, it becomes a fact. Facts are considered definite and self-evident. The role of a theory is to organize and give meaning to these facts. When facts are arranged, connected, and interpreted in a meaningful way, they form a theory. While facts contribute to building theories, theories themselves are not mere speculation. Within a theory, facts can be logically analysed, and other relationships beyond those explicitly stated can be inferred. However, the correctness of such deductions cannot be guaranteed. These deductions are referred to as hypotheses. Hypotheses must be tested and, when successfully validated, become part of future theoretical frameworks. In essence, a

theory and a hypothesis share a close relationship in the process of understanding and explaining the world.

### **Element of Theory**

The fundamental components involved in constructing a theory include four key elements: concepts, variables, statements, and formats. These elements are universally present in all theories, despite varying opinions on what constitutes a theory.

- a) **Concepts:** The foundation of theories lies in concepts, which represent various phenomena. Concepts serve to pinpoint the essential aspects of the world that are considered significant at a particular moment. These concepts are defined in a structured manner, allowing us to visualize and understand the phenomena they represent. Precise definitions are crucial in sociology, as unlike the physical sciences, special symbols cannot be used. Instead, concepts are defined as accurately as possible to ensure they convey the same meaning to all users. The use of concepts in theory building reveals a level of abstraction.
- b) **Variables:** Scientific theories should incorporate concepts that represent the variable characteristics of the world. To comprehend events, it is essential to visualize how changes in one phenomenon relate to changes in another. In the physical sciences, variables are the qualities of objects that can be physically manipulated. In social sciences, variables refer to attributes that remain constant for each object but are observed to vary in terms of quantity, amount, or strength across different samples and aggregate groups. Variables are used to measure social constructs like age, class, etc., in a way that allows for numerical analysis. An important characteristic of a variable is its ability to reflect variations within a population and not remain constant.
- c) **Statements and Formats:** The concepts within a theory must be interconnected, forming theoretical statements. These statements outline the manner in which events represented by concepts are interrelated. Simultaneously, they provide an interpretation of why and how these events should be connected to one another. This connection between concepts generates theoretical statements that elucidate the relationships between phenomena.

**Purpose of Research:** Research is all about digging into a specific topic to either find new information or confirm what we already know. In simple terms, it helps us learn new things.

### **Types of Research:**

**Exploration:** Think of this like an adventure. When we explore, we're trying to get to know a social issue or a problem better. If nobody has really talked about a topic before and you start studying it, that's exploratory research. It's like the first step in understanding something. Exploratory research helps us come up with precise questions for future studies. It's creative and open-minded and doesn't stick to one theory or set of questions.

**Description:** This is like taking a close look at something and describing it in detail. Descriptive research starts with a clear subject, and its job is to give us a thorough picture of that subject. Instead of explaining why something happens, it focuses on the "how" and "who" questions. For example, it might describe how people behave in a certain situation.

**Explanatory Research:** This type of research is like being a detective. It's not just about describing what happened, but it's trying to figure out why it happened. In explanatory research, we don't just state facts; we also try to come up with new explanations or reasons for why things happen the way they do. We then gather evidence to back up these explanations. So, in a nutshell, explanatory research is all about explaining why certain events occur and sometimes even coming up with new ideas to understand them better.

**Steps in Research:**

Choosing the Research Problem and Stating the Hypothesis: First, you decide what you want to study and what you expect to find. This sets a clear goal for your research. Formulating the

**Research Design:** Next, you plan how you'll collect and analyse your data. Think of it as making a detailed plan for your research journey.

- **Collection of Data:** In this step, you gather information, like collecting pieces of a puzzle.
- **Coding and Analysing Data:** Once you have all the data, you organize it and look for patterns, just like putting the puzzle pieces together to see the bigger picture.
- **Interpreting the Results:** Now, you make sense of what you found and see if it supports your initial idea. It's like figuring out if your puzzle fits together the way you thought it would.

These steps are all connected. You can't analyse data without collecting it first, and research is like a circle because you might need to go back to earlier steps if things don't work out as expected.

After you finish your research, it's a good idea to do it all over again to make sure your findings weren't just a coincidence. This is called "replication." So, it's important to design your study in a way that others can easily repeat it to check your results.

**Relationship Between Research Theory and facts****Meaning of Research**

Certainly, research is an ongoing process in numerous fields and occupations. Its primary purpose is to uncover new information, validate existing knowledge, and question complex concepts that might be challenging to comprehend based on current data. For effective managerial decision-making, it is crucial to understand the various steps involved in problem-solving.

Research involves systematically observing processes to discover more efficient methods of achieving objectives and evaluating the validity of set targets. It plays a vital role in critically assessing our work methods, policy execution, and instructional approaches within our professions.

In reality, research is a subconscious activity inherent in our daily lives, whether we are purchasing everyday items, a car, electronic devices, or planning a holiday. It aids us in making informed decisions, reducing efforts, and ensuring the validity of our choices.

**RESEARCH METHODOLOGY**

A research methodology serves as a structured plan detailing the procedures employed in a particular research endeavor. It delineates the methods and techniques used to gather and analyze information related to a specific research subject. Essentially, it outlines the systematic approach adopted by researchers to identify, gather, interpret, and evaluate data pertinent to their study. The purpose of a research methodology is to enable researchers to attain credible, accurate, and consistent outcomes while fulfilling their research goals. It involves careful planning and organization, ensuring that the chosen methods align with the research objectives and can produce dependable results.

In essence, a well-developed research methodology is fundamental to the validity and reliability of any research project. It provides a roadmap for researchers, guiding them on how to conduct their study effectively. By defining the strategies, tools, and techniques used to collect and analyze data, researchers can enhance the quality and trustworthiness of their findings.

Moreover, a robust research methodology also aids in replicating the study in similar contexts, allowing other scholars to validate the results and contribute to the existing body of knowledge.

In summary, a research methodology acts as a blueprint, directing researchers on how to carry out their study in a manner that ensures the accuracy, consistency, and credibility of their findings. It is a crucial element that shapes the entire research process, guiding researchers toward meaningful and reliable outcomes in their pursuit of knowledge.

### **“Relationship between Research Theory and Facts”**

## **INTRODUCTION**

The intricate relationship between research theory and facts constitutes the very essence of scientific exploration, shaping the way we perceive and comprehend the world. In this multidimensional interplay, theories emerge as the bedrock of scientific understanding. They provide the essential framework upon which researchers formulate hypotheses and design experiments. These hypotheses, serving as educated conjectures, guide the meticulous collection of empirical evidence. It is within this nexus of theories and facts that the essence of scientific inquiry thrives, fostering an environment where knowledge is perpetually refined, expanded, and redefined.

### **I. The Role of Research Theory**

At the heart of scientific discovery lies research theory, a conceptual scaffold constructed from existing knowledge and observations. Theories encapsulate the collective wisdom of the scientific community, offering a systematic lens through which phenomena are analyzed and understood. These theoretical frameworks not only provide structure but also serve as catalysts for curiosity, propelling researchers toward unexplored realms of inquiry. They offer a roadmap, delineating the boundaries of what is known and inspiring the formulation of hypotheses, the stepping stones toward empirical exploration.

### **II. Formulation of Hypotheses**

Hypotheses, born from the womb of theories, are pivotal in the scientific method. They encapsulate the essence of scientific curiosity, articulating specific and testable predictions. Rooted in theories, hypotheses serve as the guiding stars for research endeavors. A well-crafted hypothesis not only encapsulates the essence of a theory but also channels the researcher's efforts, steering them toward the collection of pertinent facts. Through hypotheses, theories transition from abstract concepts into tangible, testable propositions, setting the stage for empirical examination.

### **III. Gathering Empirical Evidence**

The pursuit of facts, the empirical backbone of scientific inquiry, involves meticulous observation, rigorous experimentation, and sophisticated data analysis. Researchers meticulously design experiments, employing methodologies carefully crafted to capture the essence of the hypothesis. Through systematic observation and data collection, a tapestry of facts is woven. These facts, grounded in the reality of the natural world, serve as the empirical validation or refutation of hypotheses. In this empirical quest, theories and facts engage in a symbiotic dance, where theories guide the collection of facts, and facts, in turn, validate or challenge the very theories from which they were born.

### **IV. The Interplay Between Theory and Facts**

The relationship between theory and facts is not static; it is dynamic, characterized by a continuous interplay. When empirical evidence aligns harmoniously with theoretical predictions, theories are fortified, gaining credibility and acceptance within the scientific community. This congruence between theory and facts illuminates the path toward a deeper understanding of natural phenomena. However, the scientific landscape is also marked by the

intriguing interplay between conflicting facts and established theories. When facts challenge existing theories, it catalyzes scientific revolutions, propelling researchers toward innovative paradigms and reshaping the contours of knowledge.

### **V. Evolution of Scientific Knowledge**

Scientific knowledge, in its perpetual state of flux, undergoes a constant process of evolution. The dynamic synergy between research theory and facts propels this evolution, driving scientific progress. New facts, gleaned from pioneering experiments and observations, often lead to the inception of novel theories. These fresh theoretical frameworks, in turn, inspire further empirical exploration, resulting in the generation of additional facts. It is this iterative cycle of theory formulation, empirical validation, and subsequent theory refinement that underpins the remarkable evolution of scientific knowledge, ushering humanity into ever-expanding frontiers of understanding.

### **VI. Challenges and Limitations**

Amidst the awe-inspiring process of scientific exploration, challenges and limitations cast their shadows. Human bias, experimental constraints, and the complexity of certain phenomena can cloud the relationship between theory and facts. Researchers, driven by their hypotheses and influenced by their perspectives, might inadvertently skew observations.

Experimental limitations, whether technological or ethical, can constrain the gathering of comprehensive facts, limiting the scope of empirical validation. Additionally, the enigmatic nature of certain phenomena might defy easy categorization, rendering the establishment of clear facts a daunting task. Acknowledging these challenges is paramount, as it underscores the importance of rigorous methodology, critical thinking, and ongoing scrutiny in scientific research.

## **CONCLUSION**

In the grand tapestry of scientific inquiry, the relationship between research theory and facts emerges as a profound narrative, weaving together the abstract realms of hypotheses and the tangible fabric of empirical evidence. The synergy between theory and facts propels the relentless pursuit of knowledge, fueling the engines of scientific progress. It is within this symbiotic relationship that the essence of scientific exploration thrives, enabling humanity to unravel the mysteries of the universe, one hypothesis and one empirical observation at a time. As we navigate the complex web that binds theory and facts, we not only illuminate the path to discovery but also embrace the inherent uncertainties and challenges, fostering a deep appreciation for the intricacies of the scientific process.

### **Stages in Research Process**

The research process consists of a series of systematic procedures that a researcher must go through in order to generate knowledge that will be considered valuable by the project and focus on the relevant topic.

To conduct effective research, you must understand the research process steps and follow them. Here are a few steps in the research process to make it easier for you:

#### **Step 1: Identify the Problem**

Finding an issue or formulating a research question is the first step. A well-defined research problem will guide the researcher through all stages of the research process, from setting objectives to choosing a technique. There are a number of approaches to get insight into a topic and gain a better understanding of it. Such as:

- A preliminary survey
- Case studies

- Interviews with a small group of people
- Observational survey

**Step 2: Evaluate the Literature**

A thorough examination of the relevant studies is essential to the research process. It enables the researcher to identify the precise aspects of the problem. Once a problem has been found, the investigator or researcher needs to find out more about it.

This stage gives problem-zone background. It teaches the investigator about previous research, how they were conducted, and its conclusions. The researcher can build consistency between his work and others through a literature review. Such a review exposes the researcher to a more significant body of knowledge and helps him follow the research process efficiently.

**Step 3: Create Hypotheses**

Formulating an original hypothesis is the next logical step after narrowing down the research topic and defining it. A belief solves logical relationships between variables. In order to establish a hypothesis, a researcher must have a certain amount of expertise in the field.

It is important for researchers to keep in mind while formulating a hypothesis that it must be based on the research topic. Researchers are able to concentrate their efforts and stay committed to their objectives when they develop theories to guide their work.

**Step 4: The Research Design**

Research design is the plan for achieving objectives and answering research questions. It outlines how to get the relevant information. Its goal is to design research to test hypotheses, address the research questions, and provide decision-making insights.

The research design aims to minimize the time, money, and effort required to acquire meaningful evidence. This plan fits into four categories:

- Exploration and Surveys
- Experiment
- Data Analysis
- Observation

**Step 5: Describe Population**

Research projects usually look at a specific group of people, facilities, or how technology is used in the business. In research, the term population refers to this study group. The research topic and purpose help determine the study group.

Suppose a researcher wishes to investigate a certain group of people in the community. In that case, the research could target a specific age group, males or females, a geographic location, or an ethnic group. A final step in a study's design is to specify its sample or population so that the results may be generalized.

**Step 6: Data Collection**

Data collection is important in obtaining the knowledge or information required to answer the research issue. Every research collected data, either from the literature or the people being studied. Data must be collected from the two categories of researchers. These sources may provide primary data.

- Experiment

- Questionnaire
- Observation
- Interview

**Secondary data categories are:**

- Literature survey
- Official, unofficial reports
- An approach based on library resources

**Step 7: Data Analysis**

During research design, the researcher plans data analysis. After collecting data, the researcher analyzes it. The data is examined based on the approach in this step. The research findings are reviewed and reported.

Data analysis involves a number of closely related stages, such as setting up categories, applying these categories to raw data through coding and tabulation, and then drawing statistical conclusions. The researcher can examine the acquired data using a variety of statistical methods.

**Step 8: The Report-writing**

After completing these steps, the researcher must prepare a report detailing his findings. The report must be carefully composed with the following in mind:

- o **The Layout:** On the first page, the title, date, acknowledgments, and preface should be on the report. A table of contents should be followed by a list of tables, graphs, and charts if any.
- **Introduction:** It should state the research's purpose and methods. This section should include the study's scope and limits.
- o **Summary of Findings:** A non-technical summary of findings and recommendations will follow the introduction. The findings should be summarized if they're lengthy.
- **Principal Report:** The main body of the report should make sense and be broken up into sections that are easy to understand.
- **Conclusion:** The researcher should restate his findings at the end of the main text. It's the final result.

**CONCLUSION**

The research process involves several steps that make it easy to complete the research successfully. The steps in the research process described above depend on each other, and the order must be kept. So, if we want to do a research project, we should follow the research process.

**Motivation in Research**

Motivation in research is a crucial factor that drives researchers to explore, investigate, and contribute to the body of knowledge in their respective fields. It plays a pivotal role in shaping the direction, quality, and outcome of research endeavours.

The possible motives for doing research may be either one or more of the following:

- Desire to get a research degree along with its consequential benefits.
- Desire to face the challenge in solving the unsolved problems, i.e., concern over practical problems initiate's research.



- Desire to get intellectual joy of doing some creative work.
- Desire to be of service to society.
- Desire to get respectability.
- Curiosity about unknown.
- Desire to understand the cause and effect of wide spread social problems.
- Appearance of novel and unanticipated situations.
- Desire to discover new and test old scientific procedure as an efficient way to gain useful and fundamental knowledge.

### **Techniques to Boost Motivation in Research:**

#### **❖ Set Clear Goals:**

- Define specific research objectives and goals.
- Break larger goals into smaller, manageable tasks.
- Create a timeline or research plan to track progress.

#### **❖ Find intrinsic Motivation:**

- Identify your personal interests and passions within the research topic.
- Connect your research to your long-term career goals and aspirations.

#### **❖ Stay Organised:**

- Maintain a well-organised workspace and digital files.
- Use tools like calendars to-do lists, or project management software.

#### **❖ Seek Support and collaborations:**

- Join research groups or teams to foster a sense of community and shared motivation.
- Collaborate with mentors, peers, or colleagues for guidance and feedback.

#### **❖ Celebrate milestones:**

- Acknowledge and reward yourself when you achieve research milestones.
- Small celebrations can help maintain motivation over time.

#### **❖ Maintain a routine:**

- Establish a daily or weekly research routine.
- Consistency can help create a sense of purpose and habit.

#### **❖ Stay Informed:**

- Keep up with the latest developments in your research field.
- Attend conferences, workshops, and seminars to stay motivated and inspired.

#### **❖ Set Realistic Expectations:**

- Understand that research can be challenging and may not always yield immediate results.
- Manage expectations to prevent frustration.

❖ **Visualize success:**

- Imagine the impact of your Research on your field or society.
- Visualizing positive outcomes can boost motivation.

❖ **Take breaks:**

- Avoid burnout by taking regular breaks and practicing self-care.
- Short breaks can refresh your mind and improve productivity.

❖ **Embrace Failure as learning:**

- Understand that set backs and failures are part of the research process.
- Use them as opportunities to learn and improve.

❖ **Incorporate variety:**

- Rotate tasks or switch between different aspects of your research to prevent monotony.
- Variety can keep motivation levels high.

❖ **Share your progress:**

- Share your research progress with others.
- Explaining your works to others can reinforce your commitment.

❖ **Track your progress:**

- Keep a research journal or log to document your daily accomplishments.
- Seeing your progress can be motivating.

❖ **Reward yourself:**

- Plan rewards for yourself upon completing significant research milestones.
- Rewards can serve as incentives.

Motivation is the lifeblood of research. It propels researchers forward, fuels their curiosity, and empowers them to make meaningful contributions to the advancement of knowledge.

Understanding, nurturing, and harnessing motivation are essential aspects of conducting successful and impactful research.

### **Research Approaches**

Research methodology is a way of explaining how a researcher intends to carry out their research. It is a logical, systematic plan to resolve a research problem. A methodology gives out details of researcher's approach to a research so as to ensure reliable, valid results that address their aims and objectives are obtained.

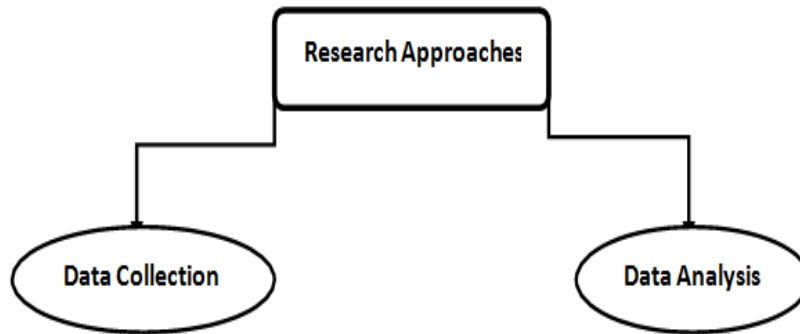
#### **Definition**

Research approaches refers to the systematic and structured ways that researchers use to conduct research, they differ in terms of their underlying logic and methods of inquiry.

#### **Meaning**

The research approach is a plan and procedure that consists of the steps of broad assumptions to detailed methods of data collection, analysis and interpretation. It is based on the nature of the research problem being addressed. The research approach is divided into two categories:

## 1. The approach of data collection and



## 2. The approach of data analysis or reasoning.

### Purpose of Research Approach

The purpose of research approach is to provide a systematic and logical way of conducting research to achieve the research goals and objectives. It helps the researcher to plan, design and conduct research effectively and efficiently, ensuring that the research is reliable, valid and useful.

Different research approaches have different purposes and are suited for different types of questions and contexts. Some specific purposes of different research approaches are:

#### Deductive Approach:

- To test hypothesis or theories.
- To confirm existing knowledge.
- To generalize findings to broader populations.

#### Inductive Approach:

- To identify different patterns, themes, relationships in data.
- To generate new theories or hypothesis.
- To develop an understanding of social as well as natural phenomenon.

#### Abductive Approach:

- To propose new research questions or directions.
- To develop new theories or explanations when existing ones are inadequate.
- To identify new patterns that may have been overlooked by existing theories.

### Types of Research Approach

**The three main research approaches are:**

#### Deductive Approach

The deductive approach starts with a theory or a hypothesis and the researcher tests the hypothesis through the collection and analysis of data. The researcher develops a research design and data collection methods based on the theory or hypothesis. The goal of this approach is to confirm or reject the hypothesis.

**Example:** A researcher starts with a theory or hypothesis and then develops a research design to test it.

The researcher designs a study to test his hypothesis by surveying students to assess their feedback from teachers and compare their academic performance.

The research hypothesize that students who receives positive feedback from their teachers are more likely to perform well academically.

### Inductive Approach

The inductive approach starts with the collection and analysis of data. The researcher develops a theory or an explanation based on the patterns and themes that emerge from the data. The goal of this approach is to generate a new theory or to refine an existing one.

**Example:** A researcher begins with data and then develops a theory or explanation to account for it.

A researcher collects data on the experiences of immigrants in a particular city and then use that data to develop a theory about the factors that contribute to their success or challenges.

### Abductive Approach

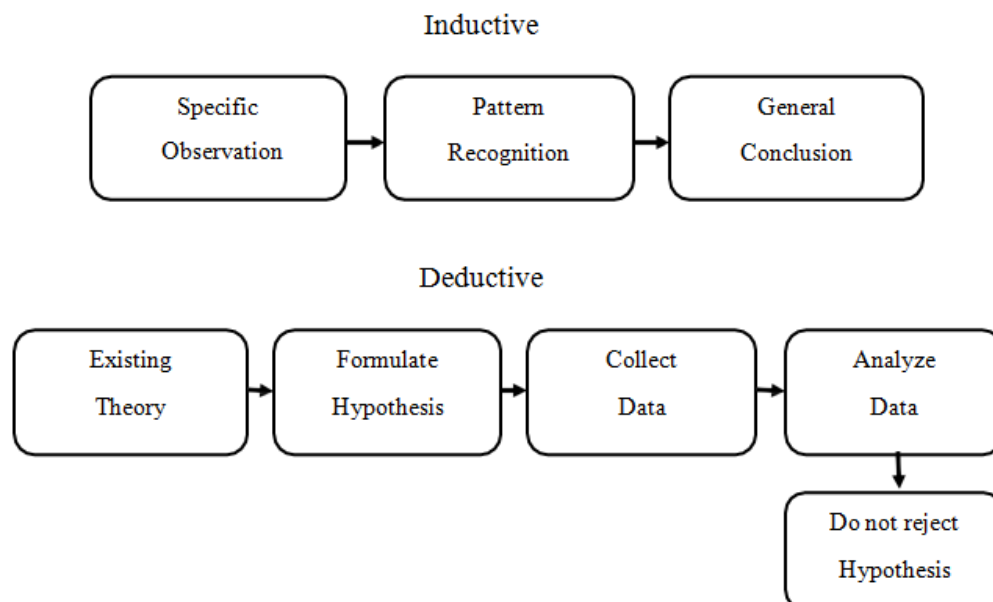
The abductive approach is a combination of deductive and inductive approaches. It starts with a problem or a phenomenon that is not fully understood and the researcher develops a theory or an explanation that can account for the data. The researcher then tests the collection and analysis of more data. The goal of this approach is to generate a possible explanation or theory that can be further refined or tested.

**Example:** Diagnosis in medicine using abductive approach by a researcher.

A physician starts with a set of symptoms and uses deductive reasoning to generate a list of possible diagnosis.

The physician then uses inductive reasoning to gather more information about the patient and the symptoms to narrow down the list of possible diagnosis and arrive at a final diagnosis.

## INDUCTIVE VS. DEDUCTIVE REASONING



**Research Approach Methods**

Research approach methods are the specific techniques or tools that are used to conduct research within a particular research approach.

Some examples of commonly used methods in research approach are:

**Deductive approach methods:**

- ✓ Statistical analysis to test the significance of relationships between variables.
- ✓ Surveys and questionnaires to collect data from a large sample of participants.
- ✓ Content analysis to analyze and interpret text-based data.
- ✓ Experiments to manipulate variables and test hypotheses under controlled conditions.

**Inductive approach methods:**

- ✓ Observations to gather data on naturalistic settings and behaviors.
- ✓ Interviews to collect in-depth data and explore individual experiences and perspectives.
- ✓ Grounded theory to develop theories or concepts from data through iterative cycles of analysis and interpretation.
- ✓ Focus groups to collect data from group of participants who share common characteristics or experiences.

**Abductive approach methods:**

- ✓ Exploratory research to gather preliminary data and generate new research questions.
- ✓ Case studies to examine a phenomenon in its real-life context and generate new insights or explanations.
- ✓ Concept mapping to visually represent relationships and patterns in data and develop new theoretical frameworks.

**Applications of Research Approach**

**Some common applications of research approach are:**

**➤ Educational Research**

Researchers use research approaches to study teaching and learning processes, develop new teaching methods and materials to improve educational results.

**➤ Academic Research**

Researchers use research approaches to study a wide range of topics in various academic fields such as sociology, psychology, economics and education.

**➤ Business Research**

Organizations use research approaches to gather information on customer preferences, market trends and competitor behaviour to make informed business decisions.

**➤ Marketing Research**

Various companies use research approaches to study consumer behaviour, preferences and needs in order to develop effective marketing strategies.

**➤ Medical Research**

Researchers use research approaches to study various diseases and medical conditions, develop new treatments and drugs, and improve public health.

➤ **Legal Research**

Lawyers and legal scholars use research approaches to study legal precedents, statutes and regulations in order to make legal arguments and develop new laws and policies.

➤ **Social Research**

Researches use research approaches to study social issues such as poverty, crime, discrimination, inequality and to develop policies and programs to address these issues.

➤ **Environmental Research**

Researchers use research approaches to study environmental problems such as climate change, pollution, biodiversity loss and to develop strategies to change these problems.

## WHAT IS RESEARCH PROBLEM?

### Meaning of Research

Research is a systematic and scientific set of activities to get the solution of a predefined problem with the help of reviewing literature and analyzing the collected data to influence the conclusion.

## DEFINITION OF RESEARCH

### According to Redman Mory,

“Research is a systematic effort to gain a new knowledge.”

### According to Emary,

“Research can be defined as any organized activity designed and carried out to provide information for solving a problem.”

## MEANING OF RESEARCH PROBLEM

A Research problem may be defined as an area of concern, a gap in the existing knowledge or a deviation in the norm or standard that points to the need for further understanding and investigation.

## DEFINITION OF RESEARCH PROBLEM

### According to R.S. Woodworth,

“A Research problem is a situation for which we have no ready solution.”

### According to John Dewey,

“A Problem represents the information’s required by researchers and seeks solution for it.

### In a broad way we can define Research Problem as follows:-

- Research Problem definition begins with identifying a broad problem area, followed by learning more about the problem, identifying the various variables and how they are related, considering practical aspects, and finally developing the problem statement.
- The importance of Research Problem is that it guides the research and helps advance human understanding and development of practical solutions.
- A Research Problem concerns an area of interest, a situation necessitating improvement, and obstacle requiring eradication, or challenge in theory or practical applications.
- Different types of Research Problem include **Theoretical Research Problem**, **Applied Research Problem** and **Action Research Problem**, and these depend on the discipline and nature of the study.
- An ideal Problem is original, important, feasible, specific and based on evidence.

### Characteristics of Research Problem

1. **Novel:** - An ideal Research Problem introduce a fresh perspective, offering something new to the existing body of knowledge. It should contribute original insights and address unresolved matters or essential knowledge.
2. **Significant:** - A Problem should hold significant in terms of its potential impact on theory , practice , policy , or the understanding of a particular phenomenon addressing a gap in knowledge , a practical concern , or a theoretical concern that holds significance.
3. **Clear and specific:** - A well defined Research problem is clear and specific, leading no room for ambiguity. It should be easily understandable. Ensuring specific in the problem ensure that it focused, addresses a distinct aspect of a broader topic and is not vague
4. **Rooted in evidence:** - A good Research Problem leans on trustworthy evidence and data while dismissing unverified information. It must also consider ethical guidelines, ensuring the well-being and rights of any individual or group involved in the study.

In other words, research problem, also called a research issue, is a statement about an area or field of concern that professionals aim to understand and address. The aim of the research may be clarify a contradiction or fill a knowledge gap. Research may decide to conduct research to solve a problem, contribute to solve all scientific change, or add additional knowledge to an existing topic. The purpose of research is typically to introduce readers to the research purpose and provide a framework for reporting results that can highlight discovered information.

### IDENTIFICATION OF RESEARCH PROBLEM

#### Meaning of Research Problem

A research problem is a specific question, problem or difficulty that needs to be investigated or analyzed.

It is a concise statement that expresses the difference between what is currently known and what needs to be known or the difference between current situation and a desired state.

#### STEPS IN RESEARCH PROBLEM IDENTIFICATION

- a) Statement of the problem in general way.
- b) Understanding the nature of the problem.
- c) Surveying the available literature.
- d) Developing the ideas through discussions.
- e) Rephrasing the research problem into a working proposition.

#### a) Statement of the problem in a general way

- Define the problem in general way.

**Example:** Does negative news interest people more than positive news?

- Narrow it down by rethinking over the problem.

**Example:** Does negative news such as robbery, corruption interest people more than positive news like country economic growth?

#### b) Understanding the nature of the problem

- Best way to understand the problem is through discussion.
- Discussion with the people who has good knowledge about the problem

**c) Surveying the available literature** Survey all the research which are already undertaken in related problem. It helps to:

- Narrow down the problem.
- To identify research gaps.
- Give new ideas in related area.
- Helps for research design.

**d) Developing the ideas through discussion**

- Discussion always produces useful information.
- Various new ideas can be developed through such an exercise.
- Researcher must discuss their problem with their colleagues and other who have enough experience in the same area. All in working on similar problems. This is known as experience survey.

**e) Rephrasing the reasearch problem**

- Rephrase the research problem in to operational term.
- **Initial research question:** Why is productivity in Japan so higher than in India?
- After, the problem has understood, available literature has taken place and discussion over the problem has taken place the question has rephrased.
- **Rephrased research question:** what factors were responsible for the high labour productivity of Japan's manufacturing industries during the decade 1971 to 1980 relative to India's manufacturing industries?

**Definition of research problem**

A research problem is a statement that addresses a gap in knowledge, a challenge or a contradiction in a particular field. Scientists use research problems to identify and define the aim of their study and analysis. A research problem may also help to identify key concepts and terms, overarching questions and variables associated with a study.

**Characteristics of an effective research problem**

- Reflecting on issues or required knowledge in a particular field prior to conducting a study
- Ensuring that the topic you aim to examine has a sufficient amount of relevant data
- Relying on reputable evidence and data and disregarding information that you can't verify
- Remaining practical, manageable and communicative with researchers involved in data collection and analysis
- Adhering strictly to a budget and timeline

**Types of research problem**

**Here are the three types of research problem:**

**1. Theoretical research problems**

Theoretical research problems allow you to contribute to the overall information and knowledge in an area of study. These kinds of research problems are exploratory and provide basic definitions of a problem's overarching nature or areas of informational gaps. Theoretical research problems can address contradictions between two or more perspectives or address an unresolved question.



## 2. Applied research problems

Applied research problems, or unsystematic problems, involve the practical use of theoretical knowledge, meaning that scholars may use a particular theoretical framework to gain information. It also includes an exploratory hypothesis and tests to verify the accuracy of the hypothesis. Social scientists typically use applied research problems in studies where the objective is to provide practical and applicable solutions to help specific individuals and groups if they encounter challenges.

## 3. Action research problems

Similar to applied research problems, action research problems also aim to provide solutions for problems but are typically more time-sensitive in nature. Action research problems can also be one component of a larger reflective process that combines ongoing research, analysis and action. Researchers develop and implement a research strategy to create innovative solutions and discoveries as soon as possible.

### Formulation of research problem

Identification and formulation of research problem is the first step of a research process. It is the challenging and difficult phase of the research process. A research problem is a question that a researcher wants to answer and a problem that a researcher wants to solve. Research problem refers to some difficulty which is a researcher's experience in the context of either a theoretical and practical situation and wants to obtain a solution for the same. Formulating your research problem enables you to make a purpose of your study clear to yourself and target readers.

#### It is statement about:

- an area of concern
- a condition to be improved
- a difficulty to be eliminated

#### The purpose of research problem statement is to:-

1. Introduce the reader to the importance of the topic being studied.
2. Place the problem into a particular context thus define the parameter of what is to be investigated.
3. Provide the framework for reporting the result and indicate what is probably necessary to conduct the study.

#### Steps of formulation of research problem 1. Identify a general area of interest:-

As you determine an area of study, consider areas that haven't been explored thoroughly or present challenges within a particular field. Assess how you might address the area of concern and whether you can develop a research problem related to this issue. If your research is action-based or applied, consider contacting those who work in a relevant field to attain feedback about problems to address. You can also follow up on research that others have already conducted. Consider these various aspects when choosing an area of interest:

- Contradictions between two or more theoretical perspectives
- Situations or natural relationships that haven't been investigated thoroughly
- Processes in an institution or organization that you and your research team could improve
- Areas of concern raised by individuals who work or are experts in a particular industry

#### 2. Learn more about the problem:-

The next step is to learn more about the area of interest. Ask yourself what you need to know about a particular topic before you begin your study. Assess who or what it might affect and

how your research could address those relationships. Consider whether other research groups have already tried to solve the problem you're interested in analyzing and how your approach might differ.

### **3. Review the context of the :-**

Reviewing the context of your research involves defining and testing the environmental variables in your project, which may help you create a clear and focused research problem. It may also help you note which variables are present in the research and how to account for the impact that they may have on it. By reviewing the context, you may easily estimate the amount of data your research is likely to require.

### **4. Determine relationships between variables:-**

After identifying the variables involved in your research, you can learn how they're related to one another and how these relationships may contribute to your research problem. Consider generating as many potential perspectives and variable interactions as possible. Identifying the relationships between variables may be useful when deciding the degree to which you can control them in your study and how they might affect potential solutions to the problem you're addressing.

### **5. Select and include important variables:-**

A clear and manageable research problem typically includes the variables that are most relevant to the study. A research team summarizes how they plan to consider and use these variables and how they might influence the results of the study. Selecting the most important variables can help the study's audience better understand the trajectory of your research and the potential impact of the solution.

### **6. Receive feedback and revise:-**

Consider contacting mentors, teachers or industry experts for feedback on your research problem. They may present you with new information to consider or suggest you edit a particular aspect of your research design. Revising your research problem can be a valuable step in creating impactful and precise research, as well as developing beneficial research skills.

## **CONCEPT OF HYPOTHESIS**

### **Definition of a Hypothesis:**

A hypothesis is a fundamental concept in scientific inquiry and research methodology. It serves as a crucial starting point in the scientific process, providing researchers with a structured way to explore and understand the world around us. At its core, a hypothesis is a statement or an educated guess that proposes a potential explanation for a specific phenomenon or question. It lays the foundation for empirical investigation, guiding researchers in the pursuit of knowledge and understanding.

### **Components of a Hypothesis:**

A hypothesis typically consists of the following components:

**Independent Variable:** This is the factor or condition that the researcher manipulates or examines to observe its effects.

**Dependent Variable:** The dependent variable is the outcome or result that the researcher measures or observes as a response to changes in the independent variable.

**Relationship:** The hypothesis should state the expected relationship between the independent and dependent variables. It outlines what the researcher predicts will happen if the independent variable is altered.

**Example of a Hypothesis:**

Suppose a biologist is studying plant growth and suspects that the amount of sunlight (independent variable) affects the height of a specific plant species (dependent variable). They might formulate a hypothesis like this:

“If the amount of sunlight received by the plant is increased, then the height of the plant will also increase.”

**Role in Scientific Research:**

The concept of a hypothesis is integral to the scientific method, a systematic approach used by scientists across various disciplines to investigate, analyze, and explain natural phenomena. A well-formulated hypothesis acts as a roadmap for scientific inquiry, directing researchers toward the collection of relevant data and the testing of their proposed ideas. Without hypotheses, scientific investigations would lack direction and purpose, making it difficult to draw meaningful conclusions or advance our understanding of the world.

**Key Characteristics of a Hypothesis:**

**Testability:** One of the defining features of a hypothesis is its testability. It must be possible to design experiments or gather data that can either support or refute the hypothesis. This requirement ensures that hypotheses are based on empirical evidence rather than mere speculation.

**Falsifiability:** A hypothesis must also be falsifiable, meaning that there must be a way to demonstrate that it is incorrect. If a hypothesis cannot be proven false, it lacks scientific validity. Scientists use experimentation and observation to determine whether a hypothesis is false or should be retained for further investigation.

**Hypothesis Development:**

Hypotheses are typically developed in response to a specific question or problem. Researchers start by identifying an area of interest or a phenomenon they wish to explain. They then conduct preliminary research to gather background information and understand existing knowledge related to the topic. Based on this information, they formulate a hypothesis that proposes a cause-and-effect relationship or an explanation for the observed phenomena.

**The Hypothetical "If-Then" Statement:**

A common way to structure a hypothesis is through an “if-then” statement. In this format, the hypothesis presents a clear prediction of what should happen if the proposed relationship is true. For example, “If [independent variable] is manipulated, then [expected outcome] will occur.” This format helps researchers articulate their expectations and design experiments accordingly.

This introduction sets the stage for a deeper exploration of hypotheses in scientific research. It emphasizes their importance as the foundation of empirical investigation and outlines key characteristics that make hypotheses essential tools in the pursuit of knowledge.

Subsequent pages will delve into the components of hypotheses, their types, formulation, testing, and evaluation.

**Testing Hypotheses****The Scientific Method:**

Testing hypotheses is a critical step in the scientific method, a systematic approach used by researchers to investigate and understand natural phenomena. The scientific method involves several key stages, and testing hypotheses is at the heart of the process.

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**Experimental and Observational Approaches:****1. Experimental Testing:**

In experimental research, researchers manipulate the independent variable, which is the factor or condition under investigation.

Controlled experiments are designed to isolate the effects of the independent variable while keeping all other factors constant. This control helps ensure that any observed changes in the dependent variable can be attributed to the manipulation of the independent variable.

Researchers collect data through careful observation and measurement, comparing outcomes between experimental and control groups if applicable.

The goal is to determine whether the results support or refute the hypothesis.

**2. Observational Testing:**

In observational research, researchers do not manipulate variables but instead observe and record naturally occurring phenomena.

Observational studies are often used when it is unethical or impractical to conduct experiments. They are common in fields like sociology, anthropology, and ecology.

Researchers gather data by observing subjects or situations, often over an extended period.

Data analysis focuses on identifying patterns, correlations, or relationships between variables, helping to test the hypothesis.

**Role of Control Groups and Variables:**

In experimental research, control groups are essential. These are groups that are treated identically to the experimental group, except for the manipulation of the independent variable. They provide a baseline for comparison.

Control variables are other factors that are kept constant during experimentation to ensure that they do not influence the results. This helps isolate the effects of the independent variable.

**Data Collection and Analysis:**

Data collection involves the systematic gathering of information related to the dependent variable under different conditions or treatments.

Statistical methods are often employed to analyze the data. This includes techniques like t-tests, ANOVA, regression analysis, and more, depending on the nature of the data and the research design.

Researchers assess whether the collected data supports the hypothesis by comparing it to the expected outcomes stated in the hypothesis.

**Drawing Conclusions:**

After conducting experiments or observations, researchers draw conclusions based on the results.

If the data aligns with the predictions made in the hypothesis, it suggests that the hypothesis is supported.

If the data contradicts the hypothesis, it indicates that the hypothesis is not supported, and researchers may need to revise their theories or explore alternative explanations.

**Iterative Nature of Hypothesis Testing:**

It's important to note that the testing of hypothesis is often an iterative process. If a hypothesis is not supported, researchers may refine it, develop new hypothesis, or explore different research avenues. This cyclic approach to hypothesis testing contributes to the dynamic nature of scientific inquiry and the advancement of knowledge.

## Evaluating Hypothesis

### The Significance Level and P-Values:

In hypothesis testing, the significance level (often denoted as  $\alpha$ ) is predetermined. It represents the threshold for statistical significance, typically set at 0.05 (5%). This value determines the level of confidence required to accept or reject a hypothesis.

Researchers calculate a test statistic (e.g., t-value, F-value, chi-squared statistic) and compare it to a critical value from a statistical distribution (e.g., t-distribution, F-distribution) to determine if the result is statistically significant.

The p-value is another crucial metric. It quantifies the probability of obtaining results as extreme as the observed data, assuming the null hypothesis (the default hypothesis that there is no effect or relationship) is true. A small p-value (usually less than  $\alpha$ ) suggests that the results are statistically significant, leading to the rejection of the null hypothesis.

### Acceptance or Rejection of Hypotheses:

If the p-value is less than or equal to the significance level ( $\alpha$ ), researchers typically reject the null hypothesis in favor of the alternative hypothesis. This suggests that the observed results are unlikely to occur by random chance alone, providing evidence in support of the hypothesis.

If the p-value is greater than  $\alpha$ , researchers fail to reject the null hypothesis. This implies that the data do not provide sufficient evidence to support the alternative hypothesis, and the null hypothesis is retained.

### Type I and Type II Errors:

In hypothesis testing, there are two types of errors that can occur:

#### Type I Error:

This occurs when the null hypothesis is incorrectly rejected when it is actually true. It is often denoted as  $\alpha$  and represents the probability of making such an error.

**Type II Error:** This occurs when the null hypothesis is incorrectly retained when it is actually false. It is often denoted as  $\beta$ .

### Interpreting Results:

When a hypothesis is rejected, it does not necessarily mean that the alternative hypothesis is proven true. It simply suggests that the data provide strong evidence against the null hypothesis.

The strength of evidence depends on the p-value. Smaller p-values indicate stronger evidence.

Researchers should interpret results cautiously, considering the practical significance and context of the findings. Statistical significance does not always imply practical significance.

### Limitations and Considerations:

Hypothesis testing has its limitations, including the reliance on predetermined significance levels and the potential for false positives (Type I errors) and false negatives (Type II errors).

Researchers should consider the power of their statistical tests, sample size, and effect size when designing experiments to minimize errors and draw meaningful conclusions.

### Revising Hypotheses:

If a hypothesis is rejected, it may be necessary to revise or refine it. This can involve altering the research question, modifying the hypothesis, or considering alternative explanations for the results.

Scientific research often involves an iterative process where hypotheses are continually tested, revised, and expanded upon as knowledge evolves.

**CONCLUSION:**

It emphasizes the critical phase of evaluating hypotheses in the scientific process. It introduces the significance level, p-values, and the potential for Type I and Type II errors. Researchers must carefully interpret results, consider limitations, and be prepared to revise hypotheses as needed to advance scientific understanding.

**Research Hypothesis**

A research hypothesis is a statement or idea that proposes a potential relationship between variables and is typically used in scientific research or experiments. It functions as a testable prediction or an educated guess about what might happen in a research study.

**A research hypothesis typically consists of two key parts:**

**Independent Variable:** This is the variable that a researcher investigates or manipulates to see how it affects another variable. It's often denoted as X in a hypothesis.

**Dependent Variable:** This is the variable that is expected to change or be influenced by the independent variable. It's often denoted as Y in a hypothesis.

**A hypothesis can take one of two forms:**

**Null Hypothesis:** This statement suggests that there is no significant relationship or effect between the independent and dependent variables. It essentially represents the idea that there's no effect or change.

**Alternative Hypothesis:** This statement suggests that there is a significant relationship or effect between the independent and dependent variables. It represents what the researcher is trying to find evidence for.

Researchers use hypothesis testing to analyse data collected in a study and determine whether the evidence supports the null hypothesis or the alternative hypothesis. This process helps researchers make conclusions about the relationships between variables and answer their research questions. For instance, in a medical study, a researcher might have these hypotheses:

**Null Hypothesis:** "There is no significant difference in blood pressure between Group A (treated with Drug X) and Group B (treated with a placebo)."

**Alternative Hypothesis:** "There is a significant difference in blood pressure between Group A (treated with Drug X) and Group B (treated with a placebo)."

By analysing data and using statistical tests, the researcher can determine if the evidence supports the null hypothesis or provides enough evidence to reject it in Favor of the alternative hypothesis. This process is essential in scientific research and hypothesis-driven investigations.

**Concept of Hypothesis**

The hypothesis concept is fundamental to the scientific method and research process, serving as an important element. It involves proposing a provisional and verified statement or educated speculation that suggests a potential explanation between variables within a research inquiry. Researchers create hypotheses by drawing upon their existing knowledge, observations, or pertinent theories. These hypotheses must fulfil the criteria of being both testable and questionable, ensuring their empirical examination through data collection and subsequent analysis.

**Hypothesis:**

An idea or explanation for something that is based on known facts but has not yet been proved. In other words, it's a statement that provides an explanation for why or how something works, based on facts (or some reasonable assumptions), but that has not yet been specifically tested.

**The purpose of Research Hypothesis is:**

The purpose of a research hypothesis is to provide a testable statement or prediction about the relationship between variables in a research study. It serves several important functions in the research process:

1. **Directing Research:** Research hypotheses are like roadmaps for scientists. They help researchers figure out exactly what they're studying and what specific things they're looking at. For example, if scientists are studying a new medicine for a health problem, their hypothesis might say, 'Medicine X will make the health problem better by a lot when compared to a fake medicine.'
2. **Testability:** Hypotheses are carefully crafted to make it possible to check if they are true or not. To do this, scientists set up experiments or collect information in a very organized way. This helps them gather real evidence that either supports or disagrees with their hypothesis.

In the example about the medicine, scientists might run a very well-organized test with real patients to see if the medicine really makes a big difference in reducing the health problem's symptoms.

3. **Formulating Research Queries:** Hypotheses often lead to very specific questions that need careful investigation during the study. These questions guide how data is collected and analysed.

In the medicine study, some questions could be, 'What exactly does Medicine X help with?' or 'Does Medicine X have any bad side effects when people take it?'

4. **Testability:** Hypotheses are carefully crafted to make it possible to check if they are true or not. To do this, scientists set up experiments or collect information in a very organized way. This helps them gather real evidence that either supports or disagrees with their hypothesis.

In the example about the medicine, scientists might run a very well-organized test with real patients to see if the medicine really makes a big difference in reducing the health problem's symptoms.

5. **Finding Interpretation:** When the study is finished, hypotheses help researchers make sense of what they discovered. They use the hypotheses as a kind of guidepost to see if the real results match what they expected. For example, in the medicine study, if they see that people who took Drug X had a big improvement in their symptoms, that's like saying their guess (hypothesis) was right. But if there's not much difference between the people who took Drug X and those who didn't, it means their guess (hypothesis) might be wrong.
6. **Scientific Communication:** Hypotheses are like a crucial part of telling others about the research. They're used in research papers, reports, and presentations to quickly explain what the study was all about, what questions it wanted to answer, and what results were expected. When other scientists and people in the academic world see these well-explained hypotheses, it helps them understand the research better.
7. **Theory Advancement:** As time goes on, when lots of research studies find the same things related to a particular hypothesis, these combined results can really help in making big scientific ideas better or clearer. For instance, in the medicine study, if many studies one after the other keep showing that Drug X really helps with the health problem's symptoms, this evidence can make our understanding of how to treat that health problem even better.
8. **Predicting Results:** Research hypotheses are like educated guesses about what we think will happen in a study. They help us make predictions about how different things are connected. These predictions can be useful for planning and decision-making. For example, if we

believe that more education leads to higher income, this prediction can help us make decisions about education policies.

9. **Managing Risks and Decisions:** Hypotheses can also help us understand risks and make choices, especially in business and government. When we have hypotheses and test them, we can use the results to make decisions and handle risks better. In financial markets, for instance, hypotheses about how assets behave can help investors decide where to put their money and how to protect it.
10. **Building on What We Know:** Hypotheses give us a starting point for doing more research or repeating studies. When other researchers want to check if something is true or learn more about it, they often begin with the hypotheses from earlier studies. Repeating research based on existing hypotheses helps us see if the findings are strong and apply to different situations, adding to what we know.

In summary, research hypotheses play multifaceted roles in scientific inquiry and beyond. They guide research, enable empirical testing, frame research questions, structure studies, facilitate interpretation of findings, aid in scientific communication, contribute to theory development, make predictions, inform decision-making, and serve as a foundation for future research and replication efforts.

### Types of Hypothesis

There are 13 different types of hypothesis. These include simple, complex, null, alternative, composite, directional, non-directional, logical, empirical, statistical, associative, exact, and inexact.

#### 1. Simple Hypothesis

A simple hypothesis is a hypothesis that predicts a correlation between two test variables: an independent and a dependent variable. This is the easiest and most straightforward type of hypothesis. You simply need to state an expected correlation between the dependant variable and the independent variable.

#### Simple Hypothesis Example

Question	Simple Hypothesis
Are carpenters more liberal than plumbers?	Carpenters are more liberal than plumbers.

#### 2. Complex Hypothesis

A complex hypothesis is a hypothesis that contains multiple variables, making the hypothesis more specific but also harder to prove. You can have multiple independent and dependant variables in this hypothesis.

#### Complex Hypothesis Example

Question	Complex Hypothesis
Do (1) age and (2) weight affect chances of getting (3) diabetes and (4) heart disease?	(1) Age and (2) weight increase your chances of getting (3) diabetes and (4) heart disease.

**In the above example, we have multiple independent and dependent variables:**

- **Independent variables:** Age and weight.
- **Dependent variables:** diabetes and heart disease.



Because there are multiple variables, this study is a lot more complex than a simple hypothesis.

### 3. Null Hypothesis

A null hypothesis will predict that there will be no significant relationship between the two test variables.

For example, you can say that “The study will show that there is no correlation between marriage and happiness.”

A good way to think about a null hypothesis is to think of it in the same way as “innocent until proven guilty”. Unless you can come up with evidence otherwise, your null hypothesis will stand.

### 4. Alternative Hypothesis

An alternative hypothesis is a hypothesis that is anything other than the null hypothesis. It will disprove the null hypothesis

**For example:** “Does eating oatmeal before an exam impact test scores?”

**We can have two hypotheses here:**

- **Null hypothesis (H<sub>0</sub>):** “Eating oatmeal before an exam does not impact test scores.”
- **Alternative hypothesis (H<sub>A</sub>):** “Eating oatmeal before an exam does impact test scores.”

For the alternative hypothesis to be true, all we have to do is *disprove* the null hypothesis for the alternative hypothesis to be true. We do not need an exact prediction of how much oatmeal will impact the test scores or even if the impact is positive or negative.

### 5. Composite Hypothesis

A composite hypothesis is a hypothesis that does not predict the exact parameters, distribution, or range of the dependent variable.

Often, we would predict an exact outcome. For example: “23-year-old men are on average 189cm tall.” Here, we are giving an exact parameter. So, the hypothesis is not composite.

But, often, we cannot exactly hypothesize something. We assume that *something* will happen, but we’re not exactly sure what. In these cases, we might say: “23-year-old men are *not* on average 189cm tall.”

### 6. Directional Hypothesis

A directional hypothesis makes a prediction about the positivity or negativity of the effect of an intervention prior to the test being conducted.

**For example**

Question	Directional Hypothesis
Does giving children chocolate rewards during study time for positive answers impact standardized test scores?	Giving children chocolate rewards during study time for positive answers increases standardized test scores.

### 7. Non-Directional Hypothesis

A non-directional hypothesis does not specify the predicted direction (e.g., positivity or negativity) of the effect of the independent variable on the dependent variable.

**For Example-**

Question	Non-Directional Hypothesis
Does giving children chocolate rewards during study time for positive answers impact standardized test scores?	Giving children chocolate rewards during study time for positive answers will affect standardized test scores.

**8. Logical Hypothesis**

A logical hypothesis is a hypothesis that cannot be tested, but has some logical basis underpinning our assumptions.

- For example: Dinosaurs closely related to Alligators probably had green scales because Alligators have green scales. However, as they are all extinct, we can only rely on logic and not empirical data.

**9. Empirical Hypothesis**

An empirical hypothesis is the opposite of a logical hypothesis. It is a hypothesis that is currently being tested using scientific analysis. We can also call this a ‘working hypothesis’.

**For example:**

- Raising the wage of restaurant servers increases staff retention.
- Adding 1 lb of corn per day to cows’ diets decreases their lifespan.
- Mushrooms grow faster at 22 degrees Celsius than 27 degrees Celsius.

**10. Statistical Hypothesis**

A statistical hypothesis utilizes representative statistical models to draw conclusions about broader populations. It requires the use of datasets or carefully selected representative samples so that statistical inference can be drawn across a larger dataset.

**11. Associative Hypothesis**

An associative hypothesis predicts that two variables are linked but does not explore whether one variable directly impacts upon the other variable.

**Associative Hypothesis Example**

- Sick people in hospital. You could conduct a study hypothesizing that hospitals have more sick people in them than other institutions in society. However, you don’t hypothesize that the hospitals caused the sickness.

**12. Causal Hypothesis**

A causal hypothesis predicts that two variables are not only associated, but that changes in one variable will cause changes in another.

**Causal Hypothesis Example**

Question	Causation Hypothesis
Does marriage cause baldness among men?	Marriage causes stress which leads to hair loss

**13. Exact Vs. Inexact Hypothesis**

An exact hypothesis (also known as a point hypothesis) specifies a specific prediction whereas an inexact hypothesis assumes a range of possible values without giving an exact outcome.

**Formulation of Hypothesis: - A Comprehensive Guide****INTRODUCTION**

The formulation of a hypothesis is a critical step in the scientific research process. Hypotheses serve as the foundation upon which scientific investigations are built, guiding researchers in

their quest to answer questions, test theories, and advance our understanding of the natural world. In this comprehensive guide, we will explore the concept of hypothesis formulation in detail, discussing its definition, importance, types, and the steps involved in creating a well-structured hypothesis.

### **Definition of Hypothesis**

A Hypothesis is a precise, testable statement of what the researcher predicts will be the outcome of study. It is stated at the start of the study.

This usually involves proposing a possible relationship between two variables: the independent variable (what the researcher changes) and the dependent variable (what the research measures).

In research, there is a convention that the hypothesis is written in two forms, the null hypothesis, and the alternative hypothesis.

A fundamental requirement of a hypothesis is that it can be tested against reality, and then can be supported or rejected.

To test a hypothesis the researcher first assumes that there is no difference between the population from which they are taken. This is known as the null hypothesis. The research is often called the alternative hypothesis.

### **IMPORTANCE OF HYPOTHESIS**

The hypothesis plays a significant role in scientific studies. The following are some of the important roles, which are given below:

- Helps in testing of the theories.
- Serves as a great platform in the investigation activities.
- Provide guidance to the research work or study.
- Hypothesis sometimes suggests theories.
- Explains the social phenomena.
- Develops the theory.
- Also acts as a bridge between the investigation and the theory.
- Provides a relationship between phenomena in such a way that it leads to the empirical testing of the relationship.
- Helps in knowing the most suitable technique of analysis.
- Helps in the determination of the most suitable type of research.

### **TYPES OF HYPOTHESES**

**Different types of research hypothesis are used. These are as follows:**

- **Null Hypothesis:** A null hypothesis states that there is no change in the dependent variable due to changes to the independent variable. This means that the results are due to chance and are not significant. A null hypothesis is denoted as  $H_0$  and is stated as the opposite of what the alternative hypothesis states.

**Example  $H_0$ :** There is no significant difference in the test scores of two groups.

- **Alternative Hypothesis:** This states that there is a significant relationship between the variables being studied. It is denoted as  $H_1$  or  $H_a$  and is usually accepted or rejected in favor of the null hypothesis.

**Example:  $H_a$ :** Group A has significantly higher test scores than Group B.

- **Directional Hypothesis:** This specifies the direction of the relationship or difference between variables; therefore, it tends to use terms like increase, decrease, positive, negative, more or less.

**Example: Ha:** Group A has significantly higher test scores than Group B.

- **Non-Directional Hypothesis:** While it does not predict the exact direction or nature of the relationship between the two variables, a non-directional hypothesis states that the existence of a relationship or difference between variables but not the direction, nature, magnitude of the relationship. A non-directional hypothesis may be used when there is no underlying theory or when findings contradict previous research.

**Example: Ha:** There is a significant difference in test scores between Group A and Group B.

- **Simple Hypothesis:** A simple hypothesis only predicts the relationship between one independent variable and another independent variable.

**Example: Ha:** Increasing the amount of sunlight will lead to higher plant growth

- **Complex Hypothesis:** A complex hypothesis states that the relationship between two or more independent and dependent variables.

**Example: Ha:** The interaction of temperature, humidity, and light will have a significant effect on plant growth, with the highest growth occurring at moderate temperature levels, high humidity, and ample sunlight.

- **Research Hypothesis:** A research hypothesis is a specific statement that outlines the expected outcome of a research study. It is often derived from existing theories or prior research findings.

**Example:** Based on the theory of cognitive development, we hypothesize that children in the experimental group will show greater improvement in problem-solving skills compared to the control group.

### Steps in Formulating a Hypothesis

Formulating hypothesis is a crucial step in the research process, as it helps you define the problem you want to investigate and provides a clear direction for your research. Here are the steps to formulate a hypothesis in research:

- **Identity the research problem:** Begin with identifying a specific research problem or question that you want to explore. This problem should be well defined and focused, addressing a gap knowledge or an area of interest within your field of study.
- **Review existing literature:** Conduct a thorough review of existing literature related to your research problem. This will help you to understand what is already known and what gaps or unanswered questions exist in the literature.
- **Define key concepts:** Clearly define the key concepts, variables, and terms relevant to your research problem. Precise definition are essential for formulating a hypothesis that is testable and specific.
- **Determine the type of hypothesis:** Decide whether your research will involve a null hypothesis ( $H_0$ ) and an alternative hypothesis ( $H_a$ ) or a directional hypothesis. A null hypothesis represents a statement of no effect or no relationship, while the alternative hypothesis posits a specific effect or relationship.
- **Specify the direction:** If your research involves a directional hypothesis, specify the expected direction of the relationship or effect. Will it be positive or negative?

- **Formulate the hypothesis:** Based on your research problem, literature review and the type of hypothesis you have chosen, create a clear and concise statement that summarizes your hypothesis. This statement should be a testable proposition that reflects the relationship or effect you are investigating.
- **Ensure testability:** Ensure that your hypothesis is testable through empirical research. You should be able to design experiments or gather data that can either support or reject your hypothesis.
- **Consider variables and population:** Clearly define the variables you are working with and the population or sample to which your hypothesis applies.
- **Be specific:** Make sure your hypothesis is specific and not vague. It should be clear what you are testing and what the expected outcome is.
- **Write the hypothesis:** Finally, write down your hypothesis in a clear and concise statement. It should be a single, declarative sentence.

Remember that the hypothesis is a working proposition and can be revised as your research progresses. Once you have a hypothesis, you can design your research study and collect data to test it. The results of your research will either support or refute your hypothesis, leading to a deeper understanding of the topic you are investigating.

## REVIEW OF LITERATURE

### Meaning -:

“Review of literature means to find out for yourself what’s already known about the topic”.

- It also means to give your reader a critical overview of what you found.
- Literature review tells to find out what is missing.
- Literature review helps to find out the original content for our topic.

### Definition -:

- “A literature review is an account of what has been already established or published on particular research topic by accredited scholars and researchers” By University Of Toronto .
- “A literature review is a piece of academic writing demonstrating knowledge and understanding of the academic literature on a specific topic placed in context” By University of Edinburgh.

### Need -:

- To know more about the chosen topic.
- Helps in making a good review.
- Tells about what others have already discovered.
- To avoid unnecessary conflicts.
- To solve the unsolved problem.

### Types -:

- **Narrative literature review** - Also referred as traditional literature review. Narrative review draws conclusion about the topic.
- **Systematic literature review** - It is a systematic and detailed review within limited timeline.
- **Scoping literature review** - It is used to find out the scope of the topic. And identify

Evidences which are still unclear.

- Argumentative literature review - This literature review helps to examine the evidence. And evaluate conflicting claims.
- Integrative literature review - This literature review Summaries past Theories for better understanding of topics.
- Theoretical literature review - As its name denotes that this review focus on theory concept and tell the difference between past theory and present theory.

#### Sources -:

1. **Primary data** - Primary data give real and unedited data that is closest to the subject. Sources of primary data are as following -:

- Photographs
- Research papers
- Voice recording
- Film footage
- Speeches
- Artwork

2. **Secondary data** - Secondary data are not real and they are edited one. Sources of secondary data are as following -:

- Newspapers
- Books
- Magazines
- Commentary

#### Steps -:

##### There are six involved in literature review-:

- 1- **Define your topic:** The first step is defining your task – choosing a topic and noting the questions you have about the topic. This will provide a focus that guides your strategy in step II and will provide potential words to use in searches in step III.
- 2- **Develop the strategy:** Strategy involves figuring out where the information might be and identifying the best tools for finding those types of sources. The strategy section identifies specific types of research databases to use for specific purposes.
- 3- **Locate the information:** In this step, you implement the strategy developed in II in order to actually locate specific articles, books, technical reports, etc.
- 4- **Use and evaluate the information:** Having located relevant and useful material, in step IV you read and analyze the items to determine whether they have value for your project and credibility as sources.
- 5- **Synthesize:** In step V, you will make sense of what you've learned and demonstrate your knowledge. You will thoroughly understand, organize and integrate the information – become knowledgeable—so that you are able to use your own words to support and explain your research project and its relationship to existing research by others.

6- **Evaluate the work:** At every step along the way, you should evaluate your work. However, this final step is a lastcheck to make sure your work is complete and of high quality.

#### **BENEFITS -:**

##### **Benefit of conducting literature review -:**

- **Demonstrate a Clear Understanding of the Subject:** Writing a literature review demonstrates that you have a clear understanding of the subject you're investigating. It also means that you can easily identify, evaluate, and summarize existing research that's relevant to your work.
- **Justify Your Research:** There's more to writing a research paper than just identifying topic and generating your research question from it. You also have to go as far as to justify your research, and the only way to do that is by including a literature review in your work. It's important to understand that looking at past research is the only way to identify gaps that exist in the current literature. That can go a long way to help fill in the gap by addressing them in your own research work.
- **Helps to Set a Resourceful Theoretical Framework:** Because a research paper assignment builds up on the ideas of already existing research, doing a literature review can help you to set a resourceful theoretical framework on which to base your study. The theoretical framework will include concepts and theories that you will base your research on. And keep in mind that it's this framework that professors will use to judge the overall quality of your work.

#### **Functions -:**

- Establishing a context for the research.
- Providing a shape for the research under consideration.
- Establishing a connection between what the researcher is proposing and what he has already read.
- Revealing the differences or areas of gap between present and earlier research findings.
- Improving researcher's research methodology.
- Expanding researcher's knowledge base.
- Ensuring that the researcher is carrying out new research that has not been carried out earlier.

#### **Importance -:**

- Identifying experts related to particular research.
- Identifying questions that need further research and exploration.
- Identifying what methodologies have been used in the related past studies and what methodology should be used in current research.
- Justifying a proposed research methodology.
- Indicating the originality and relevance of the given research problem.
- Demonstrating the preparedness of a researcher to complete the research.

#### **Objectives -:**

- Develop an understanding of how each source of literature helps in understanding the research problem.

- Find out ways to interpret earlier similar researches on the topic under study.
- Rectify the conflicts that exist among previously conducted studies.
- Get an idea regarding the required sample size.
- Determine the research method that can be used in the research.

**Good literature review -:**

- **Understand your topic or have a general area of interest:** To begin with a literature review, you need to either have a tentative topic or a general area of interest in mind. But, you should understand that you cannot build research on guesswork. If you have a topic in mind, read as much as you can; by the end of it, you will surely develop a fair idea of whether or not to go ahead with the topic or area of interest.
- **A literature review is extensive:** If you thought a quick overview of the first few articles on the web or library is enough, then you do not get it at all. You will have to read and review a range of literature so that there is substantial material to back up your reasoning of whether or not to go ahead with the topic.
- **Identify the problem or gap:** How do we know that there is a need to supplement the existing scholarship? We review the existing scholarship and identify the gaps. Yes, exactly what I mean when I write that you must identify the problem or gap.
- **Ask for help:** If all else fails, then don't hesitate to ask for help. Start by approaching the librarian at your university and colleges, ask him/her if your library has a subscription to the journal you need. If you have found a few articles, then identify the journal they were published in and seek it out for similar articles. You could also ask a professor, a supervisor or a senior head, even your school teachers. Having gone through a similar content as the one you are currently facing. It is perfectly fine to ask them to guide you in the right direction when you find yourself stuck.



**Unit - 2**

**Research Design and  
Methods**

Research design is the blueprint or plan that outlines how a research study will be conducted. It encompasses the overall strategy, structure, and approach to collecting and analysing data to address a specific research question or problem. A well-structured research design is essential to ensure that the study is methodologically sound, reliable, and capable of producing meaningful results.

### Key Components of Research Design

1. **Research Questions or Objectives:** The research design process typically begins with the identification of research questions or objectives. These are the specific goals or inquiries that the study aims to address. Clear and well-defined research questions are essential for guiding the entire research process.
2. **Research Approach:** Researchers must choose a suitable research approach, which can be qualitative, quantitative, or mixed methods. Qualitative research focuses on understanding the underlying reasons, motivations, and behaviours of individuals, while quantitative research involves the measurement and analysis of numerical data. Mixed methods combine both approaches to gain a comprehensive understanding of the research problem.
3. **Sampling:** Sampling involves selecting a subset of individuals or elements from a larger population to study. The choice of sampling method and size is critical to ensure the sample is representative and can provide generalizable results.
4. **Data Collection Methods:** Researchers must decide on the methods and tools they will use to collect data. Common data collection methods include surveys, interviews, observations, experiments, and archival research. The selection of appropriate methods depends on the research questions and objectives.
5. **Data Analysis:** This component outlines how the collected data will be analysed to answer the research questions. It includes the use of statistical techniques, qualitative coding, or other analytical methods. The choice of analysis method should align with the research approach.
6. **Timeframe and Budget:** Researchers should establish a timeline for conducting the study and allocate resources, including funding and personnel, to ensure the research is feasible and stays on track.

### Types of Research Designs

Research designs can be broadly categorized into two main types:

1. **Qualitative research:** Qualitative research design focuses on understanding and interpreting subjective experiences, meanings, and social contexts. It often involves methods such as interviews, focus groups, and observations to gather rich and detailed data. The aim is to explore complex phenomena and generate theories or hypotheses.
2. **Quantitative research:** Quantitative research design, on the other hand, emphasizes the measurement and analysis of numerical data. It aims to establish relationships, test hypotheses, and make generalizations about a population. Quantitative research often involves surveys, experiments, and statistical analysis.

### Steps in the Research Design Process

The research design process typically consists of several sequential steps:

1. **Identifying the Research Problem:** This step involves defining the research problem, specifying research questions or objectives, and conducting a literature review to understand existing knowledge on the topic.

2. **Selecting the Research Approach:** Researchers decide whether the study will be qualitative, quantitative, or a combination of both. This decision is based on the nature of the research questions and the available resources.
3. **Choosing the Sampling Method:** Researchers select a sampling method (e.g., random sampling, purposive sampling) and determine the sample size. Sampling decisions should ensure the sample is representative and suitable for analysis.
4. **Developing Data Collection Instruments:** Researchers design surveys, questionnaires, interview guides, or other data collection instruments. These tools should be valid and reliable for collecting data.
5. **Data Collection:** Data is collected according to the chosen methods. Researchers must maintain consistency and rigor throughout this phase to minimize bias and errors.
6. **Data Analysis:** Collected data is analysed using appropriate statistical or qualitative techniques.

The goal is to derive meaningful insights and answers to the research questions.

7. **Interpreting Results:** Researchers interpret the findings in the context of the research questions and objectives. They assess the significance of the results and draw conclusions.
8. **Drawing Implications:** Based on the findings, researchers discuss the practical implications of their study and make recommendations for future research or action.
9. **Report Writing:** Researchers document their research design, methodology, findings, and conclusions in a comprehensive research report or paper. This report should adhere to academic or professional standards.
10. **Peer Review and Publication:** If applicable, researchers may submit their work for peer review and publication in academic journals or other outlets to disseminate their findings.

### “Types of Research Design”

A Research Design is simply a structural framework of various research methods as well as techniques that are utilised by a researcher. Moreover, a clear understanding of different research designs helps choose the proper technique for the research.

Research design is broadly divided into quantitative and qualitative research design.

#### □ Quantitative research design

Quantitative research design aims at finding answers to who, what, where, how, and when through the course of research. Moreover, the outcome of the quantitative analysis is easy to represent in the form of statistics, graphs, charts, and numbers.

#### □ Qualitative research design

Qualitative research design focuses on finding answers to how and why. It uses open-ended questions and helps the subjects express their views clearly. Qualitative research is ideal for businesses that aim to understand customers' behaviour and requirements.

You can further break the types of research designs into five categories.

### 1. Experimental design

This type of research design looks at a problem scientifically by establishing a clear cause and effect of every event. It also tries to understand the impact of the independent variable on the dependable variable. Often social sciences use it to observe human behaviours and understand the social psychology of human being better.

**2. Correlational design**

Correlation research design establishes a relationship between two related variables. The researcher observes the variables over time and then draws conclusions based on them. This type of research design requires two different groups. A correlation coefficient determines the relationship between two variables. The value of the correlation coefficient ranges between -1 and +1. If the correlation coefficient is +1, it indicates a positive relationship between the two variables, and -1 means a negative relationship.

**3. Descriptive design**

Descriptive design is a theory-based research method describing the research's primary subject matter. This type of research design uses data collection techniques like natural observation, case studies, and surveys to derive results. This type of research design provides insight into the why and how of research.

**4. Diagnostic design**

In diagnostic research, the design strives to explore the reason behind an issue and find solutions to solve it. This type of research design tries to solve the problems in a structured form divided into three phases- the issue's inception, diagnosis of the issue, and solution for the issue.

**5. Explanatory design**

In this research design, the researcher explores concepts and ideas on a subject to explore more theories. The main aim of the research is to explore the subjects' undiscovered aspects and answer questions like what, how, and why.

**6. Observational research design**

Observational design is also a common type of research design. The observational research design format emphasizes observing your research topic without altering any variables. When using an observational research design, you can simply observe behaviors or phenomena and record them rather than conducting an experiment.

**7. Causal research design**

The causal research design is another type of research design that researchers commonly choose. The causal research design format attempts to identify and understand relationships between variables, which can be valuable across many industries. Causal research designs typically involve at least two variables and explore many possible reasons for a relationship between variables.

**8. Cross-sectional research design**

Cross-sectional design is another type of observational research design. The cross-sectional research design involves observing multiple individuals at the same point in time. This research type does not alter variables.

**9. Sequential research design**

Sequential research design is another useful type of research design. The sequential research design format divides research into stages, and each stage builds on the last. Therefore, you can complete sequential research at multiple points in time, allowing you to study phenomena that occur over periods of time. 10. Historical research design – Researchers can also use historical research design. Using the historical research design allows you to use past data to test your hypothesis. Historical research relies on historical data like archives, maps, diaries and logs. Using this research design can be especially useful for completing trend analysis or gathering context for a research problem.

## QUANTITATIVE AND QUALITATIVE RESEARCH DESIGN

### –INTRODUCTION

Research design plays a pivotal role in the field of academic research, serving as the blueprint for data collection, analysis, and interpretation. In the realm of research, two major types of research designs have gained prominence: quantitative research design and qualitative research design. These two approaches are distinct in their methodologies, data collection techniques, and purposes, and each serves its own unique role in generating knowledge.

This comprehensive guide will delve into the fundamental aspects of both quantitative and qualitative research designs. We will explore the key characteristics, methodologies, advantages, and limitations of each approach, allowing you to gain a thorough understanding of when and how to employ them in your research endeavours. By the end of this exploration, you will have a solid foundation for choosing the most appropriate research design for your specific research objectives.

### Section 1: Quantitative research design

#### Key characteristic of Quantitative Research Design

Quantitative research design is characterized by its focus on empirical data, numerical analysis, and objective measurement. Its primary goal is to gather and analyse data that can be quantified and subjected to statistical analysis. Here are some key characteristics of quantitative research design:

- **Structured Approach:** Quantitative research is highly structured and follows a predefined plan. Researchers typically design questionnaires, surveys, or experiments with closed-ended questions to collect specific data.
- **Numerical Data:** Quantitative research relies on numerical data and aims to establish patterns, relationships, and correlations within datasets. This data is often collected using standardized instruments and scales.
- **Large Sample Sizes:** Quantitative studies often require larger sample sizes to ensure the statistical validity of the findings. This is essential for generalizing results to a broader population.
- **Objectivity:** Researchers strive for objectivity and aim to minimize bias during data collection and analysis. Statistical tests are used to draw objective conclusions.
- **Hypothesis Testing:** Quantitative research typically involves hypothesis testing, where researchers formulate hypotheses and test them using statistical methods to determine their validity.

#### Methodologies in Quantitative research design

Quantitative research design encompasses several methodologies, including:

- **Surveys:** Surveys involve administering structured questionnaires to collect data from a large sample of respondents. Researchers use surveys to gather information about opinions, behaviours, and demographics.
- **Experiments:** Experimental designs involve manipulating one or more variables to study their effects on a dependent variable. Randomized controlled trials (RCTs) are a common form of experimental research in fields such as medicine.
- **Observational Studies:** Researchers use observational studies to collect data in a natural setting without intervening or manipulating variables. This approach is often used in social sciences and ethnographic research.

### Advantages of Quantitative Research Design

Quantitative research offers several advantages:

- **Objectivity:** Quantitative research aims to minimize bias and subjectivity, producing objective findings that can be replicated.
- **Generalizability:** With its emphasis on large sample sizes and statistical analysis, quantitative research allows for the generalization of findings to a broader population.
- **Precision:** Quantitative research provides precise numerical data, facilitating the identification of patterns and relationships.
- **Replicability:** Other researchers can replicate quantitative studies, increasing the reliability of the findings.
- **Causality:** Experimental designs in quantitative research can establish causal relationships between variables.

### Limitations of Quantitative Research Design

However, quantitative research also has its limitations:

- **Lack of Depth:** Quantitative research may not capture the richness and depth of human experiences and motivations, which qualitative research can provide.
- **Limited Context:** It may not fully capture the context in which data is collected, leading to a superficial understanding of phenomena.
- **Ethical Constraints:** In experimental designs, ethical constraints may limit researchers from manipulating certain variables, especially if it involves potential harm to participants.
- **Reductionism:** Quantitative research often reduces complex phenomena into measurable variables, potentially oversimplifying reality.

### Section 2: Qualitative Research Design

Methodologies in Qualitative Research Design Qualitative research design encompasses various methodologies, including:

- **Interviews:** In-depth interviews are conducted to explore participants' perspectives, experiences, and opinions. These can be structured, semistructured, or unstructured.
- **Focus Groups:** Focus groups bring together a small group of participants to discuss a specific topic, allowing for group interactions and the exploration of shared experiences.
- **Observations:** Researchers engage in direct observations of people, events, or settings to gain insights into behaviours and interactions.
- **Case Studies:** Case studies involve an in-depth examination of a single case or a few cases to gain a deep understanding of a particular phenomenon.
- **Content Analysis:** Content analysis in qualitative research involves systematically analysing textual or visual data to identify themes, patterns, and meanings.

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## ADVANTAGES OF QUALITATIVE RESEARCH DESIGN

### Qualitative research offers several advantages:

- **In-Depth Understanding:** Qualitative research allows for a nuanced and in-depth understanding of complex phenomena, including the social and cultural context in which they occur.
- **Flexibility:** Researchers can adapt the research process and questions in response to emerging insights, promoting flexibility and responsiveness.

### QUANTITATIVE RESEARCH DESIGN VS QUALITATIVE RESEARCH DESIGN:

Quantitative and Qualitative research designs are two distinct approaches used in research to gather and analyse data. They have different methodologies, purposes, and data analysis techniques. Here's comparison of quantitative design and qualitative design:

#### Quantitative research design:

- **Nature of Data:** Numeric Data: In quantitative research, data is numerical and can be statistically analyzed. It deals with measurable variables and aims to establish relationships and patterns.
- **Objective:** Quantitative research aims to quantify and measure variables. It focuses on gathering numerical data to test hypothesis and establish relationships between variables.
- **Data Collection:** Data is typically collected through structured surveys, experiments, observations, or the analysis of existing datasets. Questionnaires with closed-ended questions are common in quantitative research.
- **Sample Size:** Large sample sizes are often used to ensure statistical significance and generalizability of findings.
- **Data Analysis:** Statistical techniques such as regression analysis, ANOVA, t-tests and correlations are used to analyse the data. Researchers use these techniques to identify patterns, trends, and statistical significance.
- **Results:** Quantitative research aims to provide precise and measurable results. Findings are often presented in tables, charts, and graphs.
- **Generalizability:** Quantitative research often seeks to generalize findings to a larger population, making it suitable for making prediction and drawing broad conclusions.
- **Examples:** Market research surveys, clinical trials, opinion polls and experiments in the natural and social sciences are often conducted using quantitative research methods.

#### Qualitative research design:

- **Nature of Data:** Non-Numeric: Qualitative research deals with non-numeric data, often gathered through methods like interviews, observations, or content analysis of text, images, or videos.
- **Objective:** Qualitative research seeks to understand and interpret complex phenomena, often exploring the meaning, context, and depth of a subject. It is used when the researcher wants to gain insights into people experiences, behaviours and perspectives.
- **Data Collection:** Data is typically collected through methods such as interviews, focus groups, observations or content analysis of documents. Open-ended questions and open coding are common in qualitative research.

- **Sample Size:** Qualitative research often involves smaller, purposive samples selected for their relevance to the research question. The focus is on depth rather than breadth.
- **Data Analysis:** Qualitative data is analysed using techniques like thematic analysis, content analysis, or grounded theory. Researchers aim to identify themes, patterns, and meanings in the data.
- **Results:** Qualitative research produces rich, descriptive narratives and textual or visual representations of findings, such as quotes and themes.
- **Generalizability:** Qualitative research does not aim for statistical generalizability but seeks to provide in-depth insights and understanding within a specific context.
- Transferability is often emphasized, where findings can be applied to similar contexts.
- **Examples:** Ethnographic studies, case studies, content analysis of interviews, and exploratory research in social sciences and humanities often use qualitative research methods.

In practice, researchers often choose between quantitative and qualitative designs based on their research questions, goals, and the nature of the phenomenon being studied. Some research projects may even use a mixed-methods approach, combining both quantitative and qualitative elements to gain a more comprehensive understanding of a research problem.

### **Benefits of Research Design**

A research design functions as a bridge between what has been established (the research objectives) what is actually to be performed, in the conduct of the study, to achieve those objectives. It anticipates what the client will require with regards to results and the analytical work on the gathered data which will convert it to useful findings.

### **Several benefits of Research Design are as follows:**

1. Consumes less time.
2. Ensures project time schedule.
3. Helps researcher to prepare himself to carry out research in a proper and a systematic way.
4. Better documentation of the various activities while the project work is going on.
5. Helps in proper planning of the resources and their procurement in right time.
6. Provides satisfaction and confidence, accompanied with a sense of success from the beginning of the work of the research project.
7. It cuts down on inaccuracy.
8. Allows you get optimum efficiency and reliability.
9. Reduce wastage of time.
10. Reduce uncertainty, confusion and practical haphazard related to any research problem.
11. Of great help for collection of research material and testing of hypothesis.
12. It is a guide for giving research the right path.
13. Gets rid of bias and marginal errors.
14. Provides an idea concerning the type of resources needed in terms of money, effort, time, and manpower.
15. Smooth & efficient sailing (sets boundaries & helps prevent blind search)



16. Maximises reliability of results.
17. Provides firm foundation to the endeavour.
18. Averts misleading conclusions & thoughtless useless exercise.
19. Provides opportunity to anticipate flaws & inadequacies (anticipates problems).
20. Incorporates by learning from other people's critical comments & evaluations.

A research design also provides several advantages when studying the data and interpreting their meaning.

It helps to keep the calculations and thinking on the path to solutions and recommendations. Having said that, we are really not recommending that a design be a rigid framework. A design had been selected on the basis of expectations, but surprise will be met as the research unfolds, in the character and availability of data and in new hypothesis which show up in the course of analysis. To put it briefly, the original design guides, but isn't going to dictate, the conduct of the research.

A research design is similar to a roadmap—you can see where you currently are, where you want to be at the end of your journey, and can figure out the best (most efficient and effective) path to take to reach your destination. We may have to take unexpected detours on the way, but by keeping our ultimate goal continuously in mind and using our map we can get to our destination.

### **"Need for Research Design"**

#### **The Significance and Necessity of Research Design**

Research is a systematic and organized process that aims to generate new knowledge, solve problems, or deepen our understanding of various phenomena. At the heart of any research endeavor lies the research design, a critical component that outlines the structure, methodology, and approach to be employed throughout the study. The need for research design cannot be overstated; it serves as the blueprint for the entire research process, guiding researchers in their pursuit of meaningful and reliable results. This essay will delve into the essential aspects of research design, highlighting its significance and the reasons why it is indispensable in the world of academia and beyond.

#### **The Essence of Research Design**

Research design refers to the overall plan, structure, and strategy that researchers adopt to answer their research questions or hypotheses. It encompasses a variety of decisions and considerations, including the selection of research methods, data collection techniques, data analysis procedures, and the timeline for conducting the study. The primary objectives of research design are to provide a clear roadmap for the research process, ensure the collection of relevant and valid data, minimize biases and errors, and facilitate the generalization of findings to a broader population or context.

#### **The need for research design arises from several critical factors:**

##### **1. Clarifying Research Objectives and Questions**

One of the primary functions of a research design is to provide clarity and precision regarding the objectives and questions that the study aims to address. Without a well-defined research design, researchers risk embarking on a vague and directionless journey. By explicitly stating what the research seeks to achieve and the questions it intends to answer, a research design sets the stage for focused and purposeful investigation. This initial step is crucial because it ensures that the research aligns with its intended goals, minimizing the risk of gathering irrelevant or inconclusive data.

## **2. Structuring the Research Process**

A well-structured research design acts as a roadmap for the entire research process. It outlines the steps to be followed, from data collection to analysis and interpretation, making the journey from inception to conclusion more manageable and organized. This structured approach helps researchers avoid common pitfalls such as data collection bias, incomplete analysis, or inadequate sample sizes. Without a clear design in place, researchers may wander aimlessly in their pursuit of knowledge, leading to inefficiencies and unreliable results.

## **3. Selection of Research Methods and Techniques**

The choice of research methods and techniques is a critical decision that researchers must make. These choices can greatly impact the validity and reliability of the study's findings. Research design plays a pivotal role in guiding these decisions. It assists researchers in selecting the most appropriate methods for data collection, whether they be surveys, experiments, case studies, interviews, or observations. Moreover, the design helps in determining the sample size and sampling methods, ensuring that the research is both feasible and representative of the target population.

## **4. Minimizing Biases and Errors**

Research design serves as a defense mechanism against biases and errors that can creep into the research process. It prompts researchers to consider potential sources of bias and take measures to mitigate them. For instance, a well-designed experiment will incorporate randomization and control groups to reduce the influence of confounding variables. Similarly, a robust survey design will include strategies to minimize response bias and non-response bias. By addressing these concerns proactively, research design enhances the credibility and trustworthiness of the research findings.

## **5. Resource Optimization**

Research projects often operate within constraints, including limitations in time, budget, and human resources. A well-structured research design helps optimize the allocation of these resources. It ensures that data collection and analysis methods are efficient and cost-effective.

Researchers can avoid unnecessary expenditures by focusing on the most relevant variables and measurements. Moreover, a clear design allows for effective time management, ensuring that the research progresses smoothly and stays on track to meet its objectives.

## **6. Ethical Considerations**

Ethical considerations are paramount in research, as studies involving human subjects or sensitive topics must adhere to strict ethical guidelines. Research design plays a crucial role in addressing these ethical concerns. It requires researchers to outline how they will obtain informed consent, protect participant confidentiality, and minimize any potential harm or discomfort. A thoughtful research design demonstrates the commitment to ethical research practices, which is essential for maintaining the integrity of the research and the reputation of the researchers.

## **7. Adapting to Complex Research Environment**

In some cases, research environments can be unpredictable or complex. Research design provides researchers with the flexibility to adapt to changing circumstances while maintaining the study's integrity. It includes contingency plans for unforeseen challenges and deviations from the original plan. This adaptability is particularly important in fields such as public health, where the emergence of new diseases or unforeseen events may necessitate quick adjustments to research protocols.

### **8. Ensuring Reproducibility and Generalizability**

Scientific research is built on the principles of reproducibility and generalizability. A well-documented research design facilitates the reproduction of the study by other researchers, which is essential for verifying the validity of findings. Additionally, a clear design allows for the assessment of the study's generalizability, helping to determine the extent to which the results can be applied to broader populations or contexts. Without a well-defined design, the credibility and impact of research may be diminished.

### **9. Communication of Research Findings**

The outcomes of research are often communicated through research papers, reports, or presentations. A well-structured research design eases this process by providing a logical framework for presenting the findings. It allows researchers to organize and present their results in a coherent and meaningful manner, making it easier for peers, policymakers, and the public to understand and interpret the research. Effective communication of research findings is essential for knowledge dissemination and driving evidence-based decision-making.

### **10. Continuous Improvement and Learning**

Research design is not a static element of the research process; it evolves as researchers gain their insights and learn from their experiences. It encourages a culture of continuous improvement by prompting researchers to reflect on their methods, data, and outcomes. Researchers can use the insights gained from one study to refine and enhance their future research designs, contributing to the advancement of knowledge in their field.

In conclusion, research design is not merely a technical aspect of the research process; it is the backbone that provides structure, purpose, and reliability to any study. Its significance lies in its ability to clarify research objectives, structure the research process, guide methodological choices, minimize biases, optimize resources, address ethical considerations, adapt to complex environments, ensure reproducibility and generalizability, facilitate communication of findings, and promote continuous improvement. Researchers across various disciplines recognize the need for research design as an essential tool in their quest to contribute meaningfully to their fields and society as a whole. Therefore, research design stands as an indispensable pillar of the research endeavor, guiding the way to knowledge creation and discovery.

### **IMPORTANT CONCEPTS RELATING TO RESEARCH DESIGN CONCEPTS ARE-**

- Dependent and independent Variables.
- Extraneous Variable
- Control
- Research Hypothesis
- Experimental and Non-Experimental Hypothesis- testing Research
- Experimental and Control Groups
- Treatments
- Experiment
- Experimental Unit(s)
- Confounded Relationship

### **Dependent and independent variables:-**

A concept which can take on different quantitative values is called a variable. Concepts like weight, height, income are all examples of variables.

Qualitative phenomena (or the attributes) are also quantified on the basis of the presence or absence of the concerning attribute(s). Phenomena which can take on quantitatively different values even in decimal points are called 'continuous variables'. But all variables are not continuous. If they can only be expressed in integer values, they are non-continuous variables or in statistical language 'discrete variables'. Age is an example of continuous variable, but the number of children is an example of non-continuous variable.

If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable, and the variable that is antecedent to the dependent variable is termed as an independent variable. Ex-if we say that height depends upon age, then height is a dependent variable and age is an independent variable

### **Extraneous variable**

Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables.

Suppose the researcher wants to test the hypothesis that there is a relationship between children's gains in social studies achievement and their self-concepts. In this case self-concept is an independent variable and social studies achievement is a dependent variable. Intelligence may also well affect the social studies achievement, but since it is not related to the purpose of the study undertaken by the researcher, it will be termed as an extraneous variable.

Whatever effect is noticed on dependent variable as a result of extraneous variable(s) is technically described as an 'experimental error'. A study must always be so designed that the effect upon the dependent variable is attributed entirely to the independent variable(s), and not to some extraneous variable or variables.

### **Control**

One important characteristic of a good research design is to minimize the influence or effect of extraneous variable(s). The technical term 'control' is used when we design the study minimizing the effects of extraneous independent variables. In experimental researches, the term 'control' is used to refer to restrain experimental conditions.

### **Research hypothesis**

When a prediction or a hypothesised relationship is to be tested by scientific methods, it is termed as research hypothesis.

The research hypothesis is a predictive statement that relates an independent variable to a dependent variable.

Usually a research hypothesis must contain, at least, one independent and one dependent variable. Predictive statements which are not to be objectively verified or the relationships that are assumed but not to be tested, are not termed research hypotheses.

### **Experimental and non-experimental hypothesis- testing research**

When the purpose of research is to test a research hypothesis, it is termed as hypothesis-testing research. It can be of the experimental design or of the non-experimental design.

Ex-researcher randomly selects 50 students from a group of students who are to take a course in statistics and then divides them into two groups by randomly assigning 25 to Group A, the usual studies programme, and 25 to Group B, the special studies programme. At the end of the course, he administers a test to each group in order to judge the effectiveness of the training programme on the student's performance-level. This is an example of experimental hypothesis-testing research because in this case the independent variable, viz., the type of training programme, is manipulated.

Research in which the independent variable is manipulated is termed 'experimental hypothesis-testing research' and a research in which an independent variable is not manipulated is called 'non-experimental hypothesis-testing research'.

Ex-suppose a researcher wants to study whether intelligence affects reading ability for a group of students and for this purpose he randomly selects 50 students and tests their intelligence and reading ability by calculating the coefficient of correlation between the two sets of scores. This is an example of non-experimental hypothesis-testing research because herein the independent variable, intelligence, is not manipulated.

### **Experimental and control groups**

In an experimental hypothesis-testing research when a group is exposed to usual conditions, it is termed a 'control group', but when the group is exposed to some novel or special condition, it is termed an 'experimental group'.

If both groups are exposed to special studies programmes, then both groups would be termed 'experimental groups.'

### **Treatments**

The different conditions under which experimental and control groups are put are usually referred to as 'treatments'.

If we want to determine through an experiment the comparative impact of three varieties of fertilizers on the yield of wheat, in that case the three varieties of fertilizers will be treated as three treatments.

### **Experiment**

The process of examining the truth of a statistical hypothesis, relating to some research problem, is known as an experiment.

For example, we can conduct an experiment to examine the usefulness of a certain newly developed drug.

Experiments can be of two types viz., absolute experiment and comparative experiment. If we want to determine the impact of a fertilizer on the yield of a crop, it is a case of absolute experiment; but if we want to determine the impact of one fertilizer as compared to the impact of some other fertilizer, our experiment then will be termed as a comparative experiment. Often, we undertake comparative experiments when we talk of designs of experiments.

### **Experimental unit(s)**

The pre-determined plots or the blocks, where different treatments are used, are known as experimental units. Such experimental units must be selected (defined) very carefully.

### **Confounded relationship**

When the dependent variable is not free from the influence of extraneous variable(s), the relationship between the dependent and independent variables is said to be confounded by an extraneous variable(s).

### **Meaning of Experimental Research**

Experimental research is a scientific research method that involves manipulating and controlling variables to establish cause-and-effect relationships between them. It is a systematic and controlled approach to studying phenomena, allowing researchers to test hypotheses, evaluate theories, and draw conclusions based on empirical evidence.

The primary characteristic of experimental research is the presence of a control group and an experimental group.

## **Benefits of Experimental Research**

Experimental research offers several benefits in the field of scientific investigation. Here are some key advantages of conducting experimental research:

### **1. Control over variables:**

Experimental research allows researchers to manipulate and control variables to determine cause-and-effect relationships. By systematically varying specific factors and observing their impact on the outcome, researchers can establish a clearer understanding of the relationship between variables.

### **2. Causal inference:**

Experimental research provides a strong basis for making causal inferences. With controlled conditions and random assignment of participants to different groups, researchers can confidently attribute changes in the dependent variable to the manipulation of the independent variable, thus establishing a cause-and-effect relationship.

### **3. Replicability:**

Experimental research can be replicated under similar conditions, which enhances the reliability and validity of the findings. Replication allows other researchers to confirm or challenge the initial results, contributing to the accumulation of scientific knowledge.

### **4. Precision and accuracy:**

By carefully controlling variables, experimental research can provide precise and accurate measurements. Researchers can isolate specific factors and measure their impact with minimal interference from confounding variables, leading to more precise and reliable results.

### **5. Generalizability:**

While experimental research is often conducted in controlled laboratory settings, it can still offer insights into real-world phenomena. By selecting appropriate samples and employing proper experimental design, researchers can generalize their findings to broader populations or settings, enhancing the external validity of the research.

### **6. Hypothesis testing:**

Experimental research enables researchers to test specific hypotheses and theories. By systematically manipulating variables and measuring their effects, researchers can evaluate the validity of existing theories or generate new hypotheses for further investigation.

### **7. Practical applications:**

Experimental research often leads to practical applications and interventions. By identifying causal relationships, researchers can develop evidence-based interventions, treatments, or policies to address real-world problems and improve outcomes in fields such as medicine, psychology, education, and more.

### **8. Incremental knowledge advancement:**

Experimental research contributes to the cumulative progress of scientific knowledge. Each study builds upon previous research, either by replicating or extending prior findings, which helps refine existing theories, validate previous results, or uncover new insights.

It is important to note that while experimental research offers numerous benefits, it may not always be feasible or ethical in certain situations. Researchers must carefully consider the nature of the research question, available resources, and ethical considerations before deciding on the appropriate research methodology.

– **Disadvantages of Experimental Research.**

**Disadvantages of experimental research are:**

**1. Results are highly subjective due to the possibility of human error:-**

- Because experimental research requires specific levels of variable control, it is at a high risk of experiencing human error at some point during the research.
- It is systemic or random, can reveal information about the other variables and that would eliminate the validity of the experiment and research being conducted.

**2. Experimental research can create situations that are not realistic:-**

- The variables of a product, theory, or idea are under such tight controls that the data being produced can be corrupted or inaccurate, but still seem like it is authentic. This can work in two negative ways for the researcher.
- First, the variables can be controlled in such a way that it skews the data toward a favorable or desired result.
- Secondly, the data can be corrupted to seem like it is positive, but because the real-life environment is so different from the controlled environment, the positive results could never be achieved outside of the experimental research.

**3. It is a time-consuming process.**

- It to be done properly, experimental research must isolate each variable and conduct testing on it. Then combinations of variables must also be considered. This process can be lengthy and require a large amount of financial and personnel resources. Those costs may never be offset by consumer sales if the product or idea never makes it to market. If what is being tested is a theory, it can lead to a false sense of validity that may change how others approach their own research.

**4. There may be ethical or practical problems with variable control.**

- Experimental research might be effective, but sometimes the approach has ethical or practical complications that cannot be ignored. Sometimes there are variables that cannot be manipulated as it should be so that results can be obtained.

**5. Experimental research does not provide an actual explanation.**

- Experimental research is an opportunity to answer a Yes or No question. It will either show you that it will work or it will not work as intended. One could argue that partial

“No” category because the desired results were not fully achieved. The answer is nice to have, but there is no explanation as to how you got to that answer. Experimental research is unable to answer the question of “Why” when looking at outcomes.

**6. Extraneous variables cannot always be controlled.**

- Although laboratory settings can control extraneous variables, natural environments provide certain challenges. Some studies need to be completed in a natural setting to be accurate. It may not always be possible to control the extraneous variables because of the unpredictability of Mother Nature. Even if the variables are controlled, the outcome may ensure internal validity, but do so at the expense of external validity. Either way, applying the results to the general population can be quite challenging in either scenario.

**7. Participants can be influenced by their current situation.**

- Human error isn't just confined to the researchers. Participants in an experimental research study can also be influenced by extraneous variables.

There could be something in the environment, such as an allergy, that creates a distraction. In a conversation with a researcher, there may be a physical attraction that changes the responses of the

- Even internal triggers, such as a fear of enclosed spaces, could influence the results that are obtained. It is also very common for participants to “go along” with what they think a researcher wants to see instead of providing an honest response.

#### **8. Manipulating variables isn't necessarily an objective standpoint.**

- For research to be effective, it must be objective. Being able to manipulate variables reduces that objectivity. Although there are benefits to observing the consequences of such manipulation, those benefits may not provide realistic results that can be used in the future. Taking a sample is reflective of that sample and the results may not translate over to the general population.

#### **9. Human responses in experimental research can be difficult to measure.**

- There are many pressures that can be placed on people, from political to personal, and everything in-between. Different life experiences can cause people to react to the same situation in different ways. Not only does this mean that groups may not be comparable in experimental research, but it also makes it difficult to measure the human responses that are obtained or observed.

#### **Benefits of Non –Experimental Research**

Non-experimental research is research that lacks the manipulation of an independent variable, random assignment of participants to conditions or orders of conditions, or both.

In a sense, it is unfair to define this large and diverse set of approaches collectively by what they are not.

The main characteristics of non-experimental research include that the event occurred in the past with analysis in the present, controlled experiments are not performed, study samples are not created or manipulated, participants and artifacts to be studied exist in their natural environment with no direct intervention, or the phenomenon is studied as it occurs.

Non-experimental research, also known as observational or correlational research, has several benefits. Here are some of them:

1. **Naturalistic Setting:** Non-experimental research allows researchers to study phenomena in their natural settings without manipulating variables or imposing experimental conditions. This provides a more realistic and ecologically valid understanding of the phenomenon under investigation.
2. **Ethical Considerations:** In some cases, conducting experimental research may be ethically challenging or impossible. Non-experimental research allows researchers to explore topics that involve sensitive or controversial issues without the need for experimental manipulation. This can be particularly relevant in fields such as psychology, sociology, and anthropology.
3. **External Validity:** Non-experimental research often has high external validity, meaning that the findings can be generalized to real-world contexts and populations. Since the research is conducted in natural settings, the results are more likely to be applicable to a broader range of situations and individuals.
4. **Longitudinal Studies:** Non-experimental research designs, such as longitudinal studies, allow researchers to track changes and developments over time. By following participants or observing phenomena over an extended period, researchers can gain insights into how variables interact and influence outcomes over the long term.



5. **Exploratory Research:** Non-experimental research is often used in the early stages of inquiry when little is known about a particular phenomenon. It helps researchers generate hypotheses, identify patterns, and explore new areas of study. This can lay the groundwork for future experimental research.
6. **Cost and Time Efficiency:** Non-experimental research designs are generally less resource-intensive compared to experimental research. They require fewer resources, such as funding, equipment, and personnel. As a result, non-experimental research can be conducted more quickly and at a lower cost.
7. **Real-Life Applications:** Non-experimental research often focuses on real-life issues and problems. The findings can have direct applications in fields such as education, public health, policy-making, and social sciences. By studying phenomena as they naturally occur, researchers can provide valuable insights to improve practice and inform decision-making.

### **Mention the disadvantages of non-experimental research?**

#### **Answer**

Non-experimental research is research that lacks the manipulation of an independent variable. Rather than manipulating an independent variable, researchers conducting non-experimental research simply measure variables as they naturally occur (in the lab or real world).

### **DISADVANTAGES OF NON – EXPERIMENTAL RESEARCH ARE:**

#### **1-Shallow**

The concise nature of non-experimental design becomes a disadvantage because it does not allow for the gathering of data post-treatment. Gathering data post-treatment can introduce entire new areas for researchers to consider. Without the inclusion of experimentation or applied treatments, the research becomes mostly one-dimensional – focused on a small series of variables. The quick, grab-and-go nature of non-experimental quantitative design cannot deliver the same in-depth results as experimental design. Non-experimental design often fails to produce an adequate amount of data from which researchers may draw complicated, revealing or truly valuable conclusions.

#### **2-Proving Correlation**

Gathering data with which to make an argument for correlation between variables lies at the center of research. Quantitative methods designed with experimentation or applied treatments multiply the variety of ways researchers alter the variables within the research. For example, observing subject reactions in a single scenario can only reveal information about the few variables in that scenario. When a treatment or treatments are applied to that scenario, the amount of data researchers can gather greatly increases. The more the researchers observe an effect across a variety of different scenarios, the stronger the case for correlation. Non-experimental quantitative method designs can fail to provide enough data to make a convincing argument for correlation, let alone causation.

#### **3-Lack of control over the variables:**

One of the main limitations of non-experimental studies is the lack of control over variables. Researchers cannot manipulate variables or control for extraneous factors, so it is more difficult to establish cause and effect relationships.

#### **4-Limited generalizability:**

They often have limited generalizability, as they are conducted in a specific context or population. This means that the results of non-experimental studies may not be applicable to other populations or settings.

**5-Difficulty measuring change:**

Non-experimental studies are typically conducted at a single point in time, which makes it difficult to measure change over time. This can be a problem if the research question examines changes in behaviour or attitudes over time.

**6-Potential bias:**

Non-experimental studies are prone to bias, as the researcher cannot control all factors that may affect the results. This means that the results of non-experimental studies may be influenced by factors not accounted for in the study design.

**Topic: Basic Principles of Experimental Designs.**

The basic principle of experimental designs are Randomization, Replication and local control of significance possible. Experimental design helps distinguish between factors and variables that effect on process and those that don't. There are three essential principles of experimental design. These principles make a valid test of significance possible. Each of them are briefly described. Professor Fisher has enumerated three principles of experimental design:

- The principle of Randomization
- The principle of Replication
- The principle of local control

1. **Principle of Randomization:** The first principle of an experimental design is RANDOMIZATION, which is the random process of assigning treatments to experimental units. The random process implies that every possible allotment of treatment has the same probability. An experimental unit is the smallest division of the experimental material, and a treatment means an experimental condition whose effect is to be measured and compared. The purpose of randomization is to remove bias and other sources of extraneous variation which are not controllable. Another advantage of randomization (accompanied by replication) is that it forms the basis of any valid statistical test. Hence, the treatment must be assigned at random to the experimental unit.

Randomization is usually done by drawing numbered cards from a well-shuffled pack of cards, by drawing numbered balls from a well-shaken container or by using a table of random numbers. Other words this principle indicates that we should design or plan the experiment in such a way that the variation caused by extraneous factors can all be combined under the general heading of "chance". As such, through the application of the principles of randomization we can have a better estimate of the experimental error.

- 2) **Principles of Replication:** according to the replication principles, an experiment is repeated more than once, as the name implies. Thus, every treatment is applied to many experimental units rather than one. By doing so, accuracy of the experiment is increased. The whole experiment can even be repeated several times for a better outcome. It is introduced with the objective of increasing the precision of a study in other words precision with which the main impact and interactions can be accessed. By replication we mean the repetition of basic experiments. The number of times these are applied to an experimental unit is called the number of a replication.
- 3) **Local Control:** it has been seen that all extraneous sources of variation are not eliminated by randomization and replication, i.e., they are actually unfit to control the extraneous sources of variation. Thus we need a refinement in the experimental technique. In other words we need to choose a design in such a way that all extraneous sources of variation are brought under control. A term referring to amount of (1) balancing (2) blocking, and (3) grouping of experimental units. The main objective of local control is to increase the efficiency and precision of experimental design by decreasing experimental error.

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**Topic: - Research Design In Case Of Descriptive and Diagnostic Research Studies**  
**Introduction**

Research design refers to the plan that defines how a research study will be conducted. It encompasses various elements such as the research questions or hypotheses, data collection methods, data analysis techniques, and the overall structure of the study. A well-designed research plan is important for ensuring the validity and reliability of the study's findings. It helps researchers make informed decisions about what data to collect, how to collect it, and how to analyse it to address their research objectives effectively. The choice of research design, whether experimental, observational, qualitative, or quantitative, depends on the nature of the research questions and the available resources. In essence, research design serves as the roadmap that guides the entire research process, from inception to conclusion. Research design is a necessary aspect of any research study as it provides the framework for collecting, analysing, and interpreting data. Here, we will see research design in the context of two common types of research studies descriptive and diagnostic research design.

**Descriptive Research Design**

Descriptive research design is a type of research method that aims to provide a detailed and accurate description of a phenomenon, event, or subject of study without manipulating variables or seeking to establish cause-and-effect relationships. Here are some key characteristics of descriptive characteristics of a particular phenomenon or situation without manipulating variables. It is often used to answer questions about who, what, when, where, and how. Let us delve into the key features of descriptive research design.

**Purpose:** The primary purpose of descriptive research is to describe the characteristics or attributes of a population, group, or phenomenon. Researchers seek to understand and document what exists.

**Data Collection Methods:** Descriptive research typically employs various data collection methods, such as surveys, observations, content analysis, and existing data analysis. Surveys and questionnaires are common tools for collecting quantitative data, while qualitative methods like interviews and focus groups can provide in-depth insights.

**Sampling:** To ensure the findings are representative, researchers must carefully select their sample. Sampling techniques may include random sampling, stratified sampling, or convenience sampling, depending on the research objectives and available resources.

**Data Analysis:** Statistical analysis is often used in descriptive research to summarize and present the collected data. Descriptive statistics like mean, median, mode, and standard deviation are frequently employed to describe the central tendencies and variations in the data.

**Time Frame:** Descriptive research can be cross-sectional, which captures data at a single point in time, or longitudinal, where data is collected over an extended period to observe changes.

**Diagnostic Research Design**

Diagnostic research, on the other hand, aims to identify the causes or factors contributing to a particular problem or phenomenon. Diagnostic research design is a structured approach used to investigate and understand specific issues, problems, or conditions, often in healthcare or social sciences. It aims to identify causes, effects, and characteristics of a phenomenon. Key elements include defining objectives, selecting a study population, choosing data collection methods, analysing data, and ensuring ethical considerations. The design is tailored to the research question and objectives, with a focus on accuracy and validity in diagnosing or understanding the targeted issue. It goes beyond description and seeks to uncover relationships and underlying causes.

Let us explore the key features of diagnostic research design.

**Purpose:** The primary purpose of diagnostic research is to diagnose the reasons behind a particular issue or phenomenon. It seeks to answer the question of why something is happening.

**Data Collection Methods:** Diagnostic research often involves a combination of qualitative and quantitative methods. Researchers may use surveys, experiments, interviews, and case studies to collect data. Qualitative data helps in understanding the context, while quantitative data assists in analysing relationships and patterns.

**Hypothesis Testing:** In diagnostic research, researchers often formulate hypotheses about potential causes and then test them through data analysis. This involves statistical tests to determine the significance of relationships between variables.

**Sampling:** Like descriptive research, sampling is crucial in diagnostic research. Researchers must select a sample that is representative of the population under study to draw meaningful conclusions.

**Data Analysis:** Advanced statistical techniques, such as regression analysis, correlation analysis, and causal modelling, are commonly used in diagnostic research. These methods help identify the strength and direction of relationships between variables.

### Comparing Descriptive and Diagnostic Research

Now, let us compare descriptive and diagnostic research in terms of their objectives, methods, and considerations.

**Objective:** Descriptive research aims to provide a detailed description of a phenomenon, while diagnostic research seeks to identify causes and relationships.

**Methods:** Descriptive research relies heavily on data collection methods that describe what exists, whereas diagnostic research combines both qualitative and quantitative methods to analyse causes and relationships.

**Data Analysis:** Descriptive research primarily uses basic statistical analysis for summarizing data, while diagnostic research employs advanced statistical techniques for hypothesis testing.

**Sampling:** Both types of research require careful sampling, but the focus may differ.

**Descriptive:** Research aims for a representative sample, while diagnostic research often focuses on identifying specific causes.

**Time Frame:** Descriptive research can be cross-sectional or longitudinal, while diagnostic research is typically focused on specific problems and may be cross-sectional.

### CONCLUSION

In conclusion, research design is a critical element in conducting both descriptive and diagnostic research studies. Descriptive research aims to provide a comprehensive description of a phenomenon, relying on various data collection methods and statistical analysis. On the other hand, diagnostic research delves deeper into the causes and relationships behind a phenomenon, often involving hypothesis testing and advanced statistical techniques.

Choosing the appropriate research design depends on the research objectives and the specific questions being addressed. By understanding the key features and methods of both descriptive and diagnostic research, researchers can design studies that yield valuable insights and contribute to the advancement of knowledge in their respective fields.

#### □ Research Design in case of Hypothesis-Testing Research Studies.

Hypothesis-Testing research studies (generally known as experimental studies) are those where the researcher tests the hypothesis of causal relationships between variables. Such studies require

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 designs 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 these blocks, whatever information is collected and inferences drawn from them, happens to be more reliable. This fact inspired him to develop certain experimental designs for testing hypothesis 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 (such as treatment, yield, plot, block etc.) in experimental designs.

□ **The basic principles of experimental designs:**

The basic principles of experimental designs are randomization, replication and local control.

These principles make a valid test of significance possible. Each of them is described briefly in the following subsection.

**1. Randomization:** The first principle of an experimental design is randomization, which is a random process of assigning treatments to the experimental units. The random process implies that every possible allotment of treatments has the same probability. An experimental unit is the smallest division of experimental material and a treatment means an experimental condition whose effect is to be measured and compared. The purpose of randomization is to remove bias and other sources of extraneous variation, which are not controllable. Another advantage of randomization (accompanied by replication) is that it forms the basis of any valid statistical test. Hence the treatments must be assigned at random to the experimental units. Randomization is usually done by drawing numbered cards from a well-shuffled pack of cards, or by drawing numbered balls from a well-shaken container or by using tables of random numbers.

**2. Replication:** The second principle of an experimental design is replication; which is a repetition of the basic experiment. In other words, it is a complete run for all the treatments to be tested in the experiment. In all experiments, some variation is introduced because of the fact that the experimental units such as individuals or plots of land in agricultural experiments cannot be physically identical. This type of variation can be removed by using a number of experimental units. We therefore perform the experiment more than once, i.e., we repeat the basic experiment. An individual repetition is called a replicate. The number, the shape and the size of replicates depend upon the nature of the experimental material. A replication is used

- [I] to secure more accurate of the experimental error, a term which represents the differences that would be observed if the same treatments were applied several times to the same experimental units;
- [II] to decrease the experimental error and thereby to increase precision, which is a measure of the variability of the experimental error; and
- [III] to obtain more precise estimate of the mean effect of a treatment, since  $\sigma^2 / n$ , where  $n$  denotes the numbers of replications.

**3. Local Control:** It has been observed that all extraneous sources of variation are not removed by randomization and replication. This necessitates a refinement in the experimental technique. In other words, we need to choose a design in such a manner that experimental sources of variation are brought under control. For this purpose, we make use of local control, a term referring to the amount of balancing, blocking and grouping of the experimental units. Balancing means that the treatments should be assigned to the experimental units in such a way that the result is a balanced arrangement of the treatments. Blocking means that like experimental units should be collected together to form a relatively homogenous control. It is to increase the efficiency of an experimental design by decreasing the experimental error. The point to remember here is that the term local control should not be confused with the word control. The word control in experimental design is used for treatment. Which does not receive any treatment but we need to find out the effectiveness of other treatments through comparison.

### Topic –Types of Research Methods Research Methods

Research is mainly done to gain knowledge which is required to interpret, write and to distribute data.

There are various methods of conducting research. We will focus on qualitative and quantitative research methods.

#### Quantitative Research

Quantitative research as the name suggests is based on measurement of particular amount or quantity of a particular phenomenon. It focuses on gathering and interpreting numerical data and can be adopted for discovering an average or pattern or for making predictions.

This form of research is number based and it lies under the two main research types. It makes use of tables, data and graphs to reach conclusions. The outcomes generated from such types of research methods are measurable in numerical form and can be repeated unlike the qualitative research method.

Quantitative research generally involves a large number of people and huge sections of data and has a lot of scope and accuracy in it.

These methods can be adopted for approaches like descriptive, correlation and experimental research.

#### Descriptive Research

In this study variables are carefully analysed and a summary of the same is given. Correlational Research

#### The relationship between the study variables is analysed

#### Quantitative research methods

1. **Experimental Research** – This method controls or manages independent variables for calculating the effects it has on dependent variables. Experimental research is a study conducted with a scientific approach using two sets of variables. The first set acts as a constant, which you use to measure the differences of the second set. Quantitative research methods, for example, are experimental. You can conduct experimental research in the following situations:

- Time is a vital factor in establishing a relationship between cause and effect.
- Invariable behaviour between cause and effect.
- You wish to understand the importance of cause and effect.

Experimental research is a powerful tool for understanding cause-and-effect relationships. It allows us to manipulate variables and observe the effects, which is crucial for understanding how different factors influence the outcome of a study.

But the importance of experimental research goes beyond that. It's a critical method for many scientific and academic studies. It allows us to test theories, develop new products, and make discoveries.

For example, this research is essential for developing new drugs and medical treatments. Researchers can understand how a new drug works by manipulating dosage and administration variables and identifying potential side effects.

Similarly, experimental research is used in the field of psychology to test theories and understand human behaviour. By manipulating variables such as stimuli, researchers can gain insights into how the brain works and identify new treatment options for mental health disorders.

## 2. Survey

Surveys are used as a method of gathering data in many different fields. They are a good choice when you want to find out about the characteristics, preferences, opinions, or beliefs of a group of people.

### Common uses of survey research include:

**Social research:** investigating the experiences and characteristics of different social groups

**Market research:** finding out what customers think about products, services, and companies

**Health research:** collecting data from patients about symptoms and treatments

**Politics:** measuring public opinion about parties and policies  
**Psychology:** researching personality traits, preferences and behaviours.

### Types of surveys

- **Observation** Just as the name suggests, observation is a method of gathering data by paying attention to the actions and behaviours of the research subjects as they interact in their environment. This qualitative research method allows you to get first-hand information about the research subjects in line with the aims and objectives of your systematic investigation.
- **Interviews** An interview is a survey research method where the researcher facilitates some sort of conversation with the research participant to gather useful information about the research subject. This conversation can happen physically as a face-to-face interview or virtually as a telephone interview or via video and audio-conferencing platforms.

During an interview, the researcher has the opportunity to connect personally with the research subject and establish some sort of relationship. This connection allows the interviewer (researcher) to gain more insight into the information provided by the research participant in the course of the conversation.

**Focus Groups** A focus group is an open conversation with a small number of carefully-selected participants who provide useful information for research. The selected participants are a subset of your research population and should represent the different groups in the larger population.

- In a focus group, the researcher can act as the moderator who sets the tone of the conversation and guides the discourse. The moderator ensures that the overall conversations are in line with the aims and objectives of the research and he or she also reduces the bias in the discussions. Based on the focus of your research, you can adopt one or more types of focus groups for your investigation. Common types of focus groups you should consider include: Dual-moderator focus group Mini focus group Client-involvement focus group Virtual or online focus groups.

### **3. Longitudinal study**

Longitudinal study is a research conducted over an extended period of time. It is mostly used in medical research and other areas like psychology or sociology. When using this method, a longitudinal survey can pay off with actionable insights when you have the time to engage in a long-term research project.

Longitudinal studies often use surveys to collect data that is either qualitative or quantitative. Additionally, in a longitudinal study, a survey creator does not interfere with survey participants. Instead, the survey creator distributes questionnaires over time to observe changes in participants, behaviour or attitudes.

Many medical studies are longitudinal; researchers note and collect data from the same subjects over what can be many years.

### **4. Correlational**

Correlational research is a type of non-experimental research method in which a researcher measures two variables and understands and assesses the statistical relationship between them with no influence from any extraneous variable. In statistical analysis, distinguishing between categorical data and numerical data is essential, as categorical data involves distinct categories or labels, while numerical data consists of measurable quantities.

### **5. Meta analysis**

Meta-analysis is the use of statistical methods to summarize the results of independent studies. By combining information from all relevant studies, meta-analysis can provide more precise estimates of the effects of health care than those derived from the individual studies included within a review.

Meta-analysis goes beyond critique and integration and conducts secondary statistical analysis on the outcomes of similar studies. It is a systematic review that uses quantitative methods to synthesize and summarize the results.

An advantage of a meta-analysis is the ability to be completely objective in evaluating research findings.

### **Qualitative research**

Qualitative research involves collecting non-numerical data (e.g., text, video, or audio) to understand concepts, opinions, or experiences. It can be used to gather in-depth insights into a problem or generate new ideas for research.

Qualitative research is the opposite of quantitative research, which involves collecting and analysing numerical data for statistical analysis.

Qualitative research is commonly used in the humanities and social sciences, in subjects such as anthropology, sociology, education, health sciences, history, etc.

Qualitative research is used to understand how people experience the world. While there are many approaches to qualitative research, they tend to be flexible and focus on retaining rich meaning when interpreting data.

Common approaches include grounded theory, ethnography, action research, phenomenological research, and narrative research. They share some similarities, but emphasize different aims and perspectives.



## Qualitative research methods

### Ethnographic research

Ethnographic research is the most in-depth observational research method that studies people in their naturally occurring environment.

This method requires the researchers to adapt to the target audiences' environments which could be anywhere from an organization to a city or any remote location. Here geographical constraints can be an issue while collecting data.

This research design aims to understand the cultures, challenges, motivations, and settings that occur. Instead of relying on interviews and discussions, you experience the natural settings first hand.

### Case study

The case study method has evolved over the past few years and developed into a valuable research method. As the name suggests it is used for explaining an organization or an entity. This type of research method is used within a number of areas like education, social sciences and similar.

This method may look difficult to operate, however, it is one of the simplest ways of conducting research as it involves a deep dive and thorough understanding of the data collection methods and inferring the data.

- Record keeping this method makes use of the already existing reliable documents and similar sources of information as the data source. This data can be used in new research. This is similar to going to a library.

There one can go over books and other reference material to collect relevant data that can likely be used in the research.

- Narrative The Narrative method of qualitative research, the researcher gathers data or facts from one or two subjects through interviews, documents etc. Over a period of time. Based on a theme, these are then pieced together (not necessarily in the same sequence) to derive answers and suggestions.

Example of application: A business can use this method to understand challenges faced by their target audience that can in turn be utilised for innovation and development of products.

- Phenomenology The Phenomenology qualitative research method is used to study an event or activity as it happens, from various angles. Using interviews, videos, on-site visits etc., one can add on to existing information using perspectives and insights from the participants themselves about the activity or event. It is primarily an experience or perception based research method.

Example of application: Universities can rely on this method to understand how students make their choices about applying to universities/colleges.

- Grounded theory Grounded theory starts with a question or collection of data. Through systematic data collection and analysis, repetitive ideas or elements are coded, and codes are grouped or categorised. New theories may be formed based on these categories.

Example of application: A product-based company can use this method to understand how their customers use their products or individual features of their product or products.

- Content analysis Content analysis is a research method that examines and quantifies the presence of certain words, subjects, and concepts in text, image, video, or audio messages.

The method transforms qualitative input into quantitative data to help you make reliable conclusions about what customers think of your brand, and how you can improve their experience and opinion.

You can conduct content analysis manually or by using tools to reveal patterns in communications, uncover differences in individual or group communication trends, and make connections between concepts.

- Discourse analysis Discourse analysis is the act of researching the underlying meaning of qualitative data. It involves the observation of texts, audio, and videos to study the relationships between the information and its context.

In contrast to content analysis, the method focuses on the contextual meaning of language: discourse analysis sheds light on what audiences think of a topic, and why they feel the way they do about it.

- Action research these methods focus on the emancipation, collaboration and empowerment of the participants. This methodology is appropriate for collaborative research with groups, especially marginalised groups, where there is more flexibility in how the research is conducted and considers feedback from the participants.

**Has three primary characteristics:**

- Action oriented, participants are actively involved in the research.
- Involvement by participants in the research, collaborative process between participant and researcher – empowerment of participants. The participants have more of a say in what is being researched and how they want the research to be conducted.
- Cycle is iterative so that it is flexible and responsive to a changing situation.

**Topic- Quantitative Methods and It's Types Quantitative Methods**

Quantitative methods refer to systematic collection and analysis of numerical data to understand and explain phenomenon. These methods are characterized by their reliance on quantifiable variables, statistical techniques, and structured approaches to data collection. It focuses on quantifying the collection and analysis of data. It is formed from a deductive approach where emphasis is placed on the testing of theory shaped by empiricist and positivist philosophies associated with the natural, applied, formal and social science this research strategy promotes the objective empirical investigation of observable phenomena to test and understand relationship.

This is done through a range of quantifying methods and techniques reflecting on its broad utilization as a research strategy across differing disciplines.

**Its main characteristics are:**

1. The data is usually gathered using structured research instruments.
2. The results are based on larger sample sizes that are representative of the population.
3. The research study can usually be replicated or repeated, given its high reliability.
4. Researcher has a clearly defined research question to which objective answers are sought.
5. All aspects of the study are carefully designed before data is collected.
6. Data are in the form of numbers and statistics, often arranged in tables, charts, figures, or other non-textual forms.
7. Project can be used to generalize concepts more widely, predict future results, or investigate causal relationships.

8. Researcher uses tools, such as questionnaires or computer software, to collect numerical data.

### Advantages of Quantitative Method

1. **Quantitative research is concerned with facts & verifiable information:** Quantitative research is primarily designed to capture numerical data – often for the purpose of studying a fact or phenomenon in their population. This kind of research activity is very helpful for producing data points when looking at a particular group – like a customer demographic. All of this helps us to better identify the key roots of certain customer behaviours. Businesses who research their customers intimately often outperform their competitors. Knowing the reasons why a customer makes a particular purchasing decision makes it easier for companies to address issues in their audiences. Data analysis of this kind can be used for a wide range of applications, even outside the world of commerce.
2. **Quantitative research can be done anonymously:** Unlike qualitative research questions – which often ask participants to divulge personal and sometimes sensitive information – quantitative research does not require participants to be named or identified. As long as those conducting the testing are able to independently verify that the participants fit the necessary profile for the test, then more identifying information is unnecessary.
3. **Quantitative research processes don't need to be directly observed:** Whereas qualitative research demands close attention be paid to the process of data collection, quantitative research data can be collected passively. Surveys, polls, and other forms of asynchronous data collection generate data points over a defined period of time, freeing up researchers to focus on more important activities.
4. **Quantitative research is faster than other methods:** Quantitative research can capture vast amounts of data far quicker than other research activities. The ability to work in realtime allows analysts to immediately begin incorporating new insights and changes into their work – dramatically reducing the turn-around time of their projects. Less delays and a larger sample size ensures you will have a far easier go of managing your data collection process.
5. **Quantitative research is verifiable and can be used to duplicate results:** The careful and exact way in which quantitative tests must be designed enables other researchers to duplicate the methodology. In order to verify the integrity of any experimental conclusion, others must be able to replicate the study on their own. Independently verifying data is how the scientific community creates precedent and establishes trust in their findings.

### Disadvantages of Quantitative Method

1. **Limited to numbers and figures:** Quantitative research is an incredibly precise tool in the way that it only gathers cold hard figures. This double edged sword leaves the quantitative method unable to deal with questions that require specific feedback, and often lacks a human element. For questions like, “What sorts of emotions does our advertisement evoke in our test audiences?” or “Why do customers prefer our product over the competing brand?”, using the quantitative research method will not derive a meaningful answer.
2. **Testing models are more difficult to create:** Creating a quantitative research model requires careful attention to be paid to your design. From the hypothesis to the testing methods and the analysis that comes after, there are several moving parts that must be brought into alignment in order for your test to succeed. Even one unintentional error can invalidate your results, and send your team back to the drawing board to start all over again.
3. **Tests can be intentionally manipulative:** Bad actors looking to push an agenda can sometimes create qualitative tests that are faulty, and designed to support a particular end result. Apolitical facts and figures can be turned political when given a limited context. You

can imagine an example in which a politician devises a poll with answers that are designed to give him a favourable outcome – no matter what respondents pick.

4. **Results are open to subjective interpretation:** Whether due to researchers' bias or simple accident, research data can be manipulated in order to give a subjective result. When numbers are not given their full context, or were gathered in an incorrect or misleading way, the results that follow can not be correctly interpreted. Bias, opinion, and simple mistakes all work to inhibit the experimental process – and must be taken into account when designing your tests.
5. **More expensive than other forms of testing:** Quantitative research often seeks to gather large quantities of data points. While this is beneficial for the purposes of testing, the research does not come free. The grander the scope of your test and the more thorough you are in its methodology, the more likely it is that you will be spending a sizable portion of your marketing expenses on research alone.

Polling and surveying, while affordable means of gathering quantitative data, can not always generate the kind of quality results a research project necessitates.

**Quantitative research methods encompass various approaches and techniques, including:**

**Experimental:** The experimental method is a research approach where researchers manipulate one or more independent variables to observe their effect on a dependent variable while controlling for other factors.

**It typically involves:**

**Hypothesis:** Formulating a clear and testable hypothesis.

1. **Experimental Group:** Creating a group that receives the treatment or manipulation.
2. **Control Group:** Creating a group that does not receive the treatment (used for comparison).
3. **Randomisation:** Randomly assigning participants to groups to reduce bias.
4. **Manipulation:** Introducing the independent variable to the experimental group.
5. **Measurement:** Collecting data on the dependent variable.
6. **Analysis:** Analysing the data to determine if the independent variable had an effect.
7. **Conclusions:** Drawing conclusions based on the results.
8. The experimental method is widely used in scientific research to establish cause-and-effect relationships between variables.

**Surveys:** Collecting data through structured questionnaires or interviews with closed-ended questions. This method helps gather data on opinions, preferences, and demographics.

**Longitudinal:** Longitudinal studies track the same individuals or groups over an extended period to observe changes and developments over time.

**Cross-Sectional:** Cross sectional studies collect data from a diverse group of participants at a single point in time. It's useful for examining differences between groups.

**Correlational:** This method examines the relationship between two or more variables to determine if they are associated with each other. It doesn't establish causation but identifies pattern of association.

**Casual Comparatives:** Casual Comparatives is a methodology used to identify cause –effect Relationships between independent and dependent variables There are two types of casual comparative research

1. **Retrospective Casual Comparative Research:** in this a researcher has to investigate a particular question after the effects have occurred. They attempt to determine whether or not a variable influences another variable.
2. **Prospective Casual Comparative Research:** The Research initiates a study beginning with the causes and determined to analyze the effects of a given condition. This is not as common as Retrospective Casual -Comparative Research. It's easier to compare a variable with the known than the unknown.

**Content Analysis:** Researchers analyze the content of texts, such as documents, articles, or social Media posts, to quantify patterns and themes.

**Meta Analysis:** Meta Analysis involves statistically combining and analysing the results of multiple studies on a particular topic to draw more robust conclusions.

**Quasi-Experimental:** Similar to experimental research but without random assignment, often used in situations where randomisation is not possible.

**Conclusion-**From this it concluded it should summarize the key findings and implications of the research. It should provide a concise answer to the research questions or hypotheses and highlight any significant patterns, relationships, or trends identified through data analysis.

#### **Difference between the case study method the survey method**

- Definition** - A case study refers to an in-depth study in which an individual, group, or a particular situation is studied.

A Survey refers to research where data is gathered from an entire population or a very large sample in order to comprehend the opinions on a particular matter.

- Research type** -Case studies are used in qualitative research.

Surveys are mostly used in quantitative research.

- Data** -Case studies produce rich in depth data.

Surveys produce numerical data.

- Acceptance** -it is valuable technique when complexity of research problem makes it difficult to design standardized inquiry instruments and when answers are contained in multiple data sources.

Survey method is widely accepted among scholars of economics and management as a valid research approach.

- Uses** – case study is useful in testing the hypothesis about large social aggregates.

Survey is useful in testing the hypothesis about structural and procedural characteristics of a social unit.

- Units** -case study studies a single unit or a group.

Survey method covers a large number of units.

- Investigation** -case study is an intensive investigation.

Survey method is a broad based investigation.

- Information gathered** – case study information gathered and analysed about a large number of features of each case.

Survey uses information gathered and analysed about a small number of features of each case.

- **Qualification of data is priority** – in case study method qualification of data is not a priority. indeed, qualitative data may be treated as superior.

In survey method qualification of data is a priority.

### **Qualities of a Good Research Design Research Design**

#### **Definition**

The Research design is the structure of research methods and techniques picked by a researcher to direct his study. The design allows researchers to sharpen the research methods suitable for the subject matter and set up their studies for success.

#### **Qualities of a Good Research Design**

Designing a research, is very complex as the selection of a method or methods of logic and planning of the design was not always guarantee sound results. As a model, the research design may at best be only useful to the extent of providing the researcher with a series of guidelines to keep him headed in the right direction. Although every design has its own strengths and weaknesses and together the possibility of a single perfect research design is difficult, a good research design is often believed to possess characteristic features like flexibility, appropriateness, efficiency, economically sound and so on. A design which minimizes bias and maximizes the reliability of data is understood as a good design. Similarly the design giving the smallest experimental error is considered to be the best design and the design yielding maximal information covering various aspects of a problem is construed as the most efficient design because it is appropriate to the research problem. Consideration of a design as good depends too much upon the objective of the research problem and also the nature of the problem under investigation. A single design can never serve the purpose of all types of research problems because what appears to be suitable in one case may be lacking in one respect or the other in the context of some other research problems. A good research design should always fulfill the following Six conditions; objectivity, reliability, validity, feasibility, Redundancy, and Efficiency of the findings.

- **Objectivity:-**

It refers to the findings related to the method of data collection and scoring of the responses. The research design should permit the measuring instrument which are fairly objective in which every observer or judge scoring the performance must precisely give the same report. In other words, the objectivity of the procedure may be judged by the degree of agreement between the final scores assigned to different individuals by more than one independent observer. This ensures the objectivity of the collected data which shall be capable of analysis and drawing generalizations.

- **Reliability:-**

Reliability refers to consistency throughout a series of measurements. If a respondent gives out a response to a particular item, he is expected to give the same response to that item even if he/she is asked repeatedly. If he is changing his response to the same item, the consistency will be lost. So the researcher should frame the items in a questionnaire in such a way that it provides consistency or reliability.

- **Validity:-**

Any measuring device or instrument is said to be valid when it measures what it is expected to measure. For example an intelligence test conducted for measuring the IQ should measure only the intelligence and nothing else, and the questionnaire shall be framed accordingly.

□ **Internal validity:-**

It also called causality, examines whether the observed change in a dependent variable is indeed caused by a corresponding change in hypothesized independent variable, and not by variables extraneous to the research context. Causality requires three conditions:

- (1) covariation of cause and effect (i.e., if cause happens, then effect also happens; and if cause does not happen, effect does not happen),
- (2) temporal precedence: cause must precede effect in time,
- (3) no plausible alternative explanation (or spurious correlation).

Certain research designs, such as laboratory experiments, are strong in internal validity by virtue of their ability to manipulate the independent variable (cause) via a treatment and observe the effect (dependent variable) of that treatment after a certain point in time, while controlling for the effects of extraneous variables. Other designs, such as field surveys, are poor in internal validity because of their inability to manipulate the independent variable (cause), and because cause and effect are measured at the same point in time which defeats temporal precedence making it equally likely that the expected effect might have influenced the expected cause rather than the reverse. Although higher in internal validity compared to other methods, laboratory experiments are, by no means, immune to threats of internal validity, and are susceptible to history, testing, instrumentation, regression, and other threats that are discussed later in the chapter on experimental designs. Nonetheless, different research designs vary considerably in their respective level of internal validity.

□ **External validity:-**

It refers to whether the observed associations can be generalized from the sample to the population (population validity), or to other people, organizations, contexts, or time (ecological validity). For instance, can results drawn from a sample of financial firms in the United States be generalized to the population of financial firms (population validity) or to other firms within the United States (ecological validity)? Survey research, where data is sourced from a wide variety of individuals, firms, or other units of analysis, tends to have broader generalizability than laboratory experiments where artificially contrived treatments and strong control over extraneous variables render the findings less generalizable to real-life settings where treatments and extraneous variables cannot be controlled.

□ **Construct validity:-**

It examines how well a given measurement scale is measuring the theoretical construct that it is expected to measure. Many constructs used in social science research such as empathy, resistance to change, and organizational learning are difficult to define, much less measure. For instance, construct validity must assure that a measure of empathy is indeed measuring empathy and not compassion, which may be difficult since these constructs are somewhat similar in meaning. Construct validity is assessed in positivist research based on correlational or factor analysis of pilot test data, as described in the next chapter.

- **Statistical conclusion validity** examines the extent to which conclusions derived using a statistical procedure is valid. For example, it examines whether the right statistical method was used for hypotheses testing, whether the variables used meet the assumptions of that statistical test (such as sample size or distributional requirements), and so forth. Because interpretive research designs do not employ statistical test, statistical conclusion validity is not applicable for such analysis.

- **Feasible:-**  
Good designs can be implemented. The sequence and timing of events are carefully thought out. Potential problems in measurement, adherence to assignment, database construction and the like, are anticipated. Where needed, additional groups or measurements are included in the design to explicitly correct for such problems.
- **Redundant:-**  
Good research designs have some flexibility built into them. Often, this flexibility results from duplication of essential design features. For example, multiple replications of a treatment help to insure that failure to implement the treatment in one setting will not invalidate the entire study.
- **Efficient:-**  
Good designs strike a balance between redundancy and the tendency to overdesign. Where it is reasonable, other, less costly, strategies for ruling out potential threats to validity are utilized.

### **Types of Qualitative Research Methods:**

#### **Introduction**

Qualitative research methods are a broad category of research techniques that focus on exploring and understanding the complexities of human behaviour, experiences, and social phenomena. Unlike quantitative methods, which emphasize numerical data and statistical analysis, qualitative methods prioritize in-depth exploration, interpretation, and context. In this comprehensive guide, we will delve into the world of qualitative research, covering its defining characteristics, various approaches, data collection techniques, data analysis methods, and ethical considerations. By the end of this discussion, you should have a solid understanding of qualitative research and its relevance in academic and practical settings.

#### **Defining Qualitative Research**

Qualitative research is an empirical research method that seeks to gain an in-depth understanding of social phenomena, human behaviour, and subjective experiences. It is characterized by its emphasis on non-numerical data and its commitment to exploring the complexity and context of the researched subjects. Qualitative research is particularly well-suited for addressing research questions that involve how and why rather than what or how many.

#### □ **Data Collection in Qualitative Research**

Qualitative research employs various data collection techniques to gather rich, contextually embedded information. The choice of data collection method depends on the research question, the nature of the phenomenon under study, and the available resources.

#### □ **Types of Qualitative Research**

Qualitative research encompasses various approaches and methods, each with its own unique focus and techniques. Some common types of qualitative research include:

##### **1. Case Study:**

**Definition:** A case study is an in-depth exploration of a specific individual, group, event, or phenomenon. It involves a comprehensive examination of a single case or a few cases to gain a deep understanding of them.

##### **Key Characteristics:**

**Holistic Approach:** Case studies focus on understanding the entirety of a case, considering various aspects and dimensions.



**Contextual:** They emphasize the importance of context and its influence on the case.  
**Qualitative Data:** Researchers collect qualitative data, such as interviews, observations, and documents.

**Exploratory or Explanatory:** Case studies can be used for exploratory research to generate hypotheses or explanatory research to understand causality.

**Applications:**

**Business:** Analysing the success or failure of a particular company. **Education:** Studying innovative teaching methods in a specific school.

## 2. Ethnography:

**Definition:** Ethnography is an immersive research method in which researchers participate in the culture or community they are studying. It involves prolonged engagement and participant observation to understand the beliefs, practices, and social dynamics of a group.

**Key Characteristics:**

- Participant Observation:** Researchers actively participate in the culture they are studying, often living among the participants.
- Deep Understanding:** Ethnography aims to provide an insider's perspective, leading to a rich and nuanced understanding.
- Thick Descriptions:** Ethnographers produce detailed, context-rich descriptions of the culture they study.
- Cultural Relativism:** Ethnographers try to understand the culture from the participants' point of view without imposing their own judgments.
- Market Research:** Understanding consumer behaviour and preferences.
- Education:** Examining classroom dynamics and teaching practices.

## 3. Historical Research:

**Definition:** Historical research involves the systematic study of past events, people, and phenomena. Researchers use primary and secondary sources to reconstruct and analyse historical contexts.

**Key Characteristics:**

- Use of Historical Documents:** Researchers rely on historical documents, archives, and artifacts.
- Chronological Approach:** Historical research typically follows a chronological order to trace developments over time.
- Interpretation:** Researchers interpret historical data to draw conclusions and make connections.
- Contextualization:** Historical research emphasizes the importance of understanding historical events within their social, political, and cultural contexts.

**Applications:**

- Legal Studies:** Examining historical legal cases and precedents.
- Political Science:** Analysing the historical evolution of political systems.

### 3. Content Analysis:

#### Topic: "Characteristics of Research Design"

#### **Key aspects of research design and its importance in the research process. Introduction to Research Design:**

Research design is a crucial aspect of any research study. It is the blueprint or plan that outlines how a research study will be conducted. A well-structured research design is essential for achieving the research objectives and obtaining valid and reliable results. There are several characteristics that define a research design, and these characteristics play a significant role in shaping the research process. In this discussion, we will explore the key characteristics of research design.

#### **1. Clear Research Objectives and Questions:**

One of the primary characteristics of a research design is that it should clearly define the research objectives and research questions. Before embarking on any research project, researchers need to have a clear understanding of what they aim to achieve through the study. This involves formulating research questions that are specific, measurable, and relevant. The research design should align with these objectives and questions, ensuring that the study stays focused and purposeful.

#### **2. Research Type:**

Research designs can vary based on the type of research being conducted. The two main types of research are quantitative and qualitative. Quantitative research design involves collecting numerical data and using statistical analysis to draw conclusions, while qualitative research design focuses on gathering non-numerical data, such as interviews and observations, to gain insights into underlying phenomena. The choice of research type is a critical characteristic that depends on the research objectives and the nature of the research problem.

#### **3. Data Collection Methods:**

Research design outlines the methods and techniques that will be used to collect data. These methods can include surveys, experiments, interviews, observations, content analysis, and more. The selection of data collection methods should be guided by the research objectives and the type of data required. For instance, if the research aims to understand people's opinions and experiences, qualitative methods like interviews and focus groups may be chosen, whereas quantitative methods like surveys are more appropriate for gathering numerical data.

#### **4. Sampling Strategy:**

Sampling is an integral part of research design, especially in quantitative research. Researchers must decide how they will select a subset of the population (sample) to draw conclusions about the entire population. The sampling strategy should be representative and unbiased to ensure the generalizability of the findings. Common sampling methods include random sampling, stratified sampling, and convenience sampling, among others.

#### **5. Time Frame and Research Scope:**

Research designs need to specify the time frame of the study and its scope. Researchers must determine the duration of data collection, analysis, and reporting. Additionally, they need to define the boundaries of their research, including the geographic area, demographic characteristics of the participants, and the specific variables or factors they will investigate. A well-defined scope helps maintain focus and manage resources effectively.

#### **6. Research Variables:**

In any research study, there are independent and dependent variables. Independent variables are the factors that are manipulated or controlled by the researcher, while dependent variables are the outcomes or responses that are measured. The research design should clearly identify these

variables and explain how they will be measured or manipulated. This is crucial for ensuring that the research study is structured and systematic.

### **7. Control and Experimental Groups:**

In experimental research designs, there is often a need for control and experimental groups. The control group serves as a baseline against which the effects of the experimental treatment or intervention can be compared. Proper allocation and management of these groups are essential for drawing valid conclusions about causation.

### **8. Data Analysis Plan:**

Research design should outline the data analysis plan, which includes the statistical or qualitative techniques that will be used to analyse the collected data. This plan ensures that the research objectives are met and that the results are interpreted accurately. It is essential to choose appropriate statistical tests or qualitative analysis methods based on the research design and data type.

### **9. Ethical Considerations:**

Ethical considerations are a critical aspect of research design. Researchers must address issues related to informed consent, privacy, confidentiality, and the well-being of participants. Ethical guidelines and principles should be adhered to throughout the research process, from data collection to dissemination of findings.

### **10. Flexibility and Adaptability:**

While a research design provides a structured plan, it should also allow for flexibility and adaptability. Researchers may encounter unexpected challenges or opportunities during the study, and the design should accommodate adjustments without compromising the validity of the research.

### **11. Pilot Testing:**

Before implementing a research design on a large scale, it is often advisable to conduct a pilot study. This small-scale trial run helps identify any flaws in the research design, data collection instruments, or procedures. It allows researchers to make necessary adjustments before the main study begins.

### **12. Literature Review:**

A well-designed research study is grounded in a thorough literature review. Researchers should be aware of existing studies in their field, which can help inform the research design and identify gaps in current knowledge. A comprehensive literature review is essential for creating a research design that adds value to the existing body of knowledge.

### **13. Validity and Reliability:**

Two critical characteristics of research design are validity and reliability. Validity refers to the extent to which a study accurately measures what it intends to measure, while reliability pertains to the consistency and stability of the research findings. A well-designed research study strives to maximize both validity and reliability.

### **14. Reporting and Dissemination:**

Finally, a research design should consider how the findings will be reported and disseminated. Researchers need to plan for the publication of results in academic journals, presentations at conferences, or sharing findings with relevant stakeholders. The communication of research findings is essential for contributing to the advancement of knowledge.

**CONCLUSION:**

In conclusion, research design is a multifaceted aspect of the research process, encompassing various characteristics that are essential for the successful execution of a study. A well-structured research design is the foundation upon which the entire research project is built. It guides researchers in formulating clear objectives, selecting appropriate methods, and ensuring ethical considerations are addressed. Ultimately, the characteristics of research design play a vital role in the quality and validity of research outcomes, making it a fundamental component of the research process. Researchers should carefully consider these characteristics when designing their studies to ensure the research is rigorous, reliable, and contributes meaningfully to their field of study.

**Topic: Basic Principles of Experimental Designs**

The basic principle of experimental designs are Randomization, Replication and local of significance possible. Experimental design helps distinguish between factor and variables that effect on process and those that don't. There are three essential principles of experimental design. These principles make a valid test of significance possible. Each of them are briefly described. Professor Fisher has enumerated three principles of experimental design:

- The principle of Randomization
- The principle of Replication
- The principle of local control

**1. Principle of Randomization:** The first principle of an experimental design is

**Randomization**, which is the random process of assigning treatments to experimental units. The random process implies that every possible allotment of treatment has the same probability.

An experimental unit is the smallest division of the experimental material, and a treatment means an experimental condition whose effect to be measured and compared. The purpose of randomization is it to remove bias and other sources of extraneous variation which are not controllable.

**Another**

Advantage of randomization (accompanied by replication) is that it forms the basis of any valid statistical test. Hence, the treatment must be assigned at random to the experimental unit.

Randomization is usually done by drawing numbered cards from a well-shuffled pack of cards, by drawing numbered balls from a well-shaken container or by using a table of random numbers.

**Other**

Words of this principle indicate that we should design or plan the experiment in such a way that the variation caused by extraneous factors can all be combined under the general heading of "chance".

As such, through the application of the principles of randomization we can have a better estimate of the experimental error.

**2) Principles of Replication:** according to the replication principles, experiment is repeated more than once, as the name implies. Thus, every treatment is applied to many experimental units rather than one. By doing so, accuracy of the experiment is increased. The whole experiment can even be repeated several times for a better outcome. It is introduced with the objective of increasing the precision of a study—in other words, precision with which the main impact and interactions can be accessed. By replication we mean the repetition of basic experiments. The number of times these are applied to experimental unit is called the number of a replication.

**3) Local Control:** it has been seen that all extraneous sources of variation are not eliminated by

randomization and replication, i.e., they are actually unfit to control the extraneous sources of variation. Thus we need to a refinement in the experimental technique. In other words we need to choose a design in such a way that all extraneous sources of variation are brought under control. A term referring to amount of (1) balancing (2) blocking, and (3) grouping of experimental units. The main objective of local control is to increase the efficiency and precision of experimental design by decreasing experimental error.

## **TYPES OF EXPERIMENTAL RESEARCH**

### **What is Experimental Research?**

Experimental research is a form of comparative analysis, in which you study two or more variables and observe a group under a certain condition or groups experiencing different conditions. Experimental research is the most familiar type of research design for individuals. It is widely used in the field of education. This is mainly because experimental research is a classical scientific experiment, similar to those performed in high school science classes. It allows educators to test new teaching methods and identify what works best. By using variables such as class size, teaching style and curriculum, researchers can understand how students learn and identify new ways to improve educational outcomes.

In other words, we can say that Experimental research is a scientific approach to research, where one or more independent variables are manipulated and applied to one or more dependent variables to measure their effect on the latter. The effect of the independent variables on the dependent variables is usually observed and recorded over some time, to aid researchers in drawing a reasonable conclusion regarding the relationship between these 2 variable types. It is a method of gathering information and data on a subject through observation in controlled settings. In addition, experimental research is a powerful tool for businesses and organizations. By controlling variables such as marketing strategies, product design, and customer service, companies can understand what works best and identify new opportunities for growth. It allows us to test theories, develop new products and make groundbreaking discoveries.

### **Types of Experimental Research**

The types of experimental research design are determined by the way the researcher assigns subjects to different conditions and groups. There are 3 primary types of experimental research: -

#### **1- Pre-Experimental Research: -**

A group or various dependent groups are kept under observation after implementing cause and effect factors. This research is conducted to understand whether further investigation is necessary for these particular groups. It is the simplest form of experimental research design and it is treated with no control group.

The pre-experimental research design is further divided into 3 types: -

#### **i- One-shot case study research design -**

In this type of experimental study, only one dependent group or variable is considered. The study is carried out after some treatment variable is considered. The study is carried out after some treatment which was presumed to cause change, making it a posttest study.

#### **ii- One-group pretest-posttest research design-**

This research design combines both posttest and pretest study by carrying out a test on a single group before the treatment is administered and after the treatment is administered. With the formed being administered at the beginning of treatment and later at the end.

**iii- Static-group comparison-**

In this study, two or more groups are placed under observation, where only one of the groups is subjected to some treatment while the other groups are held static. All the groups are post-tested and the observed differences between the groups are assumed to be a result of the treatment.

**2- True Experimental Research Design: -**

It relies on statistical analysis to prove or disprove a hypothesis, making it the most accurate form of research. Of the types of experimental design, only true design can establish a cause-effect relationship within a group. In a true experimental, 3 factors need to be satisfied:

- There is a control group, which won't be subject to changes and an experimental group, which will experience the changed variables.
- A variable that can be manipulated by the researcher
- Random distribution

**This experimental research method commonly occurs in the physical sciences. The classification of true experimental design include:**

**i- The Posttest-Only Control Group Design:**

In this design, subjects are randomly selected and assigned to the 2 groups (control and experimental) and only the experimental group is treated. After close observation, both groups are post- tested and a conclusion is drawn from the difference between these groups.

**ii- The Pretest-Posttest Control Group Design:**

For this control group design, subjects are randomly assigned to the 2 groups, both are presented but only the experimental group is treated. After close observation, both groups are post-tested to measure the degree of change in each group.

**iii- Solomon Four-Group Design:**

This is the combination of the pretest-only and the pretest - posttest control groups. In this case, the randomly selected subjects are placed into 4 groups. The first two of these groups are tested using the posttest-only method, while the other two are tested using the pretestposttest method.

**3- Quasi-Experimental Research: -**

The word "Quasi" indicates Similarity. A quasi - experimental research is similar to true experimental research and experimenters can apply it in similar ways. The primary distinction between the two is a lack of randomization when assigning participants to groups in a quasiexperimental study. This usually occurs because of rules or regulations that prevent researchers from applying random allocations in some settings, such as a research study at a university. It is used in the field settings where random assignment is either irrelevant or not required.

**INTERVIEW****Introduction**

Interviews are a ubiquitous and versatile form of communication that takes place between two or more individuals. These structured conversations serve numerous purposes across various domains, including employment, journalism, research, and information gathering. They are a fundamental tool for exchanging information, assessing qualification, and gaining insights. This discussion will delve into the essence of interviews, their diverse kinds, and the underlying objectives that derive their use.

, "An interview is any planned conversation with a specific purpose involving two or more people"

### Purpose of Interviews

**Assessment:** job interview are perhaps the most common form of interviews.

They are employed by employers to assess a candidates qualification, skill, and suitability for a specific job role. Through interviews, employers aim to delve deeper into a candidates resume, understanding their personality, and gauge their potential fit within the organisation.

- **Information Gathering:** journalistic interviews are a cornerstone of news reporting. Journalists conduct interviews to gather firsthand information, quotes, and insights from sources. These interviews provide the foundation for news stories, enabling the public to stay informed about current events, trends, and issues.
- **Research:** interviews play a pivotal role in academic and social research.

Researchers' employ interviews to collect primary data, delve into the experiences and perspectives of participants, and generate qualitative insights.

Qualitative research interviews can be structured or unstructured, depending on the study's goals.

- **Interrogation:** in the legal realm, interviews serve as a means of gathering crucial information from witnesses, victims, or suspects. Law enforcement officers, detectives, and legal professionals employ specialized interviewing techniques to obtain evidence and testimony, which can impact legal proceedings.

**Communication:** Interviews are also used for communication and engagement purposes. In the media and entertainment industry, interviews provide a platform for public figures, celebrities, and experts to share their views, experiences, and stories with a wider audience. These interviews can take the form of talk shows, podcasts, or press conferences.

### Kinds of Interviews

✚ **Job interviews:** These interviews are pivotal in the employment process.

**Employers conduct job interview to evaluate a candidate's** and compatibility with a particular role. They can be one-on-one or panel interviews, conducted in person or virtually.

✚ **Informational interviews:** Aspiring professionals seeking career guidance or insight into a specific industry often engage in informational interviews with experienced individuals. These interviews help gather advice, industry knowledge, and networking opportunities.

✚ **Research interviews:** Researchers conduct interviews can be structured, semi-structured, or unstructured, depending on the research objectives. They are used to collect qualitative data, opinions, and experience.

✚ **Journalistic Interviews:** journalists conduct interviews with a wide range of sources, including politicians, celebrities, experts, and eye witnesses, to gather information for news. They can be conducted in person, over the phone, or via video conferencing.

✚ **Panel interviews:** in some hiring processes, multiple interviewees come together to assess a candidate's suitability for a position. Panel interviews are common in large organisations or for senior roles.

✚ **Group Interviews:** In group interviews, multiple candidates are assessed simultaneously. These interviews are often used in the initial stages of the hiring process to narrow down the candidate pool.

✚ **Telephone/ video interviews:** with the rise of remote work and technology, telephone and video interviews have become more prevalent. They allow for convenient and efficient interviewing, especially for candidates who may be located far from the prospective employer.

- ✚ **Stress interviews:** some employers use stress interviews to assess a candidate's ability to handle pressure and remain composed under challenging circumstances. These interviews aim to evaluate a candidate's resilience and adaptability.
- ✚ **Exit interviews:** when an employee leaves a job, they may participate in an exit interview. This serves as an opportunity for departing employees to provide feedback on their work experience, contributing to organizational improvement.
- ✚ **Structured vs. Unstructured interviews:** interviews can be highly structured, with predetermined questions and more open-ended, allowing for free-flowing conversation and exploration of topics.

## CONCLUSION

Interviews are multifaceted tools that facilitate communication, information exchange, and decision-making across various domains. They come in diverse forms, tailored to their specific purposes, and play a pivotal role in shaping our understanding of the world, connecting people, and driving progress in numerous fields. Whether you are seeking a job, uncovering truth, conducting research, or simply engaging in a conversation, interviews are an indispensable means of human interaction and discovery.

## OBSERVATION

Observation is probably the oldest method used by men in scientific investigation. His first knowledge of Observation is probably the oldest method used by man in scientific investigation. His first knowledge of the universe around him begins with observation. The little child, when he opens his eyes in this world finds himself surrounded by strange and unknown things, His curiosity inspires and he begins to observe them. Gradually, he is able to understand their significance and use. So the process goes on.

Unaided sense observation was found to be crude and limited in power. So various kinds of tools were devised to increase their power, and make the observation more perfect. In modern times observation is not the only method of scientific research. Various other methods have been evolved but even now observation is one of the most important methods of research. In the physical sciences the observation is the only method for new experiment, although guided and controlled observation has replaced the ancient form of unaided observation.

The *observation method* is a process that involves human or mechanical observation to observe and describe the behaviour of a subject. As the name suggests observational research is a way of collecting relevant information and data by involves observing people's behaviour. The observational Research method is also referred to as a participatory study because the researcher has to establish a link with the respondent and for this has to immerse himself in the same setting as theirs. Only then can he use the observational research method to record and take notes.

### Kinds of Observations

Observation can be classified into various types according to the method

#### 1. Participant Observation:

The observation may be participant or make and the type of control exercised. Following are the chief types of observation participant. When the observer participates with the activities of the group under study, it is known as participant observation. Thus a participant observer is himself part of the group under study. He need not necessarily carry out all the activities as carried out by other members of the group, but; his presence as a active member of the group is necessary. Thus, he will be known as participant observer if he is present in some capacity other than as an observer viz historian, a correspondent etc. He freely mixes with social activities of the group their normal workings, functions and festivals, not as a total alien but as a fledged member of



the group, not as an outsider trying to have a critical study of what they do, but as a willing member trying to participate in what they do. Under participant observation, thus the purpose of critical study is concealed.

Participant observation is a method that helps you see and understand what people are doing and compare it with what they say. In this way, you help researchers know if the people with whom you are conducting a study act differently from what they are described.

It also allows the researcher to better understand what is happening in a given group and its cultural environment, giving greater credibility to their interpretations of the observation.

### **Types of Participant Observation**

Now that you know what this method is and what its most common characteristics are, we will introduce you to the types that exist.

#### **Passive participant observation**

Researchers observe and record the behaviours of their subjects in their own environment without conversing or interacting with them in any way.

Many of the studies that use this form of participant observation are studies in which researchers observe people's behaviour and communications in public places, such as restaurants, coffee shops, transportation hubs, and even on the Internet through innovative methods such as netnography.

#### **Active participant observation**

In this way, researchers converse with their subjects and participate in the daily life of the groups they study, including their activities, customs, rituals, routines, etc.

The degree of commitment of researchers to these groups varies. Some researchers limit their interactions to interviews, while others engage in all aspects of their subjects' lives.

Examples of this form of participant observation are studies in which researchers lived for long periods of time among different ethnic, cultural, or religious communities.

#### **Covert and overt**

In covert participant observation, researchers do not make their presence known to their subjects and, if they do, they do not identify themselves as investigators, whereas in open participant observation they do.

However, even when the investigation is open, investigators often do not inform the people they meet in the course of their investigation of the specific purpose of the investigation, nor do they inform everyone they meet that they are researchers, as this could unnecessarily interrupt conversations and events being observed.

#### **Covert and active**

Covert and active participant observation has several advantages. In this type of participant observation, researchers can have access to a group that they would not otherwise have the opportunity to observe, and they can experience the practices of the group as they are experienced by the members of the group.

Generally, researchers can alter group behaviour by their presence, but in this form of participant observation, groups would not consciously change their behaviour in response to the researcher's presence because they are not aware of being observed.

□ **Covert and passive**

In the case of covert and passive participant observation, researchers are not likely to alter the behaviours of their subjects, since the researchers do not actively engage with their subjects and because the subjects are also not aware that they are being observed.

However, since observation is passive, researchers do not have the opportunity to experience the lives of their subjects for themselves.

□ **Open and active**

If observation is open and active, people can participate in and experience their subjects' activities as their subjects would, but they run the risk of both changing the behaviour of their subjects through their interactions with them, and that their subjects change their behaviour by themselves knowing that they are being studied.

□ **Open and passive**

As in the case of covert and passive participant observation, researchers do not run the risk that their presence alters the behaviour of the groups they study through their interactions with them.

However, the guinea pig effect is a problem for this form of observation, unlike the case of covert and passive participant observation, because the participants are aware that they are being studied. Furthermore, researchers cannot experience the world as it is as subjects would.

**2. Non-Participant Observation:**

When the observer does not actually participate in the activities of the group, but simply observes them from distance, it is, known as a non-participant observation. Purely non-participant observation is extremely difficult. We can not imagine a kind of relationship which a person is always present but never participates. It is most likely to make both the observer and the group uncomfortable. A golden mean therefore, sometimes, selected. The observed of actively participates in some of the ordinary activities while remains only a distant observer in others. A non-participant observation is therefore, in practice only a quasi-participant observation. It has been found easier to carry on both the roles than to attempt to disguise one self completely.

**3. Non-Controlled Observation:**

Observation may be controlled or uncontrolled. When the observation is made in the natural surroundings and the activities are performed in their usual course without being influenced or guided by any external force it is known as non-controlled observation. Thus in case of non-controlled observation the observer visits the place of occurrence of phenomena in order to observe e.g. study of slum conditions or folklores. Non-controlled observation is generally not very reliable. We may be induced to generalize from stray incident, without properly verifying them. The observation itself may be biased and coloured by the views of the observer. because there is no check upon him. Various observers may observe the same thing differently and draw different conclusions. The greatest difficulty is that the observer may be so overpowered by uncontrolled and stray events that he may regard them to be absolutely true while they are far from being so.

**4. Controlled Observation:**

Because of the defects of non-controlled observation mentioned previously, controlled observation techniques have been developed. Such controlled observation is afforded greater precision and objectivity and can be repeatedly observed under identical conditions. The main purpose of a controlled observation is, thus, to check any bias due to faulty perception in accurate data and influence of outside factors on the particular incident. The control exercised in the observation is of two types. 1. Control over the phenomena, and 2. Control over the observation.

## INTRODUCTION

A schedule is a structure of a set of questions on a given topic that are asked by the interviewer or investigator personally. The order of questions, the language of the questions and the arrangement of parts of the schedule are not changed. However, the investigator can explain the questions if the respondent faces any difficulty. It contains direct questions as well as questions in tabular form.

- Schedules include open-ended questions and close-ended questions.

Open-ended questions allow the respondent considerable freedom in answering. However, questions are answered in details. Close-ended questions have to be answered by the respondent by choosing an answer from the set of answers given under a question just by ticking.

### Purpose of Schedules

- Schedule is the tool or instrument used to collect data from the respondents while interview is conducted. Schedule contains questions, statements (on which opinions are elicited) and blank spaces/tables for filling up the respondents. The features of schedules are :-
  - i. The schedule is presented by the interviewer. The questions are asked and the answers are noted down by him.
  - ii. The list of questions is a more formal document, it need not be attractive.
  - iii. The schedule can be used in a very narrow sphere of social research.

- **The main purposes of schedule are three fold :-**

- i. To provide a standardized tool for observation or interview in order to attain objectivity.
- ii. To act as memory tickler i.e., the schedule keeps the memory of the interviewer/ observer refreshed and keeps him reminded of the different aspects that are to be particularly observed
- iii. To facilitate the work of tabulation and analysis.

### Types of Schedule

**There are several kinds of schedule:-**

- Rating Schedules** is a schedule used to obtain opinions, preferences etc. respondents over statements on the phenomenon studied. The schedule consists of positive and negative statements of opinion on the phenomenon.
- Documents Schedules** are used to collect data/information from recorded evidences and/or case histories. Here the blanks, functional issues related blanks and the like to be filled up from records and documents are present.
- Survey Schedules** are like questionnaires.
- Observation Schedules** are schedules used when observational method of data collection is used. These could be structured or unstructured interview schedules are used for collecting data when interview method of communication with the respondents is used.

### Essentials of A Good Schedule

**A good schedule must have the following features:-**

- Content:** Should cover questions or statements relating to all significant aspects of the study.
- Dissectional:** Should look into the problem analytically, dissecting every, major and significant components of the problem.

- Context:** Should suit the context in which it is applied. Different types of studies need different schedules.
- Criterion:** Should use sound logic in classifying respondents based on opinions expressed.
- Construction:** Should be constructed in such a way that questions statements progress gradually and in order. Better it is sub-divided into parts, each part dealing with a certain sub topic of the issue studied. For each objective, a separate part may be devoted.
- Language:** Should be linguistically superbly designed. Clear and straight forward language be used.
- Reliable:** Should be reliable such that same results are obtained whenever the schedule is used when everything else remains same.
- Mechanical aspects:** Paper used, margin space given, spacing, printing, size of letters, etc. Should be normal.
- Size:** Should not too length nor too short. Should give fair coverage to the topic.
- Qualities to be avoided:** Long, complex, presumptuous, personal, embarrassing, hypothetical issues, morality oriented, upsetting type and necessary questions must be avoided.

#### Procedure for formulating a schedule

- Study the different aspects of the problem.** The problem under study should first of all be split up into various aspects. The determination of these aspects will depend upon clear understanding of the problem under study.
- Sub-divide the problem to get necessary information.** Each aspect has again to be broken up into a number of sub-parts. These sub- parts should be quite exhaustive to give a full and complete picture of the aspect under study.
- Class questions.** Care should be taken to see that the questions convey the exact sense. Respondents will be willing to supply information without any hesitation, bias or distortion of facts, if questions are exact and clear.
- Serialization of Questions.** In order to obtain well-organised information, it is necessary that the questions should be presented to the respondents in a well-ordered serial. It has been experienced to various field studies that the change in the order of questions affects the answers adversely.
- Testing the validity of schedule.** Whatever may be the degree of precaution taken, some slips are based to be left out and these can be located when the schedule is put into a reliability and validity test.
- Division.** The schedule be divided into adequate number of divisions.  
Introductory part, instructional part, issues related parts, etc. Are certain parts by which the schedule is divided into parts.
- Appropriate form of questions.** Use appropriate forms of questions at appropriate places. Open ended, close ended, pictorial, Yes or No (Questions), multiple choice questions, etc. Can be used.

#### Types of Questions in Schedules

**Schedules** are the tools or instruments to collect data from the respondents while an interview is being conducted. It contains questions, statements (on which opinions are elicited), and blank spaces or tables for responses.

Asking the right type of questions is important because doing so can help in gathering information that is relevant and useful. Questions can be divided into two broad categories, open-ended questions and structured questions.

### 1. Open Ended Questions

Open-ended questions are powerful tools for gaining deeper insights into a specific topic. It encourages deliberate and extensive responses as well as critical thinking and creativity. Open-ended questions should be thoroughly answered because they are thought-provoking. People can respond to these questions honestly and to the best of their abilities. Open-ended questions present an opportunity for learning whether they are used in surveys, interviews, or research.

Open-ended questions are essential when looking for detailed and insightful information. Each kind of open-ended question serves a certain purpose. Others are suggestion questions that encourage creativity and create an engaging environment, while some are meant for hypothetical circumstances to encourage critical thinking.

- i. **Hypothetical Questions:** Hypothetical questions offer the survey participant a hypothetical situation or scenario to consider potential results, opinions, or actions.

**These questions are also known as scenario questions.**

- ii. **Suggestion questions:** These questions are intended to encourage original and imaginative answers. Participants in surveys are permitted to freely share their own thoughts in suggestion questions.
- iii. **Future-oriented questions:** When addressing questions with a future focus, respondents make predictions about potential events or outcomes. These inquiries promote innovative thinking.
- iv. **Experiential questions:** These questions encourage participants to elaborate on their individual experiences or stories that connect to a specific theme or issue.

### Need For Open-Ended Questions

Open-ended inquiries are crucial when we want to delve further into a subject and understand more about it in-depth. We might require open-ended questions if we want to gather a lot of qualitative data. These queries prompt participants to consider several perspectives, which leads to insightful responses.

Generally speaking, open-ended questions are required to delve deeply into a topic, gather qualitative data, and foster creativity. In this regard, we may claim that open-ended inquiries are especially helpful. In conclusion, open-ended questions provide flexible chances for use in a range of contexts and purposes. Open-ended survey questions are a helpful tool in a variety of fields.

### Some examples of open-ended questions for customer surveys are-

- How would you recommend our product/service to others?
- If you could change one thing about our product/service, what would it be?
- Can you provide an example of a situation where our customer support team resolved a problem?
- Can you describe the relationship or connection you feel with our brand?

In order to thoroughly research a topic, gather extensive qualitative data, and foster critical thinking in participants, open-ended questions are essential. They are an invaluable tool for fully comprehending a topic or phenomenon and for creating comprehensive viewpoints. For scholars,

businesses, and organizations, open-ended inquiries can be a useful tool for developing distinctive views and a thorough understanding of complex events.

## 2. Structured Questions

Structured questions are close-ended questions, allowing limited, quick, and quantitative responses. Therefore, respondents can swiftly respond to these questions, and survey analysts can compare answers with ease. When we ask structured questions, we'll get quantitative responses or information that can be measured and compared rapidly to the responses of respondents to produce quantifiable insights.

### Benefits of Structured Questions

When using a large sample size or wanting to compare responses quickly and take action on the feedback received, structured survey questions are frequently the ideal approach.

- i. **High Response Rate:** We'll probably get more responses if we ask structured questions because they are simpler for respondents to complete than open-ended ones and take less time.
- ii. **Clarity and Accuracy:** Structured questions offer precise instructions and make it simple for respondents to comprehend and provide truthful answers.
- iii. **Consistency and Comparability:** We may quickly compare results by posing the same questions to respondents with the same possible answers and using reliable data.
- iv. **Relevancy:** Structured questions assist in making sure the data gathered is relevant to your survey objectives by limiting responses.
- v. **Efficiency:** Large volumes of data may be collected and analysed fast by using structured questions since they are easy to ask, answer, and analyse.
- vi. **Analysis:** Data analysis is made simpler by structured questions, which can assist us in finding trends, patterns, and insights that can guide our decision-making.

**Comparing information from several groups or surveys that ask the same questions falls under this category.**

### Types of Structured Questions

- a) **Multiple-choice questions:** Multiple-choice questions require a participant to select one or more answers from a set of predetermined options created by the researchers.

Since researchers are interested in discovering trends in their target demographic, the list of response options will include a variety of potential responses; nonetheless, there is no right or wrong response. Multiple-choice tests are used in research to evaluate ideas like satisfaction, agreement, confidence, or the chance of something happening.

- b) **Single-choice questions:** Single-select multiple-choice questions, which are the type most frequently associated with multiple-choice questions, require participants to select just one response from the list of possible answers. All possible answers are displayed simultaneously for these questions, and participants can select one of them.
- c) **Dichotomous questions:** Dichotomous multiple-choice questions involve participants selecting an answer from only two possible options, which are usually the opposite of one another. Examples of these include either 'Yes' or 'No', 'True' or 'False', or 'Agree' or 'Disagree'
- d) **Ordinal scale questions:** Sometimes we only need a one-word response or a direct, quantifiable response to the majority of the questions, and we don't need to anticipate the

respondents' responses to be lengthy paragraphs. Ordinal scales are extremely helpful in these circumstances. Through a predetermined set of ordered responses or answer choices included with the question itself, an ordinal or ordered scale enables us to examine the respondents' opinions towards our research issue. Survey questions with options like: “very good” “good” “average” “bad” and “very bad” is the ordinal scale.

For example, How would you rate our customer service?

- Very good
  - Good
  - Average
  - Poor
  - Very poor
- e) **Interval scale questions:** Respondents rate their level of agreement or disagreement, typically on a scale of 1 to 5 or 1 to 7, using terms like “strongly agree,” “neither agree nor disagree,” etc. The interval scale can measure the difference between values, which makes it quantitative. Since interval data is simple and quantifiable, it is particularly helpful in corporate, social, and scientific analysis and strategy as we may give a numerical value to any arbitrary assessment, such as feelings and sentiments.

One of the most commonly used interval scale questions is arranged on a five-point Likert Scale question, where each emotion is denoted with a number, and the variables range from extremely dissatisfied to extremely satisfied.

**For example,** Q. Customer satisfaction is key to organisational growth

- 1 Strongly Agree
  - 2 Agree
  - 3 Neither agree nor disagree
  - 4 Disagree
  - 5 Strongly Disagree
- f) **Semantic differential questions:** Using a multi-point rating system, a semantic differential scale invites respondents to score a specific entity, such as a corporation, brand, or product. Each end of these survey response possibilities uses an adjective that is grammatically contradictory.

**For example,** satisfied-unsatisfied, likely-unlikely, Very Pleasant, Very Unpleasant

123456

**How was your experience?**

- g) **Matrix questions:** In matrix questions, numerous multiple-choice questions are presented concurrently in a grid arrangement. Each row in this grid will have a single response option that participants must choose from. A Matrix question is a group of multiple-choice questions displayed in a grid of rows and columns. The rows present the questions to the respondents, and the columns offer a set of predefined answer choices that apply to each question in the row.

**For example,** Q. How satisfied are you with your flight experience?

Criteria	Very Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Very Dissatisfied
In-flight service	✓				
Onboard entertainment				✓	
WiFi connectivity		✓	✓		
Meal options					

When selecting whether to use structured or open-ended questions in schedules, there is obviously no one proper solution. If quantifiable data that can be easily analyzed is required, the advantages of structured questions will frequently prevail. However, there is something to be said about the rich insights that may be obtained from open-ended questions.

We must create a schedule that strikes a balance between the two for effective research. The majority of the time, we may employ structured inquiries, but we also carefully consider whether an unstructured question can be beneficial.

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Personal interview-all details including advantages and disadvantages Personal interview are one of the most used type of interview, where the questions are asked personally directly to the respondent as a form of an individual interview. One of the many inperson interviews a lunch interview which frequently better suit for casual inquiries and discussion for this research can have a guide to online survey to take note of answers .a. researcher can be design his her survey on such a way that they can take a notes of the comment or point of view that stand out from the interviewee it can we one -of one interviewas well.

A personal or face to face interview employs a standard structured questionnaires to ensure that all the respondent are asked questions in the same manner or in the same sequences.

It is a two way conversation initiated by interviewer to obtain information from a respondent the questions, the wording, and the sequences define the structure of the interview is conducted face to face.

Studies that obtain data by interviewing people are called survey. if the people interview represent a large population ,such studies are called sample surveys thus a sample survey is method of gathering primary data based on communication with representative sample of individuals.

The number of questions and exact wording of each questions incorporated in the questionnaire are identical to all the respondent are specified in advance

The interviewer merely reads each questions to respondent and usually restrains from providing explanations of the questions if the respondent ask for the classification.

A personal interview is the meeting organised by a recruiter in which he evaluates a potential employee for prospective employment.

However this meeting should we considered a two way process between the candidate and the interviewer .the interviewer looks to find out how well the candidate should do the job and fit in



with their organisation, and the candidate aims to show that they are the best person for the job and organisation.

A personal interviewer is expected to know more about working background and personal experiences. An interviewer will also judge you looking at your work history and success and failure stories. That's why it's essential to talk about all the points that cover your past success in your job you're applying for.

### **Type of personal interviews**

There are different types of personal interviews for different aims. Let's take a quick look at them all.

#### **There are two types of personal interview:**

##### **1. Personal interview for jobs:**

A personal interview for jobs focuses on your skill set, whether you are the right candidate for the organisation, whether or not you have clear communication skills, and how well you fit in with the team.

##### **2. Personal interview for college admission:**

An interview for admission focuses on shortlisting the right student for the limited number of seats for the selected stream. The admission panel observes the student's body language, communication skills, your ability to learn.

### **What happened in the personal interview?**

Job interviews are usually face-to-face meetings; however, in recent times, telephone interviews and Skype interviews have become more common places, especially after certain times of pandemics.

Interviews last approximately 25-30 minutes, although telephonic interviews may be slightly shorter. But it all depends upon the nature of communication between two parties. That is, mostly the profile you have applied to, depending on the type of job and seniority of the role, the interview panel may vary between one to four rounds and may be followed by an assessment task. Usually, the more senior the position, the wider the panel composition.

Personal interviews are a means of two-way communication between the recruiter and the candidate in which a meaningful conversation leads to a productive understanding and a contract between the two.

#### **Read the steps to know how to crack a personal interview carefully:**

##### **1) Be careful while creating your resume**

The purpose of your CV is to show your interviewer why you are the best person for this job. Your CV is the first to the interviewer representing your candidature. This is the best impression for you to get a job. First impression is the last impression.

Make sure to include these points while drafting a CV –

1. Your CV should look professional. Use a template if confused.
2. Use bullet points instead of big paragraphs. These motivate the interviewer to read your CV more.
3. Ensure there are no spelling mistakes.
4. Try to highlight points related to the job.
5. Use a customised resume.
6. Write a strong job objective.

**2) Think from the recruiter's prospective**

Thinking about what you could have looked for an ideal candidate if you are an interviewer is the second step for cracking interview.

**3) Prepare frequently asked questions**

Some questions are very common in job interviews, which are asked in almost every personal interview.

**Some commonly asked questions during a personal interview round are:-**

- Tell me about yourself?
- What's your current job and role?
- Why do you want to join this company?
- Why did you leave your recent job?
- What your biggest achievement so far?
- Etc

**4) Also focus on verbal communication**

There are two way of communication verbally and non verbally verbal means what you speak and write whereas non-verbal communication include tone you speak your way of setting eye contact etc

**5) Run the entire interview process several time in mind**

To crack interview is to run the entire interview process several time in the mind before you present yourself by doing this your mind become more clear about manythings Advantages of personal interview

1. Flexibility
2. Response rate
3. Nonverbal behaviour
4. Control over the interview environment
5. CompletenessFlexibility

Flexibility is the major advantages of the interview study .interviewer wants for more specific answers and can repeat and clarify a question when the response indicates that the respondent misunderstood the questions

**Response rate**

The personal interview tends to have higher interview response rate then the mail questionnaires illiterate person can still answer questions in an interview , and other unwillingto spent their time energy to reply to an impersonal mail questionnaire may be glad to talk Non verbal behaviour The interview is personally present to observe non verbal behaviour and to assess the validityof respondents answer directly Control over interview environment an interviewer can standardised the interview by ensuring that the interview was conducted in privacy that there was none to influence the respondent,nor that there was anyone to dictate Completeness In a personal interview interviewer ensure that all questions have been answered .

Limitation of personal interview 1.High cost Interview studies can be extremely costly costs are involved in selecting ,training and supervising interviewer paying them and the travel accommodation and the required toaccommodation and time required to complete the field work

2. It required high quality of trained interviewer
3. The process is time consuming
4. Geographical limitation.

### **Introduction of non-probability sampling**

- It is a technique where in the samples are gathered in a process that does not given all the individuals in the population equal chances of being selected in a sample.
- In other words, in this type of sampling every subject does not have equal chance to be selected because elements are chosen by choice not by chance.
- The non probability sampling method is a technique in which the researcher selects the sample based on subjective judgment rather than random selection. In this method, not all the members of the population have a chances to participate in the study.

### **Types of non probability sampling**

1. Convenience sampling.
2. Judgement sampling.
3. Quota sampling.
4. Snowball sampling.
5. Purposive sampling.

### **Let explain all the above types:-**

#### **1. Convenience sampling:-**

In a convenience sampling method, the samples are selected from the population directly because they are conveniently available for the researcher did not choose the sample outlines the entire population. It is also called grab sampling, availability sampling, accidental sampling etc.

- It is type of sampling in which data is collected from the “conveniently available respondents”.
- It is low cost and fast sampling technique.

#### **Merits –**

1. Collect data quickly: - In a situation where time is constraint, many researchers choose this method for quick data collection.
2. Inexpensive to create samples:- The money and time invested in other probability sampling methods are quite large compared to convenience sampling. It allows the researcher to generate more samples with less or no investment.
3. Easy to do research:- Elements are easily accessible by the researcher so collecting members for the sample become easy.
4. Low cost:- When on a small budget, researchers especially students can use the budget in other areas of the project.
5. Convenience sampling is a non sampling method and it provides a wealth of qualitative information.

#### **Demerits:-**

1. **Bias in sampling:** - When participants are not chosen at random from a larger population, this might result in sampling bias. This indicates that the sample may not be typical of the greater population, and the findings may not apply to other groups.

2. **External validity is limited:** - It may have poor external validity due to the possibility of sampling bias and a lack of diversity. As a result, the findings may not apply to different locations or populations.
3. **Unknown error:** - Convenience sampling can lead to unknown errors since the researcher may be unaware of how skewed or unrepresentative the sample is of the population.
4. A convenience sampling does not provide a representative result.

## 2. Purposive / Judgement sampling:-

Purposive sampling is used in research studies to select a specific group of individuals or units for analysis. This method is appropriate when the researcher has a clear idea of the characteristics or attributes they are interested in studying and wants to select a sample representative of those characteristics.

- It is a sampling technique in which researcher selects the sample based on his knowledge and judgement.
- Selection of sample exclusively depends on the judgement of researcher.
- It is also called authoritative sampling, deliberate sampling, selective sampling, subjective sampling etc.

### Merits-

1. **Cost** – It can be less expensive than other sampling methods, as it does not require a random selection process.
2. **Flexibility** - flexibility in the selection of the sample, which can be useful when the researcher is studying a rare or unusual phenomenon.
3. **In-depth data** - often used in qualitative research, which allows the researcher to gather in-depth data on specific topics or issues. This can provide valuable insights and understanding of the research question.
4. **Practicality** - practical and efficient in comparison to other sampling methods, particularly in small-scale studies with limited sample sizes.
5. **Accurate results:**-It gives a better result if the investigator is unbiased and has the capacity of keen observation and sound judgement.

### Demerits-

1. Sampling error, or the difference between the sample and the population, is more likely to occur in purposive sampling because the sample is not selected randomly. This can affect the reliability and accuracy of the study.
2. It is simple and easy, no complicated procedure is involved to draw the sample.
3. Data is collected only from the relevant respondents. Unnecessary respondents are rejected.
4. This method is not suitable for the large samples where the size of both the universe and the sample is considerably.
5. There is no equal chance for all the items of the universe being included in the sample.

### 3. Quota Sampling:-

1. Quota sampling is an important sampling method that involves a non-probability sampling technique in which sampling is not based upon the probability of appearance. In such a process, the researcher decides the selection of sampling based on some quota. In quota sampling, the researcher makes sure that the final sample must meet his quota criteria.

- ☐ In this sampling technique entire population is subdivided in to homogenous group and then a quota (no.of items /respondents to be selected for sample) is fixed for eachgroup.
- ☐ Once the quota is assigned to each group then sample is selected using convenience or judgement sampling.

• **Merits:-**

1. Quota sampling emerges as an attractive choice when you are pressed for time, because primary data collection can be done in shorter time.
2. The application of quota sampling can be cost-effective.
3. Quota sampling is not dependent on the presence of the sampling frames. In occasions where suitable sampling frame is absent, quota sampling may be the only appropriate choice available.
4. It facilitate the comparison of two research groups and it can be used s a primary research method in a variety of studies.

**Demerits:-**

1. Quota sampling does not allow random selection of participants of the research.
2. Quota sampling increases the risk of researcher bias as a researcher might include people in research who he finds to easy to approach or have co-operative nature.
3. The outcome of quota sampling is not accurate as it lacks randomness of the selection of participants.
4. The result of quota sampling research is not reliable as it is affected by many factors.
5. The accuracy of quota sampling largely depends on the judgment of the study. The biased approach of the researcher influences the accuracy of the result of the quota sampling research method.

**4. Snowball Sampling:-**

Snowball sampling or chain-referral sampling is defined as a non- probability sampling technique in which the samples have rare traits. This is a sampling technique, in which existing subjects provide referrals to recruit samples required for a research studies.

- In this technique researcher selects one/two initial respondents, collects data from them. These initial respondents refer or identify other respondents.

This technique works on referral system.

It is used when a population is unknown and when the respondents is not easily accessible.

**Merits:-**

1. **It's quicker to find samples:** Referrals make it easy and quick to find subjects as they come from reliable sources. An additional task is saved for a researcher, this time can be used in conducting the study.
2. **Cost effective:** This method is cost effective as the referrals are obtained from a primary data source. It's is convenient and not so expensive as compared to other methods.
3. Snowball Sampling is suitable when the population is hidden, and it is difficult to collect data from sample.

**Demerits:-**

1. Sampling bias may occur as this technique is totally based on referral system.
2. There are chances that initial respondents may not refer to other respondents.

3. There are fair chances even after referrals, people might not be cooperative and refuse to participate in the research studies.

### **IMPORTANT STEPS, PROCEDURE FOR FORMING A SCHEDULE**

Schedules are popularly used methods of collecting data in research survey. Questionnaire and schedules both are likely the same somewhat. Schedules are being prepared by enumerators who are expert in filing the schedules. It is another type of Data Collection process which contains statements, questions, and blank spaces to fill up the answers given by enumerator or interview. For making a schedule, experts are needed so that data can be collected in a proper way, with right information. Like questionnaires, the schedule making process is not inexpensive as compared to questionnaire, schedule is expensive and relatively slower than questionnaire process. As we all know schedules are made by experts so their identity is acknowledged. A schedule is a qualitative Data Collection tool. They use interview method which can be structured or even unstructured to collect qualitative types of data from the respondents. In this method there is a face to face interaction between the respondent and the interviewer. It contains low risk as compared to questionnaire on information basis.

In the schedule method of data collection, the grouping may exist or may not exist. The coverage of this method is relatively small as there are constant in sending enumerators to large areas. As the enumerators have a direct face to face communication with respondents they can solve any doubts and queries of respondents.

As we all have a busy schedule, the time is limited in this method when compared to the questionnaire method. Discussion among group of people can lead to get more information. So they sometimes try to have a group of people respond.

#### **Important Steps:-**

- **Content:** It should cover all the aspects of the study covering all the problems, solution, ideas etc.
- **Context:** Using the right context which is suitable for that topic. Different studies need different schedules.
- **Criterion:** Making a schedule on any topic should have a logic.
- **Language:** Clear and straight forward language be used so that other can also understand easily.
- **Reliable:** Same results should be obtained whenever anyone uses your schedule tools, should get the same results.
- Finding the problem or topic.
- Deciding what all information is required.
- Selecting the important tools for data collection.
- Decide the proper method.
- Framing the accurate questions.
- Make an appropriate content.
- Make an order for questions like, from low to high.

Accurate response is said to have been achieved when replies contain the information which they want. The information should not only be in para form only it should also be capable of being tabulated and if possible used for statistical analysis.

**Procedure:-**

1. The enumerator first need to understand the topic or problem he/she going to start on schedule.
2. Study about the problem and making the schedules.
3. He/She must be clear about the various aspects and should have an accurate information.
4. Deciding the tools which you are going to use.
5. The researcher must decide which types of questions to ask based on different side of society. So that respondents will be willing to supply information without any hesitation or distortion of facts.
6. Questions should be simple for people but logical for the enumerator.
7. It should be simple and straight direct questions so that the respondent should not feel difficulty in answering.
8. The schedule should be divided into sections, like Introduction part, Instruction, Topic etc. To make them understand better.

**What is the observation method?**

We always notice and observe the events around us in our daily lives. Such an observation frequently results in a choice. For instance, while we go down the street, we see vehicles and people moving in various directions. Based on these findings, we could decide whether to cross the street. We can act following such a determination. We also keep an eye out when driving to observe if the light is green or not, as well as the street conditions, other moving vehicles, people on foot or in bicycles, etc., and we drive accordingly to prevent accidents from happening when someone suddenly leaps in front of a moving vehicle.

The active collection of information from a primary source is referred to as **observation**. Observation in living beings makes use of the senses. Observation in science can also refer to the interpretation and recording of data using scientific instruments. The term could also be applied to any data gathered during the course of the scientific activity. Observations can be qualitative, which means that only the lack or presence of a property is noted, or quantitative, which means that a numerical value is assigned to the observed phenomenon by counting or measuring it.

**LIMITATIONS OF OBSERVATION:****(1) Some of the occurrences may not be open to observation:**

There are many personal behaviours or secret activities which are not open for observation. For example, no couple will allow the researcher to observe their sexual activities.

**(2) Not all Occurrences open to observation can be observed when observer is at hand:**

Such problems arise because of the uncertainty of the event. Many social events are very much uncertain in nature. It is a difficult task on the part of the researcher to determine their time and place.

**(3) Not all occurrences Lend themselves to observational study:**

Most of the social phenomenon is abstract in nature. For example, love, affection, feeling and emotion of parents towards their children are not open to our senses and also cannot be quantified by observational techniques.

**(4) Lack of reliability:**

Because social phenomena cannot be controlled or used for laboratory experiments, generalizations made by observation method are not very reliable. The relative-ness of the

social phenomena and the personal bias of the observer again create difficulty for making valid generalization in observation.

**(5) Faulty Perception:**

Observation is a highly technical job. One is never sure that what he is observing is the same as it appears to his eyes. Two persons may judge the same phenomena differently. One person may find something meaningful and useful from a situation but the other may find nothing from it.

**(6) Personal Bias of the Observer:**

The personal bias, personal view or looking at things in a particular way often creates obstacle for making valid generalization. The observer may have his own ideas of right and wrong or he may have different pre-conceptions regarding an event which kills the objectivity in social research.

**(7) Slow Investigation:**

Observation is a time taking process. P.V. Young rightly remarks that the valid observation cannot be hurried; we cannot complete our investigation in a short period through observation.

**(8) Expensive:**

Observation is a costly affair. It requires high cost, plenty of time and hard effort. Observation involves travelling, staying at the place of phenomena and purchasing of sophisticated equipment's.

**(9) Inadequate Method:**

According to P.V. Young, "the full answers cannot be collected by observation alone". Therefore many suggested that observation must be supplemented by other methods also.

**(10) Difficulty in Checking Validity:**

Checking the validity of observation is always difficult. Many of the phenomena of observation cannot be defined with sufficient precision and does not help in drawing a valid generalization.

**Advantages of the observation method**

**1. Easiest Method**

The most popular and straightforward way to get data is undoubtedly through observation. It only calls for a little technical expertise.

**2. Helpful for Framing Hypothesis**

One of the key sources for developing hypotheses is observation. The researcher can become remarkably familiar with the phenomenon they are regularly observing.

**3. Enhanced Accuracy**

The data obtained through observation is frequently more accurate than that obtained through interviews or questionnaires. The researcher must rely on the information provided by the respondents when using alternative methods, such as an interview.

**4. A Global Method**

Whether it be scientific or social sciences, observation is commonly employed in all of them. As a result, its application is more widespread. It is quite simple to follow and accept as a regular practice.

**5. An Universal Method:**

Observation is a common method used in all sciences, whether physical or social. So it has greater universality of practice. As a common method, it is very easily followed and accepted.



**6. Observation is the Only Appropriate Tool for Certain Cases:**

Observation can deal with phenomena which are not capable of giving verbal information about their behaviour, feeling and activities simply for the reason that they cannot speak e.g. infants or animals.

**7. Independent of People's Willingness to Report:**

Observation does not require the willingness of the people to provide various information about them. Often some respondents do not like to speak about themselves to an outsider.

**CONCLUSION**

Observation is the Only Appropriate Tool in Certain Cases The only option when dealing with animals is observation. Observation can deal with phenomena such as infants or animals who cannot verbally express their feelings or activities, let alone give verbal information about their behaviour.

**Independent of People's Willingness to Report**

Observation is independent of people being willing to provide various information about themselves. Many times, some individuals feel uncomfortable talking about themselves with an outsider.

**Directness**

The fundamental benefit of observation is that it is straightforward. The observer does not need to question subjects about their actions and reports from others. Data can be gathered as it happens. Real and True

Every piece of information must start as an experience or impression. Direct observation must always be attempted because it is the most reliable method.

**Improved Understanding of Consumer Behaviour**

Observation is the only relevant method for uncooperative individuals who are hesitant to share information regarding their behaviour.

**Thank you.....**

**Sampling error:** This error arises when a sample is not representative of the population. Sampling errors occur in the process of collecting data from a subset, or sample, of a larger population. These errors can introduce bias and affect the accuracy and generalizability of research findings. There are two main types of sampling errors:

**Random Sampling Error:** This type of error arises due to the natural variability inherent in any random sampling process. It occurs when the sample selected does not perfectly represent the population it is supposed to represent. Random sampling error can lead to statistical fluctuations in the data, making it important to interpret results with caution. Increasing the sample size can help reduce random sampling error.

**n-Sampling Error:** This category encompasses all other errors that can occur during the data collection process, aside from random sampling error. Non-sampling errors can result from factors like data collection methods, questionnaire design, interviewer bias, or response bias. These errors are often more challenging to identify and quantify, but they can have a significant impact on the validity of study results.

For example, if our population comprises 200 MBA students in a business school and we want to estimate the average height of these 200 students by taking a sample of 10 (say).

**Let us assume for the sake of simplicity that the true value of population mean (parameter) is known.**

When we estimate the average height of the sampled students, we may find that the sample mean is far away from the population mean. **The difference between the sample mean and the population mean is called sampling error**, and this could arise because the sample of 10 students may not be representative of the entire population.

Suppose, now we increase the sample size from 10 to 15, we may find that the sampling error reduces. This way, if we keep doing so, we may note that the sampling error reduces with the increase in sample size as an increased sample may result in increasing the representativeness of the sample.

### **Sample Design Steps**

Sampling design is a crucial step in the research process, as it determines how you will select a subset of individuals or items from a larger population for your study. Here are the steps involved in designing a sampling plan:

#### **1. Define the Population:**

- Clearly define the population of interest. This is the group of individuals, items, or entities that your research aims to study. Ensure that your population is well-defined and relevant to your research objectives.

#### **2. Determine the Sampling Frame:**

- Identify a sampling frame, which is a list or source from which you will draw your sample. The sampling frame should ideally include all members of the population, but this may not always be feasible.

#### **3. Select a Sampling Method:**

Choose an appropriate sampling method based on your research goals and available resources. Common sampling methods include:

- **Random Sampling:** Each member of the population has an equal chance of being selected.
- **Stratified Sampling:** Divide the population into subgroups (strata) based on certain characteristics and then randomly sample from each stratum.
- **Systematic Sampling:** Select every *n*th member from a list or ordered population.
- **Cluster Sampling:** Divide the population into clusters and randomly select some clusters for inclusion in the sample.
- **Convenience Sampling:** Select individuals or items that are most readily available or accessible.
- **Purposive Sampling:** Handpick specific individuals or items based on certain criteria relevant to the research.

#### **4. Determine Sample Size:**

- Calculate or determine the appropriate sample size. The sample size should be large enough to represent the population accurately while considering factors like statistical significance and practical constraints.

#### **5. Randomize:**

- If you're using random sampling, ensure that the selection process is truly random. This can be done using random number generators or other randomization techniques.

**6. Collect Data:**

- Once you've identified your sample, collect the necessary data from each member of the sample. Ensure that data collection methods are consistent and well-documented.

**7. Analyze Data:**

- Analyze the collected data using appropriate statistical techniques, depending on your research objectives. Ensure that your analysis accounts for any sampling biases or errors.

**8. Interpret Results:**

- Interpret the results of your analysis in the context of your research objectives. Consider the implications of your findings and any limitations of your sample design.

**9. Draw Conclusions:**

- Based on your analysis and interpretation, draw conclusions that address your research questions or hypotheses.

**10. Report Findings:**

- Communicate your findings through research reports, presentations, or other relevant means. Be transparent about your sampling design, limitations, and the generalizability of your results.

**11. Validate Sampling Design:**

- After completing your study, reflect on the effectiveness of your sampling design. Consider whether your sample accurately represents the population and whether any adjustments to your design would have yielded different results.

Sampling design is a critical aspect of research methodology, and careful consideration at each of these steps is essential to ensure the validity and reliability of your research finding. Difference between Questionnaire and Schedule

**Definition of Questionnaire**

We define questionnaire as an instrument for research, which consists of a list of questions, along with the choice of answers, printed or typed in a sequence on a form used for acquiring specific information from the respondents. In general, questionnaires are delivered to the persons concerned either by post or mail, requesting them to answer the questions and return it. Informants are expected to read and understand the questions and reply in the space provided in the questionnaire itself.

The questionnaire is prepared in such a way that it translates the required information into a series of questions, that informants can and will answer. Further, it should be such that the respondent gets motivated and encouraged, to make him engaged in the interview and complete it. The merits of questionnaires are discussed below:

It is an inexpensive method, regardless of the size of the universe. Free from the bias of the interviewer, as the respondents answer the questions in his own words. Respondents have enough time to think and answer. Due to its large coverage, respondents living in distant areas can also be reached conveniently.

**Definition of Schedule**

The schedule is a proforma which contains a list of questions filled by the research workers or enumerators, specially appointed for the purpose of data collection. Enumerators go to the informants with the schedule, and ask them the questions from the set, in the sequence and record the replies in the space provided. There are certain situations, where the schedule is distributed to the respondents, and the enumerators assist them in answering the questions.

Enumerators play a major role in the collection of data, through schedules. They explain the aims and objects of the research to the respondents and interpret the questions to them when required. This method is little expensive as the selection, appointment and training of the enumerators require a huge amount. It is used in case of extensive enquiries conducted by the government agencies, big organisations. Most common example of data collection through schedule is population census.

### **Key Differences between Questionnaire and Schedule**

#### **The important points of difference between questionnaire and schedule are as under:**

- 1- Questionnaire refers to a technique of data collection which consist of a series of written questions along with alternative answers. The schedule is a formalised set of questions, statements, and spaces for answers, provided to the enumerators who ask questions to the respondents and note down the answers.
- 2- Questionnaires are delivered to the informants by post or mail and answered as specified in the cover letter. On the other hand, schedules are filled by the research workers, who interpret the questions to the respondents if necessary.
- 3- The response rate is low in case of questionnaires as many people do not respond and often return it without answering all the questions. On the contrary, the response rate is high, as they are filled by the enumerators, who can get answers to all the question.
- 4- The questionnaires can be distributed a large number of people at the same time, and even the respondents who are not approachable can also be reached easily. Conversely, in schedule method, the reach is relatively small, as the enumerators cannot be sent to a large area.
- 5- Data collection by questionnaire method is comparatively cheaper and economical as the money is invested only in the preparation and posting of the questionnaire. As against this, a large amount is spent on the appointment and training of the enumerators and also on the preparation of schedules.
- 6- In questionnaire method, it is not known that who answers the question whereas, in the case of schedule, the respondent's identity is known.
- 7- The success of the questionnaire lies on the quality of the questionnaire while the honesty and competency of the enumerator determine the success of a schedule.
- 8- The questionnaire is usually employed only when the respondents literate and cooperative. Unlike schedule which can be used for data collection from all classes of people.

### **CONCLUSION**

As everything has two aspects, so as with the case of questionnaire and schedule. The risk of collection of inaccurate and incomplete information is high in the questionnaire, as it might happen that people may not be able to understand the question correctly. On the contrary, schedule faces the risk of biases and cheating of the interviewer.

### **MERITS AND DEMERITS OF QUESTIONNAIRE MERITS:**

#### **1. Efficiency:**

- **Time-saving:** By distributing questionnaires to many participants at once, it is possible to gather data from a wide range of people in a little amount of time.
- **Convenience:** There is no need to schedule interviews or meetings because respondents can complete surveys whenever it is convenient for them.

## 2. Cost-Effectiveness:

- **Lower Personnel Costs:** Comparing administering questionnaires to holding in-person interviews or focus groups, administering questionnaires often calls for less staff, which results in cost savings.
- **Lower Materials Costs:** Since digital questionnaires can be developed and delivered online, they are less expensive to print and distribute than paper surveys.
- **Savings on Data Entry:** It is frequently possible to automatically gather and enter the data from surveys into a database, eliminating the need for human data entry.

## 3. Anonymity:

- **Honest Answers:** When respondents are confident in their anonymity, they are more inclined to give open-and-shut answers to delicate or private inquiries. They can provide more accurate data since they don't have to worry about their identity being connected to their responses.
- **Reduced Social Desirability Bias:** Respondents are less likely to give responses they think are socially acceptable or anticipated than their actual opinions or experiences when they are anonymous.
- **Increased Participation:** When sensitive themes are involved, people may be more inclined to answer questions in surveys or questionnaires if they are aware that their answers would remain anonymous.

## 4. Confidentiality:

- **Protection of Personal Information:** Maintaining respondents' privacy is a component of confidentiality. Even though the responses might not be completely anonymous, the researcher makes sure that the respondent's name and answers are kept to themselves and never disclosed to anyone else.
- **Ethical Considerations:** Keeping information private is not just a recommended practice but also a necessity of ethics in many research investigations, particularly when working with delicate subjects, medical data, or personal experiences.
- **Cooperation and Trust:** Maintaining respondents' confidentiality fosters mutual trust between the researcher and them. People are more willing to collaborate and supply correct information when they have confidence that their information will be treated in confidence.

## 5. Wide geographic reach :

- **Diverse Perspectives:** A questionnaire with a wide geographic reach allows you to gather responses from people in different regions and cultures, providing diverse perspectives and insights.
- **Increased Sample Size:** A larger geographic reach can result in a larger and more representative sample size, which can improve the statistical validity of your findings.
- **Better Decision-Making:** With data from a wide geographic reach, organizations and researchers can make more informed decisions and tailor strategies to different geographic areas.

## 6. Standardization:

- **Consistency:** Standardized questions ensure that each respondent receives the same wording and format, reducing potential bias in responses.

- **Comparability:** It allows for easy comparison of responses across different respondents, groups, or time periods, aiding in data analysis.
- **Reliability:** Standardization helps increase the reliability of the questionnaire by minimizing variability in question wording, which can improve the consistency of responses.
- **Validity:** Well-standardized questions can enhance the validity of the data collected, as they are less likely to introduce confounding factors or biases.

#### 7. Versatility:

- **Wide Applicability:** Questionnaires can be used in various fields and for a wide range of research topics. Whether you're conducting research in psychology, sociology, marketing, healthcare, or any other discipline, questionnaires can be adapted to suit your needs.
- **Quantitative and Qualitative Data:** Questionnaires can be designed to collect both quantitative and qualitative data. Closed-ended questions with predefined answer choices yield quantitative data, while open-ended questions allow respondents to provide qualitative insights.
- **Longitudinal Studies:** Questionnaires can be adapted for use in longitudinal studies, where data is collected from the same respondents over an extended period. This versatility makes questionnaires suitable for tracking changes and trends over time.
- **Cross-Cultural Research:** Questionnaires can be adapted and translated into different languages, making them valuable for cross-cultural research to compare responses across diverse populations.

#### DEMERITS OF QUESTIONNAIRE:

##### 1. Limited depth:

- **Shallow Insights:** Questionnaires often yield limited depth of understanding as they rely on pre-defined questions with fixed response options, making it difficult to capture nuanced or complex information.
- **Lack of Context:** Questionnaires may fail to provide context or detailed explanations for responses, hindering researchers' ability to interpret data accurately.
- **Incomplete Picture:** Respondents may provide superficial or socially desirable answers, leading to an incomplete or biased portrayal of their true beliefs or behaviors.
- **Inflexibility:** Questionnaires may not adapt to respondents' unique perspectives or experiences, potentially missing important insights.

##### 2. Response bias:

- **Acquiescence Bias:** Some individuals tend to agree with statements without carefully considering them, leading to skewed results.
- **Confirmation Bias:** Respondents might seek affirmation of their existing beliefs, shaping their responses to fit preconceived notions.
- **Non-response Bias:** When a certain group doesn't participate, the sample may not represent the entire population accurately, introducing bias.
- **Order Bias:** The sequence of questions can influence responses, with early questions impacting how respondents answer later ones.

##### 3. Low response rates:

- **Limited Participation:** Questionnaires often suffer from low response rates, primarily due to participant apathy or lack of motivation.
- **Non-Engagement:** Respondents may find questionnaires impersonal or time-consuming, leading to a reluctance to complete them.
- **Selection Bias:** Low response rates can introduce bias, as those who do respond may not represent the broader population accurately.
- **Reduced Data Quality:** Smaller sample sizes resulting from low response rates can compromise the reliability and validity of research findings.

#### 4. Inflexibility:

- **Limited Scope:** Questionnaires have a fixed set of questions, making it challenging to capture nuanced or unexpected responses that may arise during interviews or discussions.
- **Lack of Context:** They often lack the context provided by face-to-face interactions, making it difficult to interpret responses accurately.
- **Inflexible Format:** Questionnaires cannot adapt to individual respondent needs, potentially leading to irrelevant or confusing questions.
- **Response Bias:** Inflexibility can result in response bias, as participants may be forced to choose from predetermined options that may not align with their true sentiments.

#### 5. Sampling errors:

- **Selection Bias:** If the sample isn't representative, it can misrepresent the population.
- **Sampling Frame Errors:** Incomplete or outdated lists of potential respondents can result in sampling errors.
- **Small Sample Size:** A small sample may not accurately reflect the population's diversity.
- **Random Variation:** Even with a well-constructed questionnaire, random variations can introduce errors in results.

#### 6. Limited feedback:

- **Limited Insight:** Questionnaires often provide only superficial insights as they rely on predetermined questions, limiting respondents' ability to elaborate on their thoughts or experiences.
- **Lack of Context:** They lack context and nuance, making it challenging to understand the underlying motivations or reasons behind respondents' answers.
- **Incomplete Information:** Questionnaires may miss essential details or overlook unexpected responses, resulting in incomplete data for analysis.
- **Response Bias:** Respondents may provide socially desirable answers or misinterpret questions, leading to biased or inaccurate results.

#### 7. Design challenges:

- **Ambiguity:** Poorly worded questions can lead to confusion and inaccurate responses.
- **Lack of context:** Questionnaires may miss contextual factors that influence responses.
- **Limited qualitative data:** They typically don't capture rich qualitative insights.

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**Topic: Telephonic Interview – All Details Including Advantages and Limitations****Meaning**

A telephone interview is a type of interview that is conducted over the phone. It is often used as a screening tool to assess the qualifications of potential candidates before inviting them for an in-person interview.

Telephone interviews are found to be shorter, cost less, are reported to display less interviewer bias, and are seen to report less information while in-person interviews require more training, are conducive to physical tests, and are harder to schedule.

Telephone interviews may be the preferred method unless the in-person interview provides benefits to the research that outweigh the additional costs.

Small companies conduct telephone interviews or surveys to determine interest in new products, or measure the customer satisfaction of existing products. They also determine the needs and wants of customers through phone interviews.

In the telephonic interview, you should listen carefully and speak clearly: You should listen carefully to the questions asked by the interviewer and respond accordingly. If you think you have not understood the question clearly for the first time then you may request the employer to repeat the question again. Make sure that you should speak clearly, slowly and your voice is clear loud enough.

Telephonic interviews are fast replacing traditional “on-venue” interviews due to the logistics and the time they can save. It is much easier for candidates to have a conversation over the phone nowadays, as compared to travelling to a distant place to do the same.

**Advantages:**

One advantage of a telephone interview is that it allows you to have your research and preparation materials in front of you during the interview. However, you should not read directly from these documents, as interviewers can likely tell if you are reading. Many interviewers may even try to test you to see how quickly you can think on your feet. To ensure that you do not read straight from your notes, write down important points and facts only, not entire paragraphs or sentences.

1. **Convenience** – Telephone interviews can be conducted from anywhere, at any time. This makes it easy for people to participate, even if they can't meet in person.
2. **Cost-effective** – Telephone interviews are less expensive than in-person interviews because they don't require travel expenses. Telephone interviews are relatively cost-effective compared to other methods of surveying customers. Other interview methods, such as direct mail, cost much more. A 10-minute phone call, for example, costs very little with most phone plans. Marketers can also complete phone interviews relatively quickly. They just keep calling until they reach their quota.
3. **Time-efficient** – Telephone interviews can be conducted quickly and efficiently, allowing you to get more information in a shorter amount of time. A receptionist can setup a telephone interview at a mutually convenient time. It can transpire anywhere the parties happen to be, and it can be conducted casually and without any costs incurred. Several potential candidates can be interviewed in an hour, meaning a morning spent on calls can be extremely informative.
4. **Reduced bias** – Telephone interviews can reduce bias because the interviewer cannot see the interviewee, which can help ensure that the interviewee is judged solely on their answers.
5. **Record-keeping** – Telephone interviews can be recorded, which allows for easy reference



and analysis later on. This can be particularly useful for research or assessment purposes.

6. **Wide geographic access** - Small business owners have wide geographic access with telephone interviews. Nearly everyone in the United States has a land-line telephone or cell phone, and most of these numbers can be purchased from phone companies for a price. Phone interviewers also have access to in-house or online phone directories. This enables marketers to call and talk to virtually any customer in any market.
7. **Gets you on the same page.** Issues like salary, work schedule, location and availability are all important to both sides. By having a conversation and asking about salary expectations, seeing if the work schedule is amenable and discussing other potentially non-negotiable details, it's easy to learn if the candidate may not be a fit.

**Disadvantages:**

1. **Limited information** – During a telephone interview, you can't see the interviewer's body language or facial expressions, which can make it harder to gauge their reactions to your answers.
2. **Distractions** – If you're not in a quiet place, background noise can be distracting for both you and the interviewer. Another drawback of phone interviews is that they can be intrusive. Most calls are done at random, often interrupting people's dinner or evenings. Hence, people may hang up before the survey is complete or refuse to participate.
3. **Technical difficulties** – Phone connections can be spotty, and if the line is bad, it can be hard to hear each other.
4. **Limited follow-up questions** – In a face-to-face interview, an interviewer can ask follow-up questions based on your answers, but on the phone, it's harder to have a back-and-forth conversation. It is difficult to get people to elaborate on their responses by phone. The reason is that most phone interviews must be limited to five or 10 minutes. People would hang up with longer telephone surveys, resulting in partially completed interviews. Therefore, companies using phone interviews generally keep their questions and answers relatively brief. Many of these questions must be multiple-choice in nature instead of open-ended. The open-ended questions are more informative because they allow customers to elaborate why they responded as they did on multiple-choice questions.
5. **Lack of personal connection** – Telephone interviews can feel impersonal and can be difficult to build a rapport with the interviewer. Business owners may find it hard to make a connection with customers over phone interviews. For one, they can't view the people they are interviewing. Hence, they can't see people's reactions to help determine whether the answers are truthful. In-person interviews are just the opposite, as interviewers can study respondents' facial expressions or gestures to determine whether their responses are truthful.
6. **Difficult to find skilled moderators** - Another downside to focus groups is that skilled moderators are difficult to find, according to business consulting firm Frost & Sullivan. It may take months to find a skilled moderator, which isn't convenient for small businesses. The problem with using any moderator is that the company won't know how the moderator performs until she is actually conducting the interviews. By then, the cost of the session has already accrued.
7. **Focus groups are not projectable:** The data from focus groups is not projectable. That is, the sample size is too low to be projected across the general population. A company would need to interview several hundred people in a focus group to garner reliable, projectable data. And at \$400 to \$600 per head, that would be cost prohibitive. Focus groups aren't

supposed to be projectable. These sessions are often conducted and used prior to phone surveys for a much broader look at the consumer's needs and level of satisfaction.

## **Unit - 3**

# **Data Types and Data Collection**

**Topic: Means and issues in obtaining primary data**

Data is regarded as the foundation of all types of research, and hence it is known as "**Life Blood of Research**". Any research cannot be completed without proper collection and analysis of data. In order to understand the problem underlying research accurately and designing the feasible solution for that problem, quality data is needed. Hence, data collection is crucial to analytically understand the problems and for obtaining the solutions for it.

A research can be carried-out with the help of two types of data, viz, primary data and secondary data. The former can be defined as the data which is collected for the first time by the researcher, while the later can be defined as the data which are already collected and statistically processed for a particular event or problem.

The data collected by the researcher himself for finding the solution of a particular problem or situation, is known as primary data. This type of data is characterized by its originality as it is freshly collected. Various organizations conduct surveys, observations, interviews, etc. and as a result generate primary data.

**According to W.A. Nelswanger:**

"A primary source is a publication in which the data are published by the same authority which gather and analyze them".

To conduct any research effectively and produce valid results, researchers should collect primary data as it contains current and exact information about the incident or event. One of the major benefits of primary data is that its validity and reliability can be verified by other experts. There are many ways to collect primary data such as observation, interviews, group discussions, case studies, etc.

**Sources of Primary Data**

Primary data are collected during the course of doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys, whether sample surveys or census surveys, we can obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews. Thus, in other words, means that there are several methods of collecting primary data, particularly in surveys and descriptive researches. Important ones are:

**1) Interview:**

Interview is the exchange of ideas. Which takes place between two more people with the purpose of getting information from the respondent. In this method, the interviewer organises a meeting with the respondent regarding an object or issue related to the research objective, and asks some questions. The responses of the interviewee are recorded and compiled to get a better insight into the research problem. Interview-can be conducted through various methods such as personal interview, telephonic interview, mail interview, panel interview, etc.

**2) Questionnaire:**

In order to collect the relevant information from the respondents by asking questions, it is necessary to design a questionnaire comprising of questions related to the research problem. Questionnaire is used to explore the unidentified facts and figures about a particular objective or issue. The responses of the individuals about the research problem are kept confidential. Questionnaires are the standardized and structured forms that are usually filled by the respondents. Questionnaires can be administered personally as well as through mail. When the questionnaire is filled by the researcher himself by asking questions from the respondents, it is called "schedule". With the help of questionnaires, researchers can gather genuine responses from the respondents, which enhance the effectiveness of data analysis.

**3) Schedules:**

Just like the questionnaire, a schedule is also a collection of questions. These questions are separated through different sub headings, as per the research problem. Questions are placed in a specific sequence, following the pattern of relevant topic. The researcher or the field worker describes the questions to the individuals and records the responses. The major difference between questionnaire and schedules that schedules are filled I by the field worker or the enumerator specifically appointed for this purpose, whereas in questionnaire, respondents fill the form. Enumerator explains the purpose of the research and data collection to the respondents and collects their responses. By explaining the objective to the participants, enumerators help in easy understanding of the research topic.

#### **4) Observation:**

Another technique for gathering primary data is observation. When the researcher records information about a person, organisation, or situation, without making any personal contact, it is known as "observation method". In this, the researcher or the field executive observes the activity of the concerned person or organisation, to draw a pattern of behavior or response to a particular incident. Sometimes, an artificial environment is created to collect the actual responses of the participants.

#### **5) Experimentation:**

An important method to collect primary data is experimentation. In experimentation, the causal relationship is determined and analysed between variables. Experimentation is carried-out with the objective to study effect on a dependent variable by causing a change in the independent variable. For example, a research can be conducted to analyse the influence on learning due to guidelines and instructions in schools.

#### **6) Other Methods :**

**Other methods for collection of data are described below:**

##### **i) Warranty Cards :**

Warranty cards are generally used by the dealers of consumer durable to get the feedback of products from their consumers. These are the postal sized cards placed within the package of product. These cards contain various questions regarding the performance of product and to know the needs of consumers. Customers are requested to fill and mail it back. It helps in new product development for the manufacturer

##### **ii) Auditing :**

Auditing is a technique for assessing the performance and current position of any department or the organisation. Sometimes, it is also used for understanding the market and buying behavior of customers. Distributors or manufacturers use this tool for gaining the competitive advantage and satisfying the need of customers. It is also used by the researchers for inspecting the products, services or food purchased by consumers, also known as pantry audit.

##### **iii) Mechanical Devices :**

In present time, there are a lot of electric and magnetic devices. present in the market for leader the required information or the incident Sea devices may be very useful in collecting hidden information. Some of the major mechanical devices psycho galvanometer, motion picture camera, voice recorders, audiometer, etc.

**iv) Simulation :**

Simulation is a quantitative technique for data collection. It is the creation of an artificial environment resembling a real life situation. This real life situation is simulated by using various mathematical equations and variables. Researchers can determine the relation between different variables by altering one of the variables and finding its effect on the others.

**Primary data has following limitations:****1) Costly Affair :**

Primary data collection is an expensive task. It involves different activities, like selecting type of technique, preparing questions, and hiring trained professionals for collecting information or observing targets, etc. In this process, a huge amount is spent, which is why it is costly to conduct.

**2) Time Consuming :**

Collecting primary data effectively takes more time. Developing research plan, deciding sources of information, and selecting the methods of data collection are time consuming activities.

**3) Infeasible Sometime :**

Although, primary data considered to be reliable source of information, but, sometimes it is not an easy task to collect the primary data, as the sources of information may not be in the reach of researcher or may incur a huge amount of money.

**4) Huge Quantity of Data :**

Sometimes data collected through primary sources are in huge quantity. This large volume of data leads confusion about the accuracy of the Information The processing and analysis of the data becomes complex and cumbersome due to large size.

**5) Unwillingness to Answer :**

Sometimes participants do not cooperate in data collection by showing unwillingness to answer or by giving wrong information. These factors act as burdies in primary data collection and also reflect biasness in responses.

**Issues in Obtaining Primary Data**

The collection of primary data is a fundamental aspect of research across various disciplines, serving as the cornerstone for the development of knowledge and insights. Primary data refers to data that is gathered firsthand directly from its source, often through surveys, interviews, observations, experiments, and other research methods. While primary data is invaluable for its authenticity and specificity, the process of obtaining it is not without its challenges and issues. This essay explores some of the key issues researchers encounter when obtaining primary data.

**Sampling Bias:**

One of the foremost concerns in primary data collection is the potential for sampling bias. Sampling bias occurs when the selected sample does not accurately represent the entire population under investigation. This bias can lead to erroneous conclusions and limit the generalizability of research findings. Researchers must carefully design their sampling strategies to minimize bias and ensure that the sample is truly representative.

**Non-Response Bias:**

In surveys and questionnaires, non-response bias is a significant concern. It arises when a substantial portion of the selected participants does not respond to the data collection efforts. This can result in skewed data, as the characteristics of non-respondents may differ from those who participate. Researchers must employ strategies to encourage participation and reduce non-response bias, such as follow-up surveys or incentives for respondents.

**Measurement Errors:**

Measurement errors are another critical issue in primary data collection. These errors can occur due to poorly worded questions, ambiguous survey items, or inadequate experimental design. Such errors can lead to inaccurate data and compromise the validity of research findings. Researchers must invest time in carefully constructing their instruments and validating them to minimize measurement errors.

**Ethical Concerns:**

The ethical dimensions of primary data collection cannot be overstated. Researchers must ensure that participants' rights are respected, including obtaining informed consent, maintaining confidentiality, and protecting their well-being. Ethical lapses can have severe consequences, not only for the individuals involved but also for the credibility of the research itself.

**Resource Constraints:**

Collecting primary data can be resource-intensive. Researchers often require financial resources, time, personnel, and equipment to gather data effectively. Resource constraints can limit the scope of research or lead to compromises in data quality. Researchers must carefully plan their data collection methods within the constraints of available resources.

**Data Collection Fatigue**

Data collection processes can be lengthy and demanding for participants. Respondent or participant fatigue is a common issue, particularly in surveys or experiments with extended durations. Fatigued participants may provide lower-quality responses or drop out of the study, impacting data integrity. Researchers should consider participant fatigue and employ strategies to mitigate its effects.

**Subjectivity**

In methods like interviews and observations, researchers may introduce subjectivity through their biases and interpretations. These subjective elements can influence both data collection and subsequent analysis. Researchers should employ techniques to minimize subjectivity, such as using standardized protocols and maintaining objectivity during data collection.

**Issues in Obtaining Primary Data:**

**Sampling Bias:** If the sample chosen for data collection is not representative of the entire population, the results may be biased.

**Non-Response Bias:** In surveys or questionnaires, when a significant portion of the selected participants does not respond, the data may be skewed.

**Measurement Errors:** Errors in data collection methods, such as ambiguous questions or poorly designed experiments, can lead to inaccurate data.

**Ethical Concerns:** Maintaining participant confidentiality, obtaining informed consent, and avoiding harm are critical ethical considerations.

**Cost and Resource Constraints:** Collecting primary data can be resource-intensive, including time, money, and personnel.

**Data Collection Fatigue:** Respondents or participants may become fatigued or uncooperative during lengthy data collection processes.

**Subjectivity:** In interviews and observations, the researcher's biases and interpretations can influence data collection and analysis.

**Time Constraints:** Primary data collection can be time-consuming, affecting project timelines.

**Data Security:** Protecting sensitive data from breaches or unauthorized access is crucial.

**Validity and Reliability:** Ensuring that data collection methods and instruments are valid (measuring what they intend to measure) and reliable (producing consistent results) is essential.

**Cultural Sensitivity:** In cross-cultural research, understanding and respecting cultural differences is vital to avoid misunderstandings.

To mitigate these issues, researchers need to carefully plan their data collection methods, address ethical concerns, validate instruments, and analyze data rigorously.

## CONCLUSION

Obtaining primary data is an essential step in the research process, providing valuable insights and supporting evidence-based decision-making. However, researchers must be acutely aware of the issues and challenges that can arise during data collection. Addressing issues like sampling bias, non-response bias, measurement errors, ethical concerns, resource constraints, data collection fatigue, and subjectivity is crucial to ensure the quality and reliability of primary data. By carefully navigating these challenges, researchers can harness the power of primary data to advance knowledge and make meaningful contributions to their respective fields.

## Topic- Problem of Response & Factors Affecting Response to Questionnaires

### Problem of Response

- The problem of response in a questionnaire can include issues such as low response rates, biased responses, or inaccurate data.
1. **Improve Survey Design:** Ensure that your questionnaire is clear, concise, and easy to understand. Use simple language and avoid leading or biased questions.
  2. **Pilot Testing:** Test your questionnaire with a small group of participants to identify any confusing or problematic questions.
  3. **Incentives:** Offer incentives to encourage participation, such as discounts, gift cards, or small rewards.
  4. **Multiple Channels:** Use various communication channels (email, phone, in-person) to reach a broader audience.
  5. **Follow-Up:** Send reminders and follow-up messages to non-responders to increase participation.
  6. **Confidentiality:** Assure respondents that their responses will be kept confidential, which can encourage more honest answers.
  7. **Diverse Sampling:** Ensure your sample represents the diversity of your target population to minimize bias.
  8. **Analyze Non-Responses:** Analyze the characteristics of non-responders to understand potential biases in your data.

By addressing these issues, we can improve the quality and reliability of the responses in your questionnaire.

### Factors Affecting Response To Questionnaires

The response to a questionnaire can be influenced by various factors, including:

1. **Questionnaire Design:** The clarity, simplicity, and relevance of the questions can impact response rates. Ambiguous or complex questions may lead to confusion and lower participation.
2. **Length and Complexity:** Longer and more complex questionnaires can be overwhelming, leading to lower response rates. Keeping the survey concise and focused helps.



3. **Timing:** The timing of when the questionnaire is administered can affect responses. Sending it at a convenient time for the participants can improve the response rate.
4. **Incentives:** Offering incentives, such as rewards or discounts, can motivate individuals to respond to the questionnaire.
5. **Anonymity and Privacy:** Assuring respondents of anonymity and data privacy can encourage more candid responses, especially for sensitive topics.
6. **Survey Channel:** The mode of delivery, whether online, by mail, phone, or in person, can impact responses. Some people may prefer one mode over another.
7. **Target Audience:** The characteristics of the target audience, including their demographics and interests, can affect response rates.
8. **Sender Credibility:** The perceived credibility of the sender or organization conducting the survey can influence whether individuals choose to respond.
9. **Follow-Up:** Sending reminders or follow-up messages can increase response rates as it serves as a gentle nudge for participants.
10. **Survey Fatigue:** If respondents receive multiple surveys or requests for feedback, they may be less inclined to respond.
11. **Question Order:** The order in which questions are presented can influence responses. Controversial or sensitive questions are often better placed towards the end.
12. **Social Desirability Bias:** Respondents may provide socially acceptable answers rather than their true opinions or behaviours to avoid judgment.
13. **Cultural and Language Considerations:** Cultural norms and language barriers can impact how questions are understood and answered.
14. **Technological Accessibility:** In online surveys, ensuring compatibility with various devices and internet speeds is crucial to maximize participation.
15. **Survey Timing:** Administering the survey immediately after an event or experience can yield more accurate responses related to that event.

### Guidelines for construction of Questionnaire

Following points are to be considered while constructing the questionnaire –

- Developing a conceptual framework-** The first step of designing of a good questionnaire is to construct a conceptual framework. The researcher needs to be very clear about his research questions and what “dependent” and “independent” factors he intends to investigate.
- Decide the matter/content of individual questions-** There are two deciding factors for this :
  - Is the question significant?- Observe contribution of each questions. Does the question contribute for the objective of the study?
  - **Is there a need for several questions or a single question?-Several questions are asked in the following cases:**
    - ◆ When there is a need for cross-checking.
    - ◆ When answers are ambiguous
    - ◆ When people are hesitant to give correct information.
  - Choose your question type properly. There’s wide variety in how to phrase questions. In

explorative questionnaires, you will find mainly open questions, where participants can fill in any answer (this makes sense whenever you try to gain an understanding of the topics associated with your research question).

By contrast quantitative questionnaires primarily include closed-questions, which have been predefined in the form of multiple choice answers or rating scales.

**Example –**

**Open question: What do you like about the webinar? Closed question :The webinar was useful?**

Strongly agree

Agree

Disagree

- A much greater attention is required regarding the appearance of the questionnaire because “look” of the questionnaire may decide whether the respondent is going to fill it up. A decent paper, printing, attractive layout, good letters head creates a better impression upon respondent. The title should be highlighted and it should reflect the main objective of the research. If possible, divide the questionnaire into sections according to the content (e.g. boxes with bold headings) and it should flow smoothly from one section to another with appropriate filtering. Finally, a cover letter stating the objective of your study, your affiliations, and, if appropriate, ensuring confidentiality and how you are going to use the information you have collected.
- Avoid ambiguous words and sentences so that the questions should be clearly worded and easy to understand. Avoid acronyms, abbreviations, jargons, proverbs, colloquialisms, or technical terms. Be as specific as possible when asking a question.
- Avoid double-barelled questions. This will lead to difficulty in interpreting the responses when analysing the data. Try to put that words which have same meaning for everyone. Ask for one piece of information and questions should be limited to a single idea or a single reference at a time.
- Avoid biased or leading questions and categorize the responses rather than asking a specific response figure. Use the third person technique.
- The length of the questionnaire should be kept small as small size questionnaires generally have a better response than large size ones. A questionnaire should be short, while ensuring the researcher is able to gather valid and reliable answers to all questions asked of each respondent.
- Putting question in a meaningful order and format -

**Opening question:** Opening question should be easy to answer and not in any way threatening to the respondents. The first question is crucial because it is the respondents first exposure to questionnaire and sets the tone for the nature of the task to be performed. If they find it difficult to understand, or beyond their knowledge and experience, or embarrassing in some way, they are likely to break off immediately. If, on the other hand, they find the opening question easy and pleasant to answer, they are encouraged to continue.

**Question flow:** Question should flow in some kind of psychological order, so that one leads easily and naturally to the next. Questions on one subject, or one particular aspect of a subject, should be grouped together.

**Closing question:** It is natural for a respondent to become increasingly indifferent to the questionnaire as it nears the end. Because of impatience or fatigue, he may give careless answers to the later questions. Those questions, therefore, that are of special importance should, if possible, be included in the earlier part of the questionnaire.

- **The questionnaire should be pre-** tested on a small number of respondents to identify the likely problems and to eliminate them. Each and every dimension of the questionnaire should be pre-tested. The sample respondents should be similar to the target respondents of the survey.
- Check the final draft questionnaire. Ask yourself how much will the information obtained from each question contribute to the study. Make sure that irrelevant questions are not asked. Often feedback of the respondents on the questionnaire.

### **Introduction: -**

Census method is the method of statistical enumeration where all members of population are studied. A population refers to the set of all observations under concern. The Census Method is a fundamental technique in research methodology used for data collection. It involves gathering information from every member or unit of the population under study, rather than selecting a sample. This method has been widely employed in various fields such as sociology, economics, demography, and government planning. This method is suited for heterogeneous data.

The UN's Food and Agriculture Organization (FAO), defines the census of agriculture as "a statistical operation for collecting, processing and disseminating data on the structure of agriculture, covering the whole or a significant part of a country."

### **For Example –**

Imagine you and your friends have started a lemonade stand and want to know how many people in your neighborhood would be interested in buying your lemonade. To find out, you decide to use the census method.

Using the census method means that you're going to try to ask every single person in your neighborhood if they would be interested in buying lemonade from your stand. Instead of just asking a few people, you want to include everyone in your count so you can have a complete picture of the demand.

To do this, you go door-to-door to every house in your neighborhood and ask each person if they would like to buy lemonade from your stand. You make sure to talk to every single person, young or old, to ensure that you don't miss anyone.

By using the census method, you're getting information from everyone in the neighborhood and can accurately determine the level of interest in your lemonade. This way, you have the most comprehensive data to help you make decisions about your lemonade stand, such as how much lemonade to prepare and what pricing strategy to use.

### **Merits of the census method:-**

- ✓ **Comprehensive Data:** The primary advantage of the Census Method is that it provides comprehensive data about the entire population. Researchers can obtain a complete and accurate picture of the population under investigation. This can be crucial in scenarios where every member of the population is essential, such as government censuses.
- ✓ **High Accuracy:** Since the Census Method involves collecting data from the entire population, it eliminates sampling error. The data collected is highly accurate, making it reliable for decision-making and policy formulation. This is particularly valuable when precise information is required, like in medical research or national economic planning.

- ✓ **Representativeness:** The Census Method ensures that every segment of the population is represented in the data. This helps in avoiding bias that might occur in sample-based methods. It allows for a more detailed analysis of subgroups within the population, facilitating a deeper understanding of variations and trends.
  - ✓ **Longitudinal Analysis:** Census data can be invaluable for longitudinal studies, where trends and changes in a population are monitored over time. Researchers can track the evolution of various parameters, which is crucial for studying social, economic, and demographic changes.
  - ✓ **Small Area Analysis:** In cases where researchers need data at a small geographic level, the Census Method is indispensable. It provides detailed information about even the smallest administrative units, aiding local decision-makers and urban planning.
  - ✓ **Equal Representation:** The Census Method ensures that each individual or unit is given equal importance. This is particularly relevant in situations where social equity and justice are important, as it prevents the underrepresentation of marginalized groups.
  - ✓ **Extensive Information:** Information collected through the census method is quite exhaustive and, therefore, more meaningful because all the items of a universe are examined. For example, Population census in India gives exhaustive information relating to the number of people in different parts of the country, their age and sex composition, education, status, occupation
- Demerits of the Census Method :-**
- ✓ **Resource Intensive:** One of the most significant drawbacks of the Census Method is its resource-intensive nature. Collecting data from the entire population can be costly and time-consuming, making it impractical for some research projects, especially when budgets and time constraints are tight.
  - ✓ **Logistical Challenges:** Conducting a census can be logistically challenging, especially in large or remote areas. It requires a vast workforce, transportation, and infrastructure to reach every member of the population. This can be particularly challenging in developing countries with inadequate resources.
  - ✓ **Non-Response Bias:** While the Census Method aims to collect data from everyone, there is still the possibility of non-response bias. Some individuals or groups may not participate, leading to gaps in the data. This can affect the accuracy and representativeness of the results.
  - ✓ **Invasion of Privacy:** In some cases, collecting information from every individual can be seen as an invasion of privacy. This is a significant ethical concern, and researchers must take measures to ensure that personal data is protected and used responsibly.
  - ✓ **Time-Consuming Analysis:** Analyzing data from a census can be time-consuming and complex, especially when dealing with large datasets. Researchers may require advanced statistical tools and software to process and interpret the information effectively.
  - ✓ **Limited Feasibility for Dynamic Populations:** The Census Method may not be suitable for populations that are highly dynamic or transient. For example, in studying the movement patterns of a nomadic community, a census might not provide practical results.
  - ✓ **Not suitable for Large Investigations:** If the universe comprises a large number of items, it may not be possible to cover each and every item: Census method becomes practically inoperative in such situations. Census method is suitable when:
    - Area of investigation is limited.
    - More accuracy is desired.

## Types of Statistical Tests: Concepts

Statistical tests are an important part of data analysis. They help us understand the data and make inferences about the population. They are used to examine relationships between variables based on hypothesis testing. They are a way of analyzing data to see if there is a significant difference between the two groups or a group and population. In statistics, there are two main types of tests: **parametric and non-parametric**. Both types of tests are used to make inferences about a population based on a sample. Parametric tests make certain assumptions about the data, while non-parametric tests do not make any assumptions about the data. In this blog post, we will discuss the different types of statistical tests and related concepts with the help of examples. As a data scientist, you must get a good understanding of different types of statistical tests.

Statistical tests can also be classified based on their application in **quantitative** or **qualitative research**. This classification hinges primarily on the nature of the data being analyzed: quantitative research deals with numerical data, while qualitative research often involves non-numerical data. Statistical tests used in qualitative research, particularly when dealing with categorical data, are essential for uncovering relationships and associations between different qualitative or categorical variables.

## Parametric Statistical Tests - Types

Parametric statistical tests are a group of statistical tests that make certain assumptions about the data. These tests are used to make inferences about a population based on a sample. The main assumption that these tests make is that the data is normally distributed. This means that the data follows a specific pattern where the values are evenly spread out around the mean. There are several different parametric statistical tests, including t-tests, ANOVA, and Pearson's correlation. The following is the high-level detail of these parametric tests:

- **Independent t-tests:** An independent t-test is a statistical test used to determine whether the means of two groups are statistically different from each other. This test is often used when the data in each group are supplied by different people or when the groups are randomly assigned. The independent t-test is a parametric test, meaning that it requires that the data be normally distributed. The benefits of using an independent t-test include that it is relatively easy to use and has high statistical power. Let's understand individual t-tests with an example. For example, a researcher might be interested in comparing the average reading scores of two groups of students – one group that is taking a course in English literature and one group that is taking a course in math. In this case, the researcher would use an independent t-test to compare the average reading scores of the two groups. The independent t-test allows for the comparison of two groups of unequal sizes. However, the independent t-test is limited to the comparison of two groups and cannot be used to compare more than two groups.
- **Paired t-tests:** The paired t-test is a statistical test that is used to compare the means of two groups. The groups are usually matched or paired together in some way. For example, you might have a group of people who receive a new treatment and a group of people who receive a placebo treatment. The two groups are then compared to see if there is a difference in the mean scores. The paired t-test is also used to compare the pre-treatment and post-treatment scores of a single group of people.

- **ANOVA tests:** ANOVA tests are a type of statistical test that is used to compare the means of more than two groups. There are several different types of ANOVA tests, including one-way ANOVA, two-way ANOVA, and repeated measures ANOVA. Each type of ANOVA test is used to compare different combinations of groups. The benefits of using an ANOVA test include that it is relatively easy to use and has high statistical power. Let's understand with an example of where a one-way ANOVA test can be used. One real-world example of the one-way ANOVA in action is a study that can be conducted to compare the GRE scores of students from different income levels and find whether there are significant differences between the means of the three groups. One possible outcome of the tests can be that the students from families with higher incomes tended to score higher on the GRE than students from families with lower incomes. This study can be used to assess and examine inequalities in society.
- **MANOVA tests:** MANOVA is a statistical test that is used to determine whether or not there are significant differences between two or more group means. It is similar to ANOVA, but it can be used with more than one dependent variable. MANOVA is a powerful statistical tool that can be used to examine the relationships between multiple dependent variables and a single independent variable. It can also be used to examine the relationships between multiple dependent variables and multiple independent variables. MANOVA is an important statistical test that should be used when investigating the relationships between multiple variables.
- **F-test:** The F-test is a statistical test that is used to determine whether or not there is a significant difference between the variance of two or more groups.
- **Z-test:** The Z-test is a statistical test that is used to determine the statistical significance of a difference between two groups. It is most commonly used when the groups are small. The Z-test is based on the standard normal distribution, which is a statistical model that assumes that all observations are drawn from a population that has a normal distribution. This test is used to determine whether the difference between the means of the two groups is statistically significant.
- **Correlation test (Pearson's):** Correlation tests are statistical tests that assess the strength of the relationship between two variables. The most common type of correlation test is Pearson's Correlation Coefficient, which measures the linear relationship between two variables. Correlation tests are used in a variety of fields, including psychology, sociology, and economics. Correlation tests can be used to study the cause-and-effect relationship between two variables or to predict future behavior based on past behavior. For example, a correlation test could be used to determine if there is a relationship between IQ and income. Correlation tests are also used to predict future events. For example, a correlation test could be used to predict the likelihood of a person getting divorced based on their age and education level.

### Non-Parametric Tests -Types

Non-parametric tests do not make any assumptions about the data. They can be used with data that is not normally distributed and with data that does not have equal variances. Non-parametric statistical tests are used when the assumptions of parametric statistical tests are not met, or when the data are not normally distributed. Some examples of non-parametric statistical tests include the Wilcoxon rank-sum test, the Kruskal-Wallis test. etc. Statisticians have

developed many different non-parametric statistical tests, each with its own advantages and disadvantages. When choosing a non-parametric statistical test, it is important to consider the specific research question and the type of data that are available. The following is a brief introduction to different types of non-parametric tests:

- **Wilcoxon rank-sum test:** The Wilcoxon rank-sum test is a statistical test used to compare the difference between two groups of data. It is often used when the data is not normally distributed. The test works by ranking the data from both groups, and then summing the ranks for each group. The difference between the two sums is then compared to a table of values to determine whether or not there is a significant difference between the two groups. The Wilcoxon rank-sum test is a powerful statistical tool that can be used to compare data sets of all sizes. Wilcoxon rank-sum test is also known as the **Mann-Whitney U test**.
- **Kruskal-Wallis H test:** The Kruskal-Wallis H test is a statistical test that can be used to compare the means of two or more groups. It is similar to the ANOVA, but it is more robust and can be used when the assumptions of the ANOVA are not met. The Kruskal-Wallis test is also known as a non-parametric ANOVA, or analysis of variance. The Kruskal-Wallis test is used when the assumptions of the parametric ANOVA test are not met. The Kruskal-Wallis test can be used with either continuous or categorical data. To run the Kruskal-Wallis test, the data must be in the form of ranks. The Kruskal-Wallis test is based on the ranks of the data, not the actual values. When using categorical data, the Kruskal-Wallis test is often used to determine if there are significant differences between the means of the groups. When using quantitative data, the Kruskal-Wallis test can be used to determine if there are significant differences between the distributions of the groups.
- **Chi-square test of independence:** Chi-square test of independence is a statistical test used to determine whether two variables are independent. It is a non-parametric test, meaning that it does not make assumptions about the distributions of the variables. The chi-square test is used to calculate a statistic called the chi-square statistic. This statistic is then compared to a critical value to determine whether the two variables are independent. If the chi-square statistic is greater than the critical value, then the two variables are considered to be dependent. Chi-square test of independence can be used to test for independence in a variety of situations, including comparing proportions, testing for association, and testing for goodness of fit.
- **The Friedman Test:** The Friedman test is a non-parametric statistical test used to compare more than two groups of data. The test is used when the data are not normally distributed and when the groups are related to each other, such as in a repeated measures design. The test is based on the ranks of the data, rather than the actual values.
- **The Cochran's Q Test:** The Cochran's Q test is a non-parametric statistical test used to compare more than two groups of data. The test is used when the data are not normally distributed and when the groups are independent of each other.
- **The Jonckheere-Terpstra Test:** The Jonckheere-Terpstra test is a rank-based non-parametric statistical test used to compare more than two groups of data. The test is used when the data are not normally distributed and when the groups are ordered, such as in an experiment with treatments that are administered in increasing order of intensity.

### Statistical Tests in Quantitative Research

Quantitative research involves the collection and analysis of numerical data. Most statistical tests, especially parametric tests, are used in quantitative research due to the numerical nature of the data. The ones listed below and discussed in the previous sections can be used for quantitative research:

- **T-tests:**
- One-Sample, Independent Two-Sample, Paired
- **ANOVA:**
- One-Way, Two-Way, Repeated Measures
- **Linear Regression:**
- Simple, Multiple
- **Pearson's Correlation Coefficient, Spearman's Rank Correlation Coefficient**
- **Z-test**
- **Mann-Whitney U Test**
- **Wilcoxon Signed-Rank Test**
- **Kruskal-Wallis Test**

### Statistical Tests in Qualitative Research

The following methods and tests are integral in qualitative research for analyzing categorical data. They help in understanding the relationships and associations between different categories, which is essential in fields like medicine, social science, biology and psychology, where categorical variables are frequently encountered. The choice of test depends on the nature of the data, the size of the sample, and the specific research questions being addressed.

#### 1. Chi-Squared ( $\chi^2$ ) Test of Association:

- This is a primary test used to determine if there is a significant association between two categorical variables.
- It's applicable when data is presented in a contingency table format, where frequencies or counts of occurrences in each category are compared.
- The  $\chi^2$  test evaluates whether the distribution of sample categorical data matches an expected distribution.

#### 2. Modifications for Small Samples:

- When dealing with small sample sizes, modifications to the  $\chi^2$  test are necessary.
- Fisher's Exact Test is often used as an alternative in these scenarios, especially when the sample size is too small for the  $\chi^2$  test to be reliable.

#### 3. Test for Trend:

- This test is relevant when at least one of the variables is ordinal (i.e., the categories have a natural order, like age groups).



- It assesses if there's a trend or consistent pattern across categories of an ordinal variable.
4. **Risk Measurement:**
- Involves calculating odds ratios and risk ratios.
  - These measures are crucial in understanding the likelihood or risk of a certain event occurring in one group compared to another.
5. **Confidence Intervals for Proportions and Differences Between Proportions:**
- This method involves calculating the confidence intervals to understand the range within which the true proportion or difference in proportions lies, with a certain level of confidence.
6. **Matched Samples Consideration:**
- McNemar's test is particularly useful in matched pair studies, where participants are paired in a way that controls for an extraneous variable.
  - It's used for dichotomous (binary) outcomes in paired samples to determine if there are differences in the paired proportions.
7. **Yates' Correction:**
- This is a correction applied to the  $\chi^2$  test to adjust for continuity when dealing with small sample sizes.
  - It's typically used when the total sample size is small and the data is distributed in a 2x2 contingency table.

**MULTIPLE CHOICE QUESTIONS (MCQ)**

**Q1. What is it called when the data is sourced from the place of origin ?**

- A. Secondary Data
  - B. Primary Data
  - C. Secondary and Primary Data
  - D. All of the above
- Answer – (B)

**Q2. What is it called when the data source is gathered and compiled with others ?**

- A. Primary Data
  - B. Quantitative Data
  - C. Secondary Data
  - D. None of the above
- Answer – (C)

**Q3. Information of research is called –**

- A. Qualitative
  - B. Quantitative
  - C. Qualitative and Quantitative both
  - D. None of the above
- Answer – (C)

**Q4. The method of collecting primary data is –**

- A. Questionnaire and Schedule Method
  - B. Observation and Interview Method
  - C. None of the above
  - D. All of the above
- Answer – (D)

**Q5. Data that are collected or sourced from the internet is called –**

- A. Documentary source of data
  - B. Internal source of data
  - C. External source of study
  - D. All of the above
- Answer – (C)

**Q6. What comes right before the formulation of the hypothesis in the research ?**

- A. Collection of data
  - B. Analysis of data
  - C. Selection of the tools of research
  - D. Statement of objectives
- Answer – (A)

**Q7. What are the key factors in choosing the right or correct method for research ?**

- A. Availability of funds and time
  - B. Scope , Nature and Objectives of research
  - C. None of the above
  - D. All of the above
- Answer – (C)

**Q8. The method of collection of data of the population of the country is an example of –**

- A. Sample Method
  - B. Census Method
  - C. Both of them
  - D. None of them
- Answer – (B)

**Q9. The method of collecting first-hand data includes –**

- A. Mailed Questionnaire
  - B. Personal Interview
  - C. Telephonic Interview
  - D. All of the above
- Answer – (D)

**Q10. Aspects one should keep in mind while gathering secondary data –**

- A. Reliability of the collection authority
  - B. Reliability of the source
  - C. Purpose of research
  - D. All of the above
- Answer – (D)

**Short Questions:-**

1. What is Primary Data? Give examples of primary data.
2. What is Secondary Data? Give example of secondary data.
3. What is Sampling Method?
4. What is the use questionnaire in primary research?
5. Why Census of India is the main source of secondary data?

**Long Questions:-**

1. What is Primary Data? What are the advantages and disadvantages of collecting primary data?
2. What is Secondary Data? What are the advantages and disadvantages of collecting secondary data?
3. Write the difference between Primary and Secondary Data and also mention the basis on which differentiation is made.
4. What is Sampling? Explain different type of Sampling Methods.
5. What are the methods of collecting Primary Data? Explain them

**Introduction of Questionnaire:-**

A questionnaire is the first section of a survey that introduces the purpose of the survey and sets the tone for the rest of the questions. The introduction should be engaging, informative, and concise. It should provide respondents with a clear understanding of what the survey is about, why it is being conducted, and how their responses will be used.

The introduction should include a brief explanation of the research topic and objectives. This helps respondents understand the context of the survey and its relevance to them. It should also mention any incentives or rewards that respondents may receive for completing the survey.

It is important to assure respondents of their anonymity and confidentiality. This can be done by starting that their responses will be kept confidential and that their personal information will not be shared with any third party.

The process of creating a questionnaire involves several steps. First, the researcher needs to define the research objectives and the target population. This will help determine the questions to ask and the format of the questionnaires. Next, the researcher needs to develop the questions, taking into account the language, tone, and clarity of the questions. It is also important to pilot-test the questionnaire with a small group of people to ensure that the questions are understandable and relevant.

**Functions of Questionnaire:-The basic functions of questionnaire are as:-**

**1:- Collect Data:** - The primary function of a questionnaire is to collect data from a group of people by asking them a series of questions.

**2:- Measures attitudes and opinions:** - Questionnaires can be used to measure attitudes, opinions, beliefs, and perceptions of individuals or groups.

**3:- Identify trends and patterns:** - The data collected from questionnaires can be analysed to identify trends and patterns in the responses. This can help researchers to identify relationships between variables and draw conclusions about the topic being studied.

**4:- Evaluate programs and interventions:** - Questionnaires can be used to evaluate the effectiveness of programs or interventions by collecting feedbacks from participants.

**5:- Test hypothesis:** - Questionnaires can be designed to test hypothesis and theories by collecting data on specific variables.

**6:- Compare groups:** - Questionnaires can be used to compare responses between different groups of people such as age, gender, or socioeconomic status.

**7:- Monitor changes over time:** - Questionnaires can be used to monitor changes in attitudes, beliefs and attitudes over time.

**8:- Provides feedback:** - Questionnaires can provide feedback to individuals or organizations about their performance or satisfaction with a product or service.

**Forms of Questionnaire: - The various forms of questionnaire are as follows:-**

**1:- Multiple Choice Questionnaire:** - This type of questionnaire presents a list of questions with multiple answer questions, and the respondent is required to select one or more options that best represent their views or opinions.

**2:- Open Ended Questionnaire:** - This type of questionnaire allows respondents to provide detailed answers in their own words. The questions are open ended and respondents are free to express their thoughts and ideas in any way they choose.

**3:- Likert Scale Questionnaire:** - This type of questionnaire presents a series of statements and asks respondents to indicate their level of agreement or disagreement on a scale of 1 to 5 or any other number.

**4:- Demographic Questionnaire:** - This type of questionnaire collects information about the respondents age, gender, income, education, and other relevant demographic factors.

**5:- Ranking Questionnaire:** - This type of questionnaire asks respondents to rank a set of items in order of importance or preference.

**6:- Rating Questionnaire:** - This type of questionnaire asks respondents to rate a set of items on a scale of 1 to 10 based on their level of satisfaction or experience.

**7:- Yes/No Questionnaire:** - This type of questionnaire asks respondents to answer a series of questions with a simple "yes" or "no" response.

## Qualities and Characteristics of a good questionnaire

### Qualities & characteristics of a good questionnaire

1. **Need to know what needs to be measured** – Having a clear picture and understanding of what data needs to be collected is the first and the most basic step taken when you write a questionnaire.
2. **Should know how to word/frame question** - Words should be neutral and should not be leading which means whatever one's opinion may be, self-opinion should never be reflected in the questions. This is done both intentionally and unintentionally but should be taken care of in order to build a good questionnaire.
3. **Emphasis on right word/phrase should be kept in mind** – The language should be clear and simple so that the required data can be received. This also makes the question and the requirement of survey easy to understand and thus help in getting a better response and answer which fulfils the main goal of building a questionnaire and provides the accurate and worthy information.
4. **Define and qualify terms** – This is most essential when a technical survey or a field specific survey is being done. If you think that the audience being surveyed might not know about some terms then they must be defined to get any proper response. This will increase the quality and decrease the bounce rate or number of questions which were left unanswered.
5. **Avoid double negatives** – Use of negative word has a psychological effect and can influence the answer so one must avoid using double negatives or more than one negative word in questions.
6. **Adequate alternatives should be provided** – Availability of options must be sufficient and should have the most expected answers.
7. **Multiple questions in question should be avoided** – One question should have one answer. If more than one question needs to be asked then it should be made a separate question to improve clarity of questions and avoid confusion.
8. **Word requiring emphasis should be emphasized** – This means that details which needs more than just a glance must be emphasized properly whether by underlining them, putting an \* sign after the term or word, marking it, by giving them a bold style or changing their font type or size. It helps in making a point and question clear.
9. **Options like good/bad/fair/average should be quantified through photographs or other mean** – These are very vague terms and interpretations of these varies from person to person so quantifying such questions with some visual representation makes it to be answered properly.
10. **Unwanted assumptions should be avoided** – A survey is about getting factual data and assumptions should be avoided.

### What to avoid in a Good Questionnaire?

Apart from the characteristics of a good questionnaire listed above there are certain negative points which should be avoided as far as possible:

1. **Greater than required length** – If there are too many questions than the chances of getting them answered is very less. In a busy schedule no one is willing to give answer for too many questions. So, try to keep it short and to the point. A good questionnaire is short and precise to fulfil the requirement, try to keep it under 1 page.

2. **Subjective Questions** – Until and unless it is very necessary to get the opinion of the user or targeted group, subjective or open-ended questions should be avoided. This is because everyone has a different perspective and the answer received might not give any useful information. It will be difficult to quantify and present. It is also seen that people start narrating their experiences in open-ended questions which does not add much value to the research being conducted. It also takes a lot of space, time and efforts so should be avoided.
3. **Contradicting questions** – Before getting a questionnaire filled make sure to read it three to four- time. This is to ensure no question is contradicting or repeating.
4. **Objectify/bias/conclusion** – This is one of the most frequent mistakes done while preparing questionnaire. Always keep in mind that the survey being conducted needs to be unbiased and must not reflect any opinion of the company or the person preparing questionnaire. All the questions should be neutral, also no question should influence the answer of any other question.

#### **Points to keep in mind while designing a good questionnaire**

- The physical appearance of the questionnaire affects the cooperation or the response from the people. An attractive looking questionnaire is a plus point. Size, quality of paper, color of paper, arrangement of items on the questionnaire or layout/ format of the questionnaire is important for improving the physical appearance.
- Consideration of who is to record the responses. If a highly trained investigator is to do the questioning and enter the replies, the form should be different from the one drawn up for the informant to fill by himself.
- Choice of word is an important consideration. Respondent with limited vocabularies is likely to be suggestive. He may just choose one of the alternative responses without any idea as to the meaning of his response. Simple word without multiple meaning is to be considered. Danger words, catchwords or words with emotional connotations should be avoided. Long questions should be avoided.
- Choice and sequence of question is important. Many refusals and misunderstandings can be avoided by a proper arrangement of questions. The opening questions should be easy to answer. Questions, which might embarrass the informant, should be placed in the middle or at the end of questionnaire.
- If the numbers of questions are less their arrangement on the questionnaire will not require detailed planning.
- Questions should be designed based on the purpose of the survey. The formulations of problems provide the starting point for developing the question. It is necessary to be clear about the information to be sought and type of questionnaire to be used.
- Must be designed with the understanding of possible process of analysis.

# **Unit - 4**

# **Data Interpretation with Advanced Excel**

## 72 - What do you understand by data analysis?

Data analysis is the process of applying statistical and logical techniques to describe and illustrate, condense and recap, and evaluate data.

“Data analysis is the process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.”

Data analysis is important because it helps business optimize their performances. Implementing it into the business model means companies can help reduce costs by identifying more efficient ways of doing business and by storing large amount of data.

Data analysis has multiple facts and approaches, encompassing diverse techniques under a variety of names, and is used in different business, science, and social science domains.

In today world, data analysis plays a role in making decision more scientific and helping businesses operate more effectively.

**Example:** a researcher wants to understand the relationship between classrooms that use hands-on activities in mathematics.

### Data Analysis skills

Knowing what data to collect and how to process it to obtain the right information. He will deliver value by taking data, communicating the results to help make business decision.

**Skills:** communication, Business Knowledge Technology: data analysis tools [example: excel, SQL, tableau, Power BI], data visualisation, data cleaning, basic statistical analysis, and a good understanding of the business domain.

### Characteristics of data analysis

- **Accuracy:** it is to determine whether data is accurate or not. Accuracy is a crucial data quality characteristics.
- **Completeness:** refers to how the comprehensive the information is. When looking at data completeness, think about whether all the data you need is available.
- **Reliability:** it means that a piece of information doesn't contradict another piece of information in a different source or system.
- **Relevance:** you must consider whether you really need this information, or whether you're collecting it just for the sake of it.
- **Timeliness:** it refers to how date information is. Information that isn't timely can lead to people making the wrong decision.

### Types of data analysis

- Predictive [forecasting]
- Descriptive [business intelligence and data mining]
- Prescriptive [optimization and simulation]
- **Diagnostic analytics**
- **Predictive analysis:** it turn the data into valuable, actionable information. Predictive analytics uses data to determine the probable outcome of an event or a likelihood of a situation occurring.
- **Descriptive analysis:** it looks at data and analyze past events for insights as to how to approach future events. Almost all management reporting such as sales, marketing,



operations, and finance uses this type of analysis.

- **Prescriptive analysis:** it automatically synthesizes big data, mathematical science, rule and machine learning to make a prediction and then suggests a decision option to take advantages of the prediction.
- **Diagnostic analysis:** in this we generally use historical data to answer any questions or for the solution of any problem. We try to find any dependency and pattern in the historical data of the particular problem.

#### Other types are:

- Exploratory
- Inferential
- Casual
- Mechanistic

#### Future scope of data analysis

- **Retail:** to study sales pattern, consumer behaviour, and inventory management, data analysis can be applied in the retail sector.
- **Healthcare:** data analysis can be used to evaluate patient data, spot trends in patient health, and create individualized treatment regimens.
- **Finance:** in this data analysis can be used to evaluate investment data, spot trends in the financial markets, and make wise investment decisions.
- **Marketing:** by analysis customer data, spotting trends in consumer behaviour, and creating customized marketing strategies, data analysis can be used in marketing.
- **Manufacturing:** data analysis can be used to examine production methods, and boost production efficiency in the manufacturing sector.
- **Transportation:** to evaluate logistics data, spot trends in transportation routes, and improve transportation routes, the transportation sector can employ data analysis.

#### Use of data analysis

- Improved decision-making
- Better customer services
- Efficient operation
- Effective marketing

#### Types of data analysis

- **Quantitative data analysis:** it involves working with numerical variables- including statistics, percentages, calculations, measurements and other data.

Quantitative data analysis can also be used to assess market data to help a company set a competitive price for its new product.

#### Techniques of quantitative data analysis

- Regression analysis
- Simple linear regression analysis
- Multiple linear regression analysis
- Hypothesis analysis

- Null hypothesis
- Alternative hypothesis
- **Qualitative data analysis:** it describes information that is typically non numerical. The qualitative data analysis approach involves working with unique identifiers, such as labels and properties and categorical variables, such as statistics, percentage, and measurements.

Qualitative data analysis can be used in various business processes. A data analyst may use firsthand or participant observation approaches, conduct interviews, run focus groups, or review documents and artifacts in qualitative data analysis.

#### **Techniques of qualitative data analysis**

- Deductive approach
- Inductive approach
- Content analysis
- Identify data sources
- Determine data criteria
- Develop coding for the data
- Analyze the result
- Discourage analysis

#### **Data analyst:**

- Examine both historical and current pattern
- Create operational and financial report
- Perform forecasting in tools such as excel
- Design infographics
- Interpret data and communicate clearly
- Perform data screening by analyzing documents and fixing data corruption

#### **Steps in Data Analysis:**

- Establish a goal
- Determine the type of data analytics to use
- Determine a plan to produce the data
- Collect the data
- Clean the data
- Evaluate the data
- Visualize the data

#### **CONCLUSION**

Data analysis is the process of analyzing data to discover useful information that is consistent with the objective of the research. Data analysis includes the inspection, modification, modelling and transforming of data as per the need of the research topic. The conclusion is the final interference drawn data analysis, review of literature, and findings.

A summary provides a provides a brief overview of the main points or content, while a conclusion offers a final statementsor judgement based on the information presented.

### **75 - What are the needs of interpretation?**

The need for the interperation is required for the data we provide for the “What are the needs of interpretation variousaspects of interpretation:

Interpretation is a critical process in various fields, includinglanguage, art, science, and even our daily lives. It involves understanding and explaining the meaning or significance of something. In this essay, we will delve into the needs and importance of interpretation, exploring its role in communication, decision-making, culture, and beyond.

#### **1. Communication and Language:**

Interpretation plays a fundamental role in language and communication. Language is a complex system of symbols, and interpretation is essential for understanding spoken and written words. Without interpretation, linguistic communication would be impossible. Interpretation allows us to decode the meaning behind words, sentences, and conversations, enabling effective communication.

#### **2. Cross-Cultural Understanding:**

In our globalized world, interpretation is crucial for cross- cultural understanding. Different cultures have unique languages, customs, and traditions. Interpretation bridges the gap between these diverse cultures, helping people understandand appreciate each other’s perspectives. This is especially important for international diplomacy, business, and cultural exchange.

#### **3. Legal and Judicial System:**

Interpretation plays a vital role in the legal and judicial system. Court interpreters help ensure that individuals who speak different languages have access to a fair trial. Accurate interpretation in legal proceedings is essential for justice to be served. Misinterpretation can lead to serious consequences, including wrongful convictions.

#### **4. Medical Field:**

In healthcare, interpretation is essential for effective doctor-patient communication. Medical interpreters help patients who speak different languages or dialects understand their diagnoses, treatment options, and medical instructions.

Misinterpretation in this context can lead to medical errorsand compromised patient care.

#### **5. Science and Research:**

Interpretation is crucial in scientific research and discovery. Scientists interpret data, experiments, and observations to draw conclusions and advance our understanding of the world. Interpretation allows researchers to make sense of complex data and communicate their findings to the scientificcommunity and the public.

#### **6. Art and Literature:**

Interpretation plays a central role in the appreciation of art andliterature. Art critics interpret the meaning and significance ofartworks, while literary scholars analyze and interpret the themes, symbols, and narratives in literature. Interpretation enhances our understanding and enjoyment of artistic and literary works.

#### **7. Historical Interpretation :**

Historical interpretation is vital for understanding the past. Historians interpret historical documents, artifacts, and events to reconstruct and analyze history accurately. Interpretation helps us learn from the past, avoid repeating mistakes, and appreciate the achievements of previous generations.

**8. Decision-Making:**

Interpretation is crucial in decision-making processes. In business, for example, interpreting market data, financial reports, and consumer behavior is essential for making informed decisions. Similarly, in politics and governance, leaders rely on interpretation to analyze complex issues and develop effective policies.

**9. Conflict Resolution:**

Interpretation can play a role in conflict resolution and diplomacy. Skilled interpreters facilitate communication between parties in conflict, helping them understand each other's grievances and find common ground. Interpretation can contribute to peaceful negotiations and conflict resolution efforts.

**10. Personal Growth and Development:**

Interpretation is not limited to professional or academic contexts. It also has personal significance. People often interpret their own experiences, emotions, and thoughts to gain self-awareness and personal growth. This introspective form of interpretation can lead to improved mental and emotional well-being.

**11. Education:**

Interpretation is a fundamental aspect of education. Teachers interpret educational materials to convey knowledge effectively to students. Similarly, students interpret information to grasp concepts and demonstrate their understanding through assignments and exams.

**12. Technology and Artificial Intelligence:**

With the advancement of technology and the rise of artificial intelligence, interpretation is becoming increasingly important. Natural language processing algorithms rely on interpretation to understand and respond to human language in chatbots, virtual assistants, and automated customer service systems.

In conclusion, interpretation is a multifaceted and indispensable process that permeates various aspects of our lives. It facilitates communication, fosters cross-cultural understanding, ensures justice, drives scientific discovery, enriches art and literature, informs decision-making, contributes to conflict resolution, promotes personal growth, and supports education. In an increasingly interconnected and complex world, the need for accurate and thoughtful interpretation remains as vital as ever, shaping our ability to understand, engage with, and navigate the diverse and dynamic facets of our existence.

**76- Topic: - What Are The Precautions In Interpretation**

**Answer:** - Interpreting information accurately is crucial for making informed decisions and avoiding misunderstandings. Here are some key precautions to take when interpreting information:

**Purpose of Precautions in Interpretation**

The purpose of taking precautions in interpretation is to ensure that information is accurately understood, leading to more informed decisions and reduced risk of misunderstandings or errors. Here are some specific purposes of these precautions:

**Introduction to Precautions in Interpretation:**

Interpreting information is an integral part of our daily lives, whether we're deciphering a news article, analyzing data, or making sense of someone's words. However, interpretation is not always straightforward, and there are inherent risks of misinterpretation. To navigate this challenge effectively, it's essential to take precautions in the interpretation process.

- 1. Context Matters:** Always consider the context in which the information is presented. Context can greatly influence the meaning of a statement or piece of data. Context matters"

is a phrase that underscores the importance of considering the surrounding circumstances, environment, or background information when interpreting or understanding something.

2. **Source Credibility:** Assess the credibility of the source. Is it a reputable and reliable source? Biases, inaccuracies, or misinformation can affect interpretation. Source credibility, also known as the credibility of a source or the reliability of information, is a fundamental concept in information evaluation and critical thinking.
3. **Confirmation Bias:** Be aware of confirmation bias, which is the tendency to interpret information in a way that confirms preexisting beliefs or opinions. Strive for objectivity. Confirmation bias is a cognitive bias that refers to the tendency of individuals to favor information or evidence that confirms their preexisting beliefs or values while ignoring or dismissing information that contradicts those beliefs.
4. **Avoid Assumptions:** Don't make assumptions about what the information means. Seek clarification or additional context if needed. Avoiding assumptions is a fundamental principle in critical thinking and effective communication.
5. **Check for Multiple Perspectives:** Consider different viewpoints and perspectives. Information can be interpreted differently by different people. Checking for multiple perspectives is a crucial aspect of critical thinking and decision-making. It involves seeking out and considering different viewpoints, opinions, and angles on a particular issue or topic.
6. **Language and Cultural Sensitivity:** When interpreting language or content from different cultures or languages, be sensitive to potential cultural nuances, idioms, or language-specific meanings. Language and cultural sensitivity are essential aspects of effective communication and interpersonal relationships, particularly in our diverse and interconnected world. These concepts involve understanding and respecting the cultural and linguistic differences that exist among people. Here's why language and cultural sensitivity are important and some strategies to promote them.
7. **Fact-Checking:** Verify facts and figures when possible. Inaccurate data can lead to incorrect interpretations. Fact-checking is the process of verifying the accuracy and reliability of information, claims, or statements. In an era of information abundance and misinformation, fact-checking is a crucial skill for individuals, journalists, researchers, and consumers of information. Here are some important aspects and principles of fact-checking.
8. **Avoid Overgeneralization:** Don't draw broad conclusions from limited or specific information. Be cautious about generalizing from a single example or case. Avoiding overgeneralization is a critical aspect of critical thinking and effective communication. Overgeneralization occurs when individuals draw sweeping conclusions or make broad statements based on limited or insufficient evidence.
9. **Distinguish between Fact and Opinion:** Clearly differentiate between factual information and opinions. Interpretations should be based on facts whenever possible. Distinguishing between fact and opinion is a critical skill in critical thinking, information evaluation, and effective communication. Differentiating between the two is essential for making informed decisions, avoiding misinformation, and engaging in rational discussions. Here's how to distinguish between fact and opinion:
10. **Consider the Audience:** Think about who the interpretation is intended for. Tailor your interpretation to the level of expertise and background knowledge of the audience. Considering the audience is a fundamental principle of effective communication. It involves tailoring your message, tone, and content to the specific needs, preferences, and expectations of the people you are communicating with.

11. **Time Sensitivity:** Be aware of the time context. Information may change over time, so consider whether the interpretation is still relevant. Time sensitivity refers to the recognition that certain tasks, decisions, or actions require immediate attention or must be completed within a specific timeframe. It is an essential aspect of effective time management and decision-making.
12. **Use Critical Thinking:** Apply critical thinking skills to evaluate the information critically. Assess the logic, reasoning, and evidence behind interpretations. Critical thinking is a foundational skill that involves actively and objectively evaluating information, arguments, and ideas, and making informed and rational decisions.
13. **Ask Questions:** If something is unclear or seems contradictory, don't hesitate to ask questions or seek clarification from the source or experts in the field. Asking questions is a fundamental aspect of critical thinking, problem-solving, and effective communication.
14. **Avoid Emotional Bias:** Emotional reactions can cloud judgment. Try to remain objective and rational when interpreting information. Avoiding emotional bias is essential for making rational decisions, conducting objective analysis, and maintaining fairness in your thinking and actions.
15. **Cross-Check Information:** Cross-reference information from multiple sources, if possible, to ensure consistency and accuracy. Cross-checking information is a crucial step in the process of verifying the accuracy and reliability of facts, claims, or data. It involves comparing information from multiple sources or perspectives to ensure its validity. Here are some reasons why cross-checking information is important and how to do it effectively.
16. **Document Sources:** Keep track of your information sources and references, especially when conducting research or making formal interpretations. Documenting sources is a critical practice when conducting research, creating content, or compiling information. Proper source documentation serves several important purposes, including:
17. **Adapt to Change:** Be open to revising your interpretation if new information emerges or circumstances change. Adapting to change is a valuable life skill that allows individuals to navigate new circumstances, challenges, and opportunities successfully. Change is inevitable in various aspects of life, including personal, professional, and societal. Here are some strategies for effectively adapting to change:
18. **Ethical Considerations:** Consider the ethical implications of your interpretation, especially in fields like journalism, law, or science. Ethical considerations are fundamental principles that guide our behavior and decision-making in various aspects of life, including personal, professional, and societal contexts. Ethics provide a framework for distinguishing right from wrong, ensuring fairness, and promoting moral values. Here are some key ethical considerations and principles to keep in mind
19. **Consult Experts:** When dealing with highly specialized or technical information, consult experts or professionals in the relevant field for guidance.

Remember that interpretation is not always a straightforward process, and it requires a thoughtful and responsible approach to ensure that conclusions are as accurate and meaningful as possible. Consulting experts is a valuable strategy when you need specialized knowledge, guidance, or insights in a particular field or domain. Experts have deep expertise and experience in their areas of specialization, and their input can be instrumental in making informed decisions, solving complex problems, and achieving specific goals. Here are some key considerations and steps for effectively consulting experts.

**77 - What are the methods of data interpretation?**

**Answer:** data interpretation refers to the process of taking raw data and transforming it into useful information. This involves analysing the data to identify patterns, trends and relationships and then presenting the result in a meaningful way. Data interpretation is an essential part of data analysis, and it is used in a wide range of fields, including business, marketing, healthcare, and many more.

**Methods of Data Interpretation**

**There are two main methods of data interpretation.**

1. Qualitative Data Interpretation Method

2. Quantitative Data Interpretation Method

1. **Qualitative Data Interpretation Method** - The qualitative data interpretation method is used to analyse qualitative data, which is also known as categorical data. This method uses texts, rather than numbers or patterns to describe data.

- Qualitative data is usually gathered using a wide variety of person-to-person techniques. This technique includes:
  - **Observations:** dealing with behavioural patterns that occur within an observation group. These patterns could be the amount of time spent in an activity, the type of activity, and the method of communication employed.
  - **Focus groups:** group people and ask them relevant questions to generate a collaborative discussion about a research topic.
  - **Secondary research:** much like how patterns of behaviour can be observed, various types of documentation resources can be divided on the basis of the type of material they contain.
  - **Interviews:** one of the best collection methods for narrative data. Enquiry responses can be grouped by theme, topic or categories. The interview approach allows for highly-focused data segmentation.

**Now the second step is to interpret the data that is produced. This is done by the following methods:-**

**Content Analysis-**

This is a popular method for analysing qualitative data. Other approaches to analysis may fall under the general category of content analysis. An aspect of the content analysis is thematic analysis. By classifying materials into words, concepts, and themes, content analysis is used to uncover patterns that arise from the text.

**Narrative Analysis –**

The focus of narrative analysis is on people's experiences and the language they used to make sense of them. It's especially effective for acquiring a through insight into customer's viewpoints on a certain topic. We might be able to describe the results of a targeted case study using narrative analysis.

**Discourse Analysis-**

Discourse analysis is a technique for gaining comprehensive knowledge of the political, cultural and power dynamics that exist in a given scenario. The emphasis here is on how people express themselves in various social settings. Brand strategists frequently utilise discourse analysis to figure out why a group of individuals reacts the way they do to a brand or product.

It's critical to be very clear on the type and scope of the study topic in order to get the most out of the analytical process.

## 2. Quantitative Data Interpretation Method -

Quantitative data also known as numerical data is analysed using the quantitative data interpretation approach. It is examine using numbers rather than words. Quantitative analysis is a collection of procedures for analysing numerical data. It frequently requires the application of statistical modeling techniques such as standard deviation, mean and median.

### • Median

The median is the middle value in a list of numbers that have been sorted ascending order descending and it might be more descriptive of the data set than the average.

### • Mean

The basic mathematical average of two or more values is called a mean. The arithmetic mean approach which utilises the sum of the values in the services, and the geometric mean method, which is the average number of products, are two way to determine the mean for a given collection of numbers .

### • Standard Deviation

This is another statistical term commonly appearing in quantitative analysis. Standard deviation reveals the distribution of the responses around the mean. It describe the degree of consistency within the responses, together with the mean, it provide insight into data sets.

## 79- Topic - Types of Data Analysis

### Answer: - Meaning of Data Analysis

Data analysis is the process of cleaning, changing and modelling data to discover Useful information for business decision- making. The purpose of data analysis is to extract Useful information from data and taking the decision based upon the data analysis.

Data analysis is the process of cleaning, changing and processing raw data and extracting actionable , relevant information that helps businesses make informed decisions .The procedure helps reduce the risks inherent in decision- making by providing useful insights and Statistics , often presented in charts, images, tables and graphs.

### Types of Data Analysis:-

1. **Descriptive Analysis:** - Descriptive Analysis involves summarizing and describing, the main feature of a data set it focuses on organising and presenting the data in a meaningful way, often using measures such as mean, median, mode, and standard deviation. It provides an overview of the data and helps identify patterns or trends.
  - Descriptive Analysis is the very first analysis performed in the data analysis process.
  - It involves common, descriptive statistical like measures of Central tendency, variability, frequency and position.
2. **Inferential Analysis:** - Inferential analysis aim to make inference or predictions about a large population based on sample data. It involves applying statistical techniques such as hypothesis testing, confidence intervals, and regressions analysis. It helps generalize findings from a sample to a longer population.
  - Inferential Analysis involves using estimated data that is representative of a population and gives a measure of uncertainty or standard deviation to your estimation.
3. **Exploratory Data Analysis:** - Exploratory data analysis focuses on exploring and understanding the data without preconceived hypotheses. It involve visualisation summary statistics, and data profiling techniques to uncover patterns, relationships and interesting features. It helps generate hypotheses for future analysis.



- It's useful for discovering new connections and forming hypotheses. It drives design planning and data collection.
  - Exploratory data analysis helps you discover relationship between measures in your data.
4. **Diagnostic Analysis:** - Diagnostic Analysis aims to understand the cause – and – effect relationship within the data. It investigates the factors or variables that contribute to specific outcomes or behaviours. Techniques such as regression analysis, ANOVA (Analysis of Variance), or correlation analysis are commonly used in diagnostic analysis.
- Diagnostic analysis typically comes after descriptive analysis taking initial finding and investigating why certain patterns in data happen.
  - Diagnostic analysis May involves analysing other related data sources, including past data, to reveal more insights into current data trends.
5. **Predictive Analysis:** - Predictive analysis involves using historical data to make predictions or forecasts about future outcomes. It utilizes statistical modelling techniques, machine learning algorithms and time series analysis to identify patterns and build predictive model. It is often used for forecasting sales, predicting customer behaviour, or estimating risk.
- The accuracy of the prediction depends on the input variables.
  - Accuracy also depends on the types of models. A linear model might work in some cases, and in other cases it might not.
6. **Prescriptive Analysis:** - Prescriptive analysis goes beyond predictive analysis by recommending actions or decisions based on the predictions. It combines historical data, Optimisation algorithms and business rules to provide actionable insights and optimise outcomes. It helps in decision- making and resource allocation.
- Prescriptive analysis may come right after predictive analysis, but it may involve combining different data analysis.

## 80- Topic- Microsoft Excel

### Answer - Microsoft Excel Introduction

MS-EXCEL is a part of Microsoft Office suite software. It is an electronic spreadsheet with numerous rows and columns, used for organizing data, graphically represent data(s), and performing different calculations. It consists of 1048576 rows and 16384 columns; a row and column together make a cell. Each cell has an address defined by column name and row number example A1, D2, etc. This is also known as a cell reference.

**Cell references:** The address or name of a cell or a range of cells is known as Cell reference. It helps the software to identify the cell from where the data/value is to be used in the formula. We can reference the cell of other worksheets and also of other programs.

- Referencing the cell of other worksheets is known as External referencing.
- Referencing the cell of other programs is known as Remote referencing.

### There are three types of cell references in Excel:

- Relative reference.
- Absolute reference.
- Mixed reference.
- **Relative Reference** - Relative reference is the default cell reference in Excel. It is simply the combination of column name and row number without any dollar (\$) sign. When you copy

the formula from one cell to another the relative cell address changes depending on the relative position of column and row. C1, D2, E4, etc. are examples of relative cell references. Relative references are used when we want to perform a similar operation on multiple cells and the formula must change according to the relative address of column and row.

- **Absolute Reference** - An absolute reference in Excel refers to a reference that is “locked” so that rows and columns won’t change when copied. Unlike a relative reference, an absolute reference refers to an actual fixed location on a worksheet. To create an absolute reference in Excel, add a dollar sign before the row and column. For example, an absolute reference to A1 looks like this:
- **Mixed Reference** - Mixed Reference is a type of Absolute reference in which either the column is made constant or the row is made constant. When we make any column or row constant then the column name or row number does not change as we copy the formula to other cell(s). The mixed reference is designated by a dollar sign (\$) in front of the row or column. For example:
  - \$F1: In this the column F is constant.
  - F\$1: In this the row 1 is constant.

#### **Feature of Microsoft excel -**

1 – You Can Insert a New Worksheet at Will

2– Time Saving Shortcut Keys

3– Get Quick Sum of Numbers

4– Filtering Data

5– Paste Special Feature

6– Insert Random Numbers

7– Insert Random Fraction Numbers

8– Goal Seek Analysis

9– Insert Serial Number

#### **Basics of Ms Excel**

MS Excel is a spreadsheet program where one can record data in the form of tables. It is easy to analyze data in an Excel spreadsheet. The image given below represents how an Excel spreadsheet looks like:

#### **How to open MS Excel?**

**To open MS Excel on your computer, follow the steps given below:**

- Click on Start
- Then All Programs
- Next step is to click on MS Office
- Then finally, choose the MS-Excel option alternatively, you can also click on the Start button and type MS Excel in the search option available.

#### **What is a cell?**

A spreadsheet is in the form of a table comprising rows and columns. The rectangular box at the intersection point between rows and columns forms a cell. Given below is an image of a cell:

**What is Cell Address?**

The cell address is the name by which a cell can be addressed. For example, if row 7 is interested in column G, then the cell address is G7.

**Benefits of Using MS Excel**

MS Excel is widely used for various purposes because the data is easy to save, and information can be added and removed without any discomfort and less hard work.

**Given below are a few important benefits of using MS Excel:**

- **Easy To Store Data:** Since there is no limit to the amount of information that can be saved in a spreadsheet, MS Excel is widely used to save data or to analyze data. Filtering information in Excel is easy and convenient.
- **Easy To Recover Data:** If the information is written on a piece of paper, finding it may take longer, however, this is not the case with Excel spreadsheets. Finding and recovering data is easy.
- **Application of Mathematical Formulas:** Doing calculations has become easier and less time-taking with the formulas option in MS Excel.
- **More Secure:** These spreadsheets can be password secured in a laptop or personal computer and the probability of losing them is way lesser in comparison to data written in registers or pieces of paper.
- **Data at One Place:** Earlier, data was to be kept in different files and registers when the paperwork was done. Now, this has become convenient as more than one worksheet can be added in a single MS Excel file.
- **Neater and Clearer Visibility of Information:** When the data is saved in the form of a table, analyzing it becomes easier. Thus, information in a spreadsheet is more readable and understandable.

**List of Top 12 Important Uses of Microsoft Excel**

There are plenty of uses of Excel, and the list goes on, but here we have listed some of the important uses of Microsoft Excel to start the things for a beginner.

- Data Analysis and Interpretation.
- Plenty of Formulas to Work with Data
- Data Organizing and Restructuring
- Data Filtering
- Flexible and User-Friendly
- Online Access
- Building Dashboards
- Interactive charts and Graphs
- Dynamic Formulas
- Automation Through Excel
- Get quick totals
- Goal seek analysis

## CONCLUSION

Microsoft Excel is clearly a resource that can be used in many careers, and is valuable for professional and personal purposes. This textbook has focused on introducing the fundamental skills necessary to get you started in using Excel and to a solid intermediate level of proficiency, confidence, and comfort using the program.

While this content refers to Microsoft Excel current full-installation versions, the skills you learn and practice here are also consistent with open-source and other variations of spreadsheet programs, like those in Google, LibreOffice, OpenOffice, etc.

### 83- Topic: What Is The Feature of Advance Excel?

**Answer:-**Microsoft Office Excel is one of the most important tools to perform the calculation, analysis, and visualization of data and information. It helps people to organize and process data by the use of columns and rows with formulas and some cool features of MS Excel.

Learning about Excel can be easy. In this day and age, Microsoft Excel has become the most famous, familiar, and widely used application in the world.

This is due to its ability to adapt to almost any business purpose. Purpose of Microsoft Excel  
Microsoft Excel is a software program that uses spreadsheets to organize numbers and data. These data are organized in the spreadsheet by using formulas and functions needed for it to make sense.

Excel is frequently used in finance and accounting. Many organizations run their forecast, budget, and accounting functions through Microsoft Excel.

Excel has a large list of cells formatted to arrange, organize and manipulate data to solve mathematical functions. Arranging data using graphing tools, tables, and formulas can be done with the spreadsheet.

### How to start MS Excel?

You must also see how MS Excel begins if you want to understand what it is. If you carefully read the methods below, you can access MS Excel on your computer with no trouble at all:

- In Windows, first click on Start.
- Next, choose All Programs.
- Your following action will be to select MS Office.
- After that, MS Office selected the MS-Excel option.

Suppose you prefer not to go such a long route. In that case, you may start by clicking the Start button, typing “Microsoft Excel” into the available search box, and then selecting “Microsoft Excel” to begin.

### Present Day Microsoft Excel

Flash forward to present day with the latest release of Excel 2019 and Excel 365, Microsoft Excel is the most familiar, flexible, and widely used business application in the world due to its capability to adapt to almost any business process. Coupled with the use of other Microsoft Office applications, Word, Outlook, PowerPoint, etc., there is little that cannot be handled by this very powerful combination.

### The top 10 list of most popular and powerful built-in Excel features:

- Efficiently model and analyze almost any data.
- Zero in on the right data points quickly.

- Create data charts in a single cell.
- Access your spreadsheets from virtually anywhere.
- Connect, share, and accomplish more when working together.
- Take advantage of more interactive and dynamic PivotCharts.
- Add more sophistication to your data presentations.
- Do things easier and faster.
- Harness more power for building bigger, more complex spreadsheets .
- Publish and share through Excel Services

### Some features of MS Excel

MS Excel is not a small program, so it has numerous features; below, we will tell you what else is on this spreadsheet apart from various editing and formatting.

1. **Home** - You have choices for font size, font style, font colour, background colour, alignment, formatting options, cell insertion and deletion, and editing options under this feature.
2. **Insert** - You may add equations, symbols, graphs, charts, and sparklines, as well as images and figures, tables, headers, and footers, using this tool, which also offers choices for table type and style.
3. **Formulas** - As we previously said, MS Excel has the ability to generate tables with enormous amounts of data. With this feature, you can add a formula to your data table and receive an immediate response.
4. **Statistics** - This category includes tools for adding external data (from the web), filtering choices, and data.
5. **Review** - Under this review category, you may proofread the Excel sheet (for example, run a spell check), and you can make comments on this part with ease.
6. **View** - The many perspectives you want the spreadsheet to be shown here may be readily modified. This category includes wonderful options like zoom-in and zooms out
7. **Page Layout** - Under this page layout option, there are some excellent choices, including theme, orientation, and page arrangement

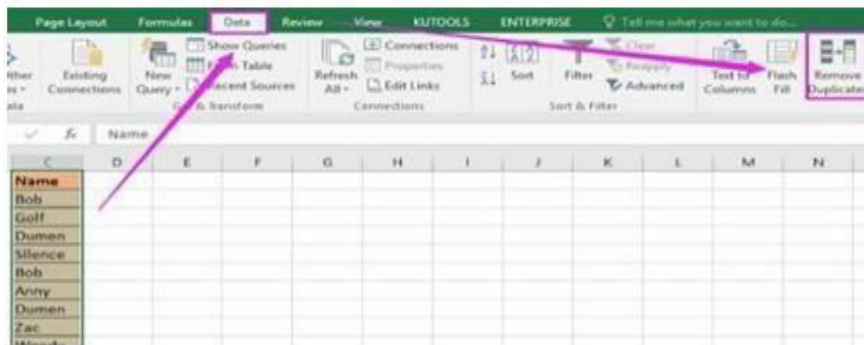
### Features of Excel

Microsoft Excel is used to perform calculations, analysis, and visualization of data and information. This helps people to organize and process data by using columns and rows with formulas and other features.

### Here are some of the advance features of Excel

#### 1. Removing duplicates:

Removing duplicates is one of the most powerful features of MS Excel. To do this, just click on a data cell. After this, look for the data tab then click Remove Duplicates in the data tools.



**2. Vlookup() -**

This function helps in searching for a value in a table. It works by searching for the given value and then returning a matching value to another column.

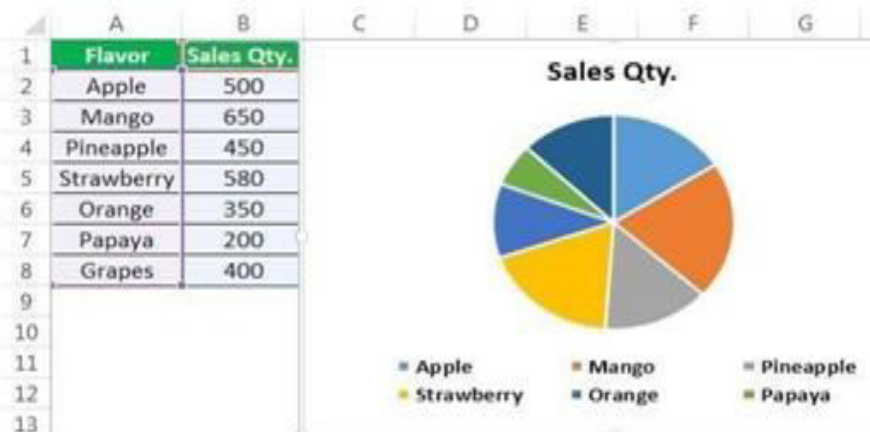
**The syntax for this is:** Vlookup (lookup\_value, table\_array,col\_index\_num, [range\_lookup])

Lookup\_value is the value to look for. Table\_array is two or more data columns. Col\_index\_num is the column number in the table\_array to which the value in the comparable row should be returned.



**3. Pie Chart**

A pie chart is used for data visualization. It visualizes the contribution of each value to a complete pie diagram. This always uses one data series. You may also use our pie chart tool to generate pie charts online.



**4. Iferror -**

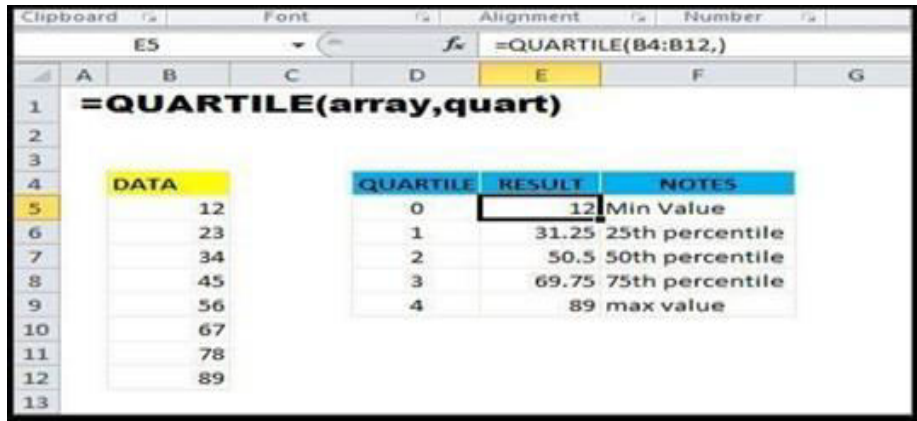
This function is useful for anyone who’s in the field of data analysis. This function returns a result when a formula generates an error. The IFERROR is a simple way to manage errors.

**The syntax is:** = IFERROR (value, value\_if\_error)

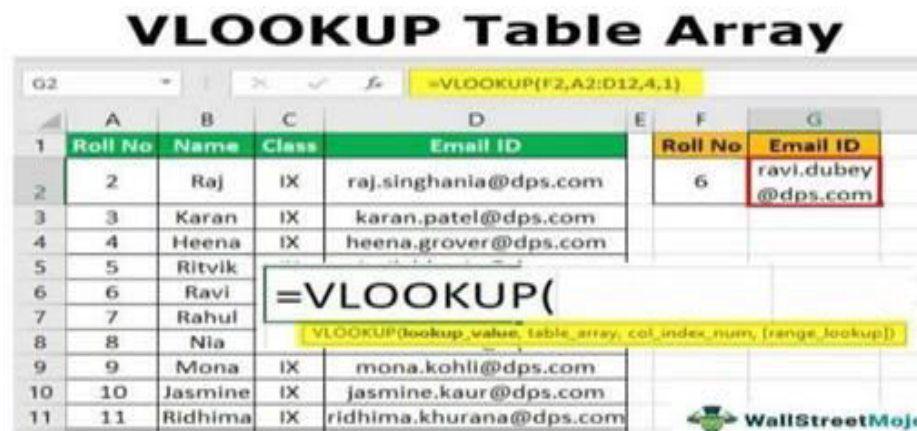
**5. Quartile -**

Quartile is usually applied in sales and to review data to classify communities into groups. This function organizes the quartile value of the cells into an arrangement.

**The syntax is:** = QUARTILE (array, quart)



6. **Table Array** - This function is a combination of two or more tables with data and values which is linked and should be related to one another. This is part of VLOOKUP.



7. **Networkdays** - The Networkdays function can estimate the number of workdays between two terms. It can also skip defined leaves and will only include working days.

**The syntax is:** = NETWORKDAYS (start\_date, end\_date, [holidays])

**8. MAX and MIN**

The MAX and MIN function provides the maximum and minimum values from the selected data sets.

**9. TREND**

The TREND function is used to calculate linear trend lines in a set of Y or X values. This is used for time series trend analysis or for projecting future trends.

The TREND function returns values along a linear trend. It fits a straightline (using the method of least squares) to the array's known\_y's and known\_x's. TREND returns the y-values along that line for the array of new\_x's that you specify.

#### 10. FV Function

This function is a business function that can give the expected value of an investment. You can apply the FV function to obtain the forecasted price of an investment. This considers intermittent, regular payments with a fixed interest rate. You may also use our Financial Calculator to calculate FV of your investments online.

**The syntax is:** = FV (rate, nper, pmt, [pv], [type])

#### 11. Randbetween

This function allows you to pick a number in an already-defined set of numbers. Once the lowest and highest numbers are set, excel can pick the correct information.

**The syntax is:** = RANDBETWEEN (starting point, ending point)

#### 12. Quick Feature

The Quick feature can give you a cluster of statistics like count, average, max, min, and sum.

This feature can be used without inserting a formula for the picked range of data.

#### 13. Named Ranges

This feature gives names to ranges of large numbers. This can help you by using the name together with other advanced Excel formulas without you having to click and pick the needed range.

#### 14. Trim

The trim function is used to remove extra spaces from a spreadsheet. Unnecessary trailing and leading spaces can be removed using this function.

The syntax is: =TRIM (text)

#### 15. Concatenate

This Concatenate function works by joining two or more strings together.

The syntax is: =Concatenate (text1, [text2, ..... text\_n])

#### 16. Transpose

This function allows the user to return a transposed set of cells. This goes under the Lookup or reference function of Excel. This feature returns a horizontal range or cells when a vertical range is entered and vice versa.

The syntax is: =TRANSPOSE (range)

#### 17. And Function

The AND function has more than one criterion that is set when searching for variables. The value will be true if the variable matches the criteria.

The value will be false if it does not.

The syntax is: =AND (logical1, [logical2], ....)

#### 84 - Topic: What Is Database?

**Answer:** A database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database is usually controlled by a database management system (DBMS). Together, the data and the DBMS, along with the applications that are associated with them, are referred to as a database system, often shortened to just



database can be in the form of text, numbers, images, or other forms of media. Data is often collected and used to support decision-making, analysis, and other activities.

It is an essential part of the operation of computers and other digital devices, as well as many modern scientific, business, and social systems. Data within the most common types of databases in operation today is typically modeled in rows and columns in a series of tables to make processing and data querying efficient. The data can then be easily accessed, managed, modified, updated, controlled, and organized. Most databases use structured query language (SQL) for writing and querying data. Database languages, also known as query languages or data query languages, are a classification of programming languages that developers use to define and access databases, which are collections of organized data that users can access electronically.

### **What Are Databases Used For?**

Databases are used to store and manage large amounts of structured and unstructured data, and they can be used to support a wide range of activities, including data storage, data analysis, and data management.

They are used in a variety of settings, including business, scientific, and government organizations.

Some examples of how databases are used include storing customer information in a customer relationship management (CRM) system, storing financial transactions in an accounting system, storing inventory and orders in an e-commerce system, storing patient records in a healthcare system, and storing student records in an educational institution.

### **What's the Difference between a Database and a Spreadsheet?**

A database and a spreadsheet are both tools for storing and organizing data, but they have some key differences. A database provides more powerful and sophisticated tools for manipulating data than a spreadsheet, such as the ability to create complex queries and update and delete data in a controlled manner. However, a spreadsheet is better suited for simple calculations and data entry. While a database is generally better suited for storing and managing large amounts of data that need to be accessed by multiple users simultaneously, a spreadsheet is more suitable for storing small amounts of data that are used primarily by a single user.

## **TYPES OF DATABASES**

### **There are several different types of databases, including:**

**Relational databases:** These databases store data in the form of tables, with rows representing records and columns representing fields. Relationships between data can be established using keys.

**Object-oriented databases:** These databases store data in the form of objects, which are self-contained units of data and functionality. Object-oriented databases are designed to support the storage and management of complex, interrelated data.

**NoSQL databases:** These databases are designed to support the storage and management of large amounts of unstructured data. They do not use the traditional table-based structure of relational databases, and they often support horizontal scaling, which allows them to handle very large amounts of data and high levels of concurrency.

### **Database Architecture**

Database architecture refers to the overall design and structure of a database system, including the hardware and software components that make up the system, the way the data is organized and stored, and the ways in which the data can be accessed and manipulated. There are several different types of database architectures, including:

- Centralized database architecture
- Distributed database architecture
- Client-server database architecture
- Cloud database architecture

### **Their Advantages and Disadvantages**

#### **There are several advantages to using database architecture:**

- A database allows data to be organized in a structured and consistent manner, making it easy to access and manipulate.
- It ensures the integrity of the data by enforcing rules on data input and storage, and by tracking changes to the data.
- It provides robust security features to protect the data from unauthorized access or changes.
- It allows applications to be developed and maintained independently of the data, making it easier to make changes to the data or the applications without affecting each other.
- It allows multiple users to access and update the data simultaneously, making it easier to share information and collaborate.

#### **There are also some disadvantages to using database architecture:**

- I. Setting up and maintaining a database can be complex, requiring specialized skills and resources.
- II. The purchase and maintenance of database software and hardware can be expensive.
- III. Large databases can be resource-intensive, and the performance of the system may suffer as the amount of data grows.
- IV. A database may need to be redesigned or reconfigured as the amount of data grows or the number of users increases, which can be a time-consuming and complex process.

### **What is a Database Management System?**

A database management system (DBMS) is software that is used to create, manage, and maintain a database. It provides a way to store, organize, and retrieve data from the database. It provides an interface between the database and the users or applications that access it. Users can create, modify, and delete database objects, as well as insert, update, and delete data from the database using a DBMS. Some examples of database management systems include MySQL, Oracle, and Microsoft SQL Server.

### **Database Languages**

Database languages are used by developers to define and access databases. When you use a database language, you can access the data and perform various operations based on the results you want. There are four main types of database languages, which are data definition language, data manipulation language, data control language, and transaction control language. All these languages serve different purposes, depending on the needs of the developer.

### **History and Evolution of Databases**

The concept of a database can be traced back to the early 1960s, when computer scientists began working on ways to store and organize large amounts of data in a structured manner. One of the first examples of a database was created by IBM in the 1960s for the U.S. Census Bureau, and it was used to store and process data from the 1960 U.S. Census.

In the 1970s, the relational database model was introduced, which organized data into tables that could be related to one another through the use of keys. This model became the basis for many of the data the abasement systems (DBMS) that are in use today.

### **Using Databases to Improve Business Performance and Decision-Making**

Databases and DBMS have the potential to improve the performance of businesses and aid in the decision-making process by providing great insights. Here are some of the ways in which databases can help you improve your business performance.

### **Examples of Database**

A database can be as simple as a telephone directory that stores contact details of people to the more sophisticated and modernized ones, such as MySQL, MongoDB, Oracle Database, and SQL Server that are managed by database management systems. While these are different types of databases, the common advantage they offer is easy collection and management of data.

### **CONCLUSION**

Hope this article was able to help you clearly understand what a database is. If you are interested in enhancing your cloud computing skills further, we would highly recommend you to check Simplilearn's Post Graduate Program in Cloud Computing. This course, in collaboration with CaltechCTME, can help you gain the right foundational and advanced skills and make you job-ready.

### **86 - Topic : How Can You Restrict Someone From Copying A Cell From Your Worksheet**

**Answer:** First, choose the data you want to protect.

Hit Ctrl + Shift + F. The Format Cells tab appears. Go to the Protection tab. Check Locked and click OK.

Next, go to the Review tab and select Protect Sheet. Enter the password to protect the sheet.

Is it possible to prevent someone from copying the cell from your worksheet?

Yes, it is possible. In order to protect your worksheet from getting copied, you need to go into Menu bar > Review > Protect sheet > Password. By entering password, you can secure your worksheet from getting copied by others.

By default, when you protect a worksheet, all the cells on the worksheet are locked, and users cannot make any changes to a locked cell.

### **To set a password to protect cells, follow the steps given below:**

- 1) Go to REVIEW tab and click on "Protect Sheet" option.
- 2) Excel opens the Protect Sheet dialog box. By default, Excel selects the Protect Worksheet and Contents of Locked Cells check box.
- 3) Select any of the check boxes in the Allow All Users of This Worksheet To list box (such as Format Cells or Insert Columns) that you still want to be functional when the worksheet protection is operational.

### **The Select Locked Cells and Select Unlocked Cells check boxes are selected by default.**

- 1) Type the password in the 'Password to unprotect Sheet' text box.
- 2) Click OK.
- 3) Excel opens the Confirm Password dialog box. Re-enter the password in the Reenter Password to proceed text box and then click OK. Notice that if you try to edit a cell, Excel displays an error message.

To remove worksheet protection, click the Unprotect Sheet button in the Changes group on the Review tab. You'll be prompted to type the password that you had set for protection.

### **How can prevent someone from copying the cell from your worksheet?**

- Right click on the cell and click on format cells
- Click on protection
- Ensure Locked is checked and click ok
- Use this key combination. Alt+P and then P again. This will give you the Protect Sheet pop up
- Remove the check from Select locked cells, type in a password and click ok. You will need to retype the password Please note that this will lock the entire sheet and will not allow "any" cell to be even selected.

For only specific cells to be selected you will have to first select the entire sheet and uncheck the box next to Locked cells in point 3 above. Click on ok. Then select only those cells that you need to lock it.

Protecting sheet is mandatory, otherwise the cells will not be locked. However password itself is not required, you can protect the sheet without typing in a password. Which would also mean it can be unprotected without a password.

You can additionally "hide" the cells. What this does is, it will hide any formulas that are typed in the cell. This option is available same as point 3 above.

### **How can you restrict someone from copying a cell from?**

- Select the cells or cells,
- Right Click, Format cells,
- Under the Protection Tab, Mark the check boxes for Locked/Hidden,
- Go to Review Tab and click on protect sheet.
- Provide the password for protecting the sheet and formulas in the selected will be hidden for viewing.

Yes you can restrict by protecting cells in excel sheet. For that you will have to go to Review Tab > Protect Sheet.

After it you will see a dialog box like this You need to uncheck 'Select Locked Cells' options and click 'Ok' Now locked cells will not be selected so those cells will not be copied.

Note: You can make some cells unprotected before locking sheet by going to sheet right click menu > format cells > Protection > (uncheck Locked and Press 'Ok')

### **How do I restrict copy and paste in Excel?**

Go to Review tab and click Protect Sheet button. In the Protect Sheet popup, check Protect worksheet and contents of locked cells option and enter a password if needed. Click OK.

Changed reference. This template has formulas so long you have to stretch excel across two monitors to see them, a ton of conditional formatting, and over 1000 lines of VBA. She has no background in programming or spreadsheets and will not recognize that she's changed a reference. The entire point of locking the spreadsheet and disabling all options other than "allow unlocked cells" was so that she couldn't do this.

Unmerging cells at random. Again, the entire page is protected and “allow formatting” isn’t enabled. I’m not sure how she’s doing it.

Carry formatting from an old cell such as borders forward to the new cell. This isn’t the end of the world, but it’s another example of how she’s going through the protection. Formatting is not enabled; even after this error, she cannot change formatting if she tries to.

One possibility that I’ve discarded is that I do have a listener that responds to certain cells. For example, one cell called numSKP allows the user to dynamically customize how many rows of SKPs will be shown vs hidden. In order to do this, the vba briefly unlocks the program then relocks it. I use the same listener module for ~10 cells, and it occurs to me as I type this that it unlocks the second it detects a cell change and locks again once it finishes processing. The issue is that lock/unlock process happens in like

0.001 seconds and when I put a pause in there (msgbox (“If it’s broken now, she broke it during the listener”)), I was never able to trigger it during the listener. I don’t think that’s the cause, but tbh I was never able to trigger the error outside of the listener,

Either: grinning\_face\_with\_sweat:. The issues she’s happening are not related to the cells It’s listening for, so I don’t think this is it but I can’t swear to it.

### **How do I restrict access to a specific worksheet in Excel?**

#### **Protecting Individual Worksheets by User in Excel**

**Step 1:** Open the Workbook.

**Step 2:** Select the Worksheet.

**Step 3:** Click on the “Review” Tab.

**Step 4:** Click on “Protect Sheet”

**Step 5:** Set Permissions.

**Step 6:** Click “OK”

#### **How to Protect Individual Worksheets by User Protecting individual worksheets in Excel is a relatively simple process. Here are the steps you need to follow:**

**Step 1:** Open the Workbook Open the Excel workbook that contains the worksheet you want to protect.

**Step 2:** Select the Worksheet Select the worksheet you want to protect by clicking on its tab at the bottom of the screen.

**Step 3:** Click on the “Review” Tab Click on the “Review” tab in the Excel ribbon at the top of the screen.

**Step 4:** Click on “Protect Sheet” Click on the “Protect Sheet” button in the “Changes” group.

**Step 5:** Set Permissions In the “Protect Sheet” dialog box, set the permissions for the worksheet. You can choose to allow users to select locked cells, select unlocked cells, format cells, or insert/delete rows and columns. You can also set a password to prevent unauthorized changes.

**Step 6:** Click “OK”

Click “OK” to apply the protection settings to the worksheet.

### **CONCLUSION**

Protecting individual worksheets by user in Excel is an important feature that can help businesses and organizations maintain the integrity and confidentiality of their data. By

following the simple steps outlined above, you can easily protect your worksheets and ensure that only authorized users have access to critical information.

## **87- Topic- How Do We Apply Advanced Filters to the Excel**

### **Introduction Microsoft Excel –**

Excel is a spreadsheet program from Microsoft and a component of its Office product group for business applications. Microsoft Excel enables users to format, organize and calculate data in a spreadsheet.

By organizing data using software like Excel, data analysts and other users can make information easier to view as data is added or changed. Excel contains a large number of boxes called cells that are ordered in rows and columns. Data is placed in these cells.

### **Organizations use Microsoft Excel for the following:**

- Collection and verification of business data;
- Business analysis;
- Data entry and storage;
- Data analysis;
- Performance reporting;
- Strategic analysis
- Accounting and budgeting;
- Administrative and managerial management;
- Account management;
- Project management; and
- Office administration.

### **Some features of MS Excel**

MS Excel is not a small program, so it has numerous features; below, we will tell you what else is on this spreadsheet apart from various editing and formatting.

- I. **Home-** You have choices for font size, font style, font colour, background colour, alignment, formatting options, cell insertion and deletion, and editing options under this feature.
- II. **Insert -** You may add equations, symbols, graphs, charts, and sparklines, as well as images and figures, tables, headers, and footers, using this tool, which also offers choices for table type and style.
- III. **Formulas -** As we previously said, MS Excel has the ability to generate tables with enormous amounts of data. With this feature, you can add a formula to your data table and receive an immediate response.
- IV. **Statistics -** This category includes tools for adding external data (from the web), filtering choices, and data.
- V. **Review -** Under this review category, you may proofread the Excel sheet (for example, run a spellcheck), and you can make comments on this part with ease.
- VI. **View-** The many perspectives you want the spreadsheet to be shown here may be readily modified. This category includes wonderful options like zoom-in and zooms out

**VII. Page Layout** - Under this page layout option, there are some excellent choices, including theme, orientation, and page arrangement.

### Uses

MS Excel is known and used all over the world for organising data and doing financial analysis. It is used in all business functions and in small to large companies.

### The main uses of Excel are:

- a. Data management
- b. Accounting
- c. Financial analysis
- d. Financial modelling
- e. Graphing and charting
- f. Programming
- g. Customer Relationship Management (CRM)
- h. Time management
- i. Task management

### How do we apply advanced filters in ms excel

Using Excel Advanced Filter is not as easy as applying AutoFilter (as is the case with many “advanced” things) but it’s definitely worth the effort. To create an advanced filter for your sheet, perform the following steps.

#### 1. Organize the source data

##### For better results, arrange your data set following these 2 simple rules:

- Add a header row where each column has a unique heading –duplicate headings will cause confusion to Advanced Filter.
- Make sure there are no blank rows within your data set.

#### 2. Set up the criteria range

Type your conditions, aka criteria, in a separate range on the worksheet. In theory, the criteria range can reside anywhere in the sheet. In practice, it’s more convenient to place it at the top and separate from the data set with one or more blank rows.

##### Advanced criteria notes:

- The criteria range must have the same column headings as the table /range that you want to filter.
- Criteria listed on the same row work with the AND logic. Criteria entered on different rows work with the OR logic.

For example, to filter records for the North region whose Sub-total is greater than or equal to 900, set up the following criteria range:

- Region: North
- Sub-total: >=900

#### 3. Apply Excel Advanced Filter

##### In the criteria range in place, apply an advanced filter in this way:

- Select any single cell within your dataset.

- In Excel 2016, Excel 2013, Excel 2010 and Excel 2007, go to the Data tab > Sort & Filter group and click Advanced.

In Excel 2003, click the Data menu, point to Filter, and then click Advanced Filter....

#### 4. Configure the Advanced Filter parameters

**In the Excel Advanced Filter dialog window, specify the following parameters:**

- Action. Choose whether to filter the list in place or copy the results to another location.

Selecting “Filter the list in place” will hide the rows that don’t match your criteria.

If you choose “Copy the results to another location”, select the upper-left cell of the range where you want to paste the filtered rows. Make sure the destination range has no data anywhere in the columns because all cells below the copied range will be cleared.

- List range. It’s the range of cells to be filtered, the column headings should be included.

If you’ve selected any cell in your data set before clicking the Advanced button, Excel will pick the entire list range automatically. If Excel got the list range wrong, click the Collapse Dialog icon to the immediate right of the List Range box, and select the desired range using the mouse.

- Criteria range. It’s the range of cells in which you input the criteria.

In addition, the check box in the lower-left corner of the Advanced Filter dialog window lets you display unique records only. For instance, this option can help you extract all different (distinct) items in a column.

#### Comparison operators for numbers and dates

In the Advanced Filter criteria, you can compare different numeric values using the following comparison operators.

The usage of comparison operators with numbers is obvious. In the above example, we already used the numeric criteria  $\geq 900$  to filter records with Subtotal greater than or equal to 900.

And here’s another example. Supposing you want to display the North region records for the month of July with Amount greater than 800. For this, specify the following conditions in the criteria range:

- Region: North
- Order date:  $\geq 7/1/2016$
- Order date:  $\leq 7/30/2016$
- Amount:  $> 800$

#### ADVANTAGES OF ADVANCED FILTERS IN EXCEL

**Advanced Filter has several useful features.**

It allows you to apply several filter criteria simultaneously to the entire data file, which AutoFilter does not.

It also lets you easily change the criteria by typing new values directly into the criteria cells.

Additionally, Advanced Filter enables you to copy the filtered data to a specified area within the same worksheet or a different worksheet rather than just filter the data within the original data file.

This can be very helpful with a large data file such as a gradebook.

#### 88. Topic - If Function



The IF function is one of the most popular functions in Excel, and it allows you to make logical comparisons between a value and what you expect.

So an IF statement can have two results. The first result is if your comparison is True, the second if your comparison is False.

For example, = IF(C2="Yes",1,2) says IF(C2 = Yes, then return a 1, otherwise return a 2).

Syntax IF(C2="Yes",1,2) Simple IF examples

- In the above example, cell D2 says: IF(C2 = Yes, then return a 1, otherwise return a 2)  
=IF(C2=1,"Yes","No")

In this example, the formula in cell D2 says: IF(C2 = 1, then return Yes, otherwise return No) As you see, the IF function can be used to evaluate both text and values. It can also be used to evaluate errors. You are not limited to only checking if one thing is equal to another and returning a single result, you can also use mathematical operators and perform additional calculations depending on your criteria. You can also nest multiple IF functions together in order to perform multiple comparisons.

=IF(C2>B2,"Over Budget","Within Budget")

- In the above example, the IF function in D2 is saying IF(C2 Is Greater Than B2, then return "Over Budget", otherwise return "Within Budget")

=IF(C2>B2,C2-B2,0)

- In the above illustration, instead of returning a text result, we are going to return a mathematical calculation. So the formula in E2 is saying IF(Actual is Greater than Budgeted, then Subtract the Budgeted amount from the Actual amount, otherwise return nothing).

=IF(E7="Yes",F5\*0.0825,0)

- In this example, the formula in F7 is saying IF (E7 = "Yes", then calculate the Total Amount in F5 \*

8.25%, otherwise no Sales Tax is due so return 0)

Note: If you are going to use text in formulas, you need to wrap the text in quotes (e.g. "Text"). The only exception to that is using TRUE or FALSE, which Excel automatically understands.

## 89-HOW DO WE USE SUMIF()? FUNCTION IN THE EXCEL.

Microsoft Excel has a handful of functions to summarize large data sets for reports and analyses. One of the most useful functions that can help you make sense of an incomprehensible set of diverse data is SUMIF.

Instead of adding up all numbers in a range, it lets you sum only those values that meet your criteria.

So, whenever your task requires conditional sum in Excel, the SUMIF function is what you need. A good thing is that the function is available in all versions, from Excel 2000 through Excel 365. Another great thing is that once you've learned SUMIF, it will take you very little effort to master other "IF" functions such as SUMIFS, COUNTIF, COUNTIFS, AVERAGEIF, etc.

**SUMIF in Excel** – syntax and basic uses

The SUMIF function, also known as Excel conditional sum, is used to add up cell values based on a certain condition.

The function is available in Excel 365, Excel 2021, Excel 2019, Excel 2016, Excel 2013, Excel 2010, Excel 2007, and lower.

The syntax is as follows:

As you see, the SUMIF function has 3 arguments – first 2 are required and the last one is optional.

**Range (required)** – the range of cells to be evaluated by criteria.

**Criteria (required)** – the condition that must be met. It may be supplied in the form of a number, text, date, logical expression, a cell reference, or another Excel function. For example, you can enter the criteria such as “5”, “cherries”, “10/25/2014”, “<5”, etc.

**Sum\_range (optional)** – the range to sum if the condition is met. If omitted, then range is summed.

Note. Please pay attention that any text criteria or criteria containing logical operators must be enclosed in double quotation marks, e.g.

“apples”, “>10”. Cell references should be used without the quotation marks, otherwise they would be treated as text strings.

#### Basic SUMIF Formula:

To better understand the SUMIF syntax, consider the following example. Suppose you have a list of products in column A, regions in column B, and sales amounts in column C. Your goal is to get a total of sales for a specific region, say North. To have it done, let's build an Excel SUMIF formula in its simplest form.

**You start with defining the following arguments:**

**Range** – a list of regions (B2:B10).

**Criteria** – “North” or a cell containing the region of interest (F1). **Sum\_range** – the sales amounts to be added up (C2:C10).

Putting the arguments together, we get the following formula:

	A	B	C	D	E	F
1	Item	Region	Sales		Region	North
2	Grapes	North	\$250		Sales	\$665
3	Apples	South	\$155			
4	Grapes	West	\$130			
5	Lemons	North	\$255			
6	Apples	North	\$160			
7	Grapes	South	\$280			
8	Lemons	East	\$170			
9	Apples	East	\$285			
10	Apples	West	\$110			

#### 89- Topic - How Can We Merge Multiple Cell Text Strings in A Cell?

**Answer** – Introduction merging multiple cell text strings into a single cell is a common task when working with spreadsheets, particularly in software like Microsoft Excel and Google

Sheets. This operation is also known as concatenation. Concatenating text strings allows you to combine information from different cells or sources into one cell, which can be useful for various purposes, such as creating reports, generating labels, or preparing data for analysis.

In this comprehensive guide, we'll explore different methods for merging text strings in cells, including basic concatenation, using functions, and advanced techniques. We'll also cover some practical examples and tips for handling complex scenarios.

### **Basic Concatenation**

The simplest way to merge text strings in a cell is through basic concatenation using the "&" (ampersand) operator. This operator allows you to combine text from multiple cells or even add constant text to create a new string. Here's a step-by-step guide on how to perform basic concatenation:

#### **Step 1: Open Your Spreadsheet**

Start by opening the spreadsheet application of your choice, such as Microsoft Excel or Google Sheets.

#### **Step 2: Select the Target Cell**

Click on the cell where you want to merge the text strings. This is the cell where the concatenated result will be displayed.

#### **Step 3: Use the "&" Operator**

In the formula bar (the area at the top of the spreadsheet where you enter formulas), type an equal sign (=) to begin a formula. Then, use the "&" operator to combine text strings. You can reference other cells by selecting them with your mouse or by typing their cell references. For example:

```
=A1 & " " & B1
```

In this formula, "A1" and "B1" are cell references, and we're using the "&" operator to concatenate the text from those cells. We've also added a space (" ") between the cell values to separate them.

#### **Step 4: Press Enter**

After entering the formula, press the "Enter" key. The result of the concatenation will appear in the selected cell.

#### **Step 5: Drag/Fill Down (Optional)**

If you want to concatenate text for multiple rows or cells, you can drag the fill handle (a small square in the lower-right corner of the selected cell) downward to copy the formula to adjacent cells. The references will automatically adjust to the new cell locations.

### **Using CONCATENATE Function (Excel) or CONCAT Function (Google Sheets)**

Both Microsoft Excel and Google Sheets provide functions specifically designed for concatenating text strings. In Excel, you can use the CONCATENATE function, while in Google Sheets, the CONCAT function serves the same purpose. These functions offer a more structured way to concatenate text.

#### **Here's how to use the CONCATENATE function in Excel:**

##### **Step 1: Select the Target Cell**

Click on the Cell Where you Want to Display the Concatenated Text.

##### **Step 2: Use The Concatenate Function**

In the formula bar, type the CONCATENATE function followed by parentheses. Inside the parentheses, list the text strings or cell references you want to concatenate, separated by commas.

**For example:**

=Concatenate (A1, “ “, B1)

In this formula, A1 and B1 are the cell references, and we’re adding a space between them.

**Step 3: Press Enter**

After entering the formula, press “Enter,” and the result will appear in the selected cell.

In Google Sheets, you would use the CONCAT function instead: **Step 1: Select the Target Cell**

Click on the cell where you want to display the concatenated text. **Step 2: Use the CONCAT Function**

In the formula bar, type the CONCAT function followed by parentheses. Inside the parentheses, list the text strings or cell references you want to concatenate, separated by commas. For example:

=Concat(A1, “ “, B1)

As with Excel, this formula combines the text from cell A1 and cell B1, separated by a space.

**Step 3: Press Enter**

After entering the formula, press “Enter,” and the result will appear in the selected cell.

**Concatenating Text with Space, Commas, or Other Delimiters** In many cases, you’ll want to concatenate text strings with specific separators or delimiters, such as spaces, commas, or hyphens. You can easily achieve this by including the desired delimiter within your concatenation formula.

**For example, to concatenate text with a comma and space as the delimiter:**

=A1 & “, “ & B1

This formula combines the text from cell A1 and cell B1, separated by a comma and a space.

To concatenate text with a hyphen:

=A1 & “-“ & B1

This formula combines the text from cell A1 and cell B1, separated by a hyphen.

You can customize the delimiter to suit your specific requirements. **Concatenating Text with Line Breaks**

Sometimes, you may need to concatenate text strings with line breaks to create multi-line text. To do this, you can use a special character known as a line break or newline character. In Excel and Google Sheets, you can use

the CHAR function with the ASCII code for a line break, which is typically 10.

Here’s how to concatenate text with line breaks:

=A1 & CHAR (10) & B1

In this formula, CHAR(10) represents the line break character, and it separates the text from cell A1 and cell B1 onto different lines in the same cell.

Keep in mind that when you use line breaks, you may need to adjust the cell’s formatting to allow text wrapping to ensure that all lines are visible.

### Concatenating Text with Conditional Statements

In some cases, you might want to concatenate text strings based on certain conditions. For example, you may want to concatenate text only if a specific condition is met. This can be achieved using conditional statements like IF in Excel or IF in Google Sheets.

Here's an example of concatenating text based on a condition in Excel:

```
=IF(C1="Yes", A1, "") & IF(C1="Yes", " - " & B1, "")
```

In this formula, we check if the value in cell C1 is "Yes." If it is, we concatenate the text from cell A1. If not, we return an empty string (""). We also check if the condition is met to concatenate the text from cell B1, separated by a hyphen and space if needed.

In Google Sheets, the formula would be similar:

```
=IF(C1="Yes", A1, "") & IF(C1="Yes", " - " & B1, "")
```

Conditional concatenation allows you to create dynamic text based on the values in your spreadsheet.

**Concatenating Text from Multiple Rows or Columns** Concatenating text from multiple rows or columns is a common requirement when dealing with larger datasets. You can use the techniques mentioned above, such as the "&" operator or functions like CONCATENATE or CONCAT, with relative cell references to achieve this.

For example, if you want to concatenate text from multiple rows in a single column, you can use a formula like this:

```
=A1 & CHAR (10)
```

### In Addition to this there are other methods –

2. **Textjoin Function (Excel) or JOIN Function (Google Sheets):** Both Excel and Google Sheets offer the Textjoin (Excel) and JOIN (Google Sheets) functions that make it easy to concatenate text strings with a specified delimiter. These functions can handle a range of cell references and automatically ignore empty cells.
3. **Arrayformula (Google Sheets):** In Google Sheets, you can use the Arrayformula function to concatenate text from multiple cells within a range. This function applies a formula to an entire range of cells and returns an array of results.
4. **Concatenatex Function (Power Query – Excel):** If you're working with Power Query in Excel, you can use the Concatenatex function to merge text strings from multiple rows based on a condition. Concatenatex is especially useful when dealing with structured data from external sources.
5. **User-Defined Functions (UDFs):** In Excel, you can create custom User-Defined Functions (UDFs) using VBA (Visual Basic for Applications) to perform text concatenation according to your specific requirements. UDFs allow you to implement custom logic for merging text strings from cells.
6. **Pivot Tables (Excel):** If you're dealing with data in Excel and want to concatenate text based on certain criteria or groupings, you can use Pivot Tables. Pivot Tables can summarize and concatenate data from multiple rows based on categories or criteria you define.

### CONCLUSION

Concatenating text strings in a cell is a fundamental skill in spreadsheet applications like Microsoft Excel and Google Sheets. Whether you need to combine information from different cells, add specific separators or delimiters, create multi-line text, or concatenate text based on

conditions, there are various methods at your disposal. Remember that concatenation is not limited to simple tasks; you can apply these techniques to more complex scenarios and tailor your formulas to meet specific requirements.

Mastering text concatenation is a valuable skill for data analysis, reporting, and many other spreadsheet-related tasks. Whether you're working on business reports, data cleaning, or any other spreadsheet operation, the ability to effectively merge text strings will save you time and help you create more organized and informative spreadsheets.

## 91 - Topic – Data Interpretation

Data Interpretation Geoff Dates, River Watch Network Jerry Schoen, Massachusetts Water Watch Partnership Introduction Turning data into useful information is one step in your monitoring program. Your program should begin with a clear study design, which describes the rationale and methods for your program. A part of the study design process is identifying the people who you expect to use your data, how you expect them to use it, and what specific questions you're trying to answer about the river. If you've geared your monitoring to the needs of identified data users and conducted your monitoring to answer specific questions about your river, you'll find that this step is not as difficult as it might seem.

### Turning monitoring data into useful information a process that involves several steps:

- 1) **Data Entry:** This involves getting your raw data into a computer so that you can store it and retrieve it for analysis. It includes two steps:
  - a. **Entry:** Data should be entered into a computer data management application.
  - b. **Validation:** The entered data must be checked against the field and lab sheets to assure that it has been entered correctly.
- 2) **Summary:** The data is put into a form that allows you to view it as a whole, such as simple statistics, tables, and graphs.
- 3) **Data Interpretation:** This involves asking a series of questions about your data that relate to your study question(s). Your answers to these questions are organized as findings and conclusions. Based on these, you may develop recommendations for action or further study.
- 4) **Presenting Your Results:** Present your findings, conclusions, and recommendations in a form that best tells the story of your river.

This story can be told in text and selected tables and graphs that are organized into an oral presentation and/or a written report.

Your presentation or report should be geared to the audience you are trying to reach.

This paper focuses on the data interpretation step.

### DATA INTERPRETATION:

**Interpreting your data is a process that involves answering a series of questions about it.**

**We suggest the following steps:**

- 1) Review and interpret the data "in-house" to develop preliminary findings, conclusions, and recommendations.
- 2) Review the data and your interpretation of it with an advisory group or technical committee. This group should involve local, regional, and state resource people who are familiar with monitoring and with your river. They can verify, add to, or correct your interpretation of the results.

- 3) Review the data and your interpretation of it with the people who will use your data – for example, the public, river users, and government officials.

**Step 1: Assemble the Information You'll Need**

**Make sure that you have all the information that you will need for data interpretation.**

**Important information to have available include:**

- ◆ a map of your watershed with the sites marked on it and the water quality classification of the segments you sampled.
- ◆ correct units of measurement clearly reported on your data tables and graphs.

**Step 2: Develop Findings**

Findings are observations about your data. They are the statements that summarize the important points. Findings will help you to come up with conclusions, because they help you form a more thorough and accurate interpretation. We tend to look at data and begin to try to explain it before thoroughly observing and summarizing the trends, patterns or lack of patterns.

**Examples of findings are:**

- ◆ Site number 3 violated water quality standards for dissolved oxygen on all days
- ◆ The number of benthic macroinvertebrates at all sites declined over the 3-year period.
- ◆ Secchi depths were lowest in August at two of the three sites.
- ◆ Moving downstream, the amount of phosphorus increased on all days.
- ◆ Bacteria levels exceeded the safe swimming standard on 4 out of 5 sampling days.

Developing findings is a process in which you compare your results with known standards or guidelines:

**WITHIN YOUR DATA SET:**

**With other data sets:**

And in which you analyze your quality assurance/quality control results. Compare your results with known standards or guidelines: State water quality standards contain criteria which are numbers that define acceptable levels of common water quality indicators. If criteria are not available for an indicator you've measured, consult a water quality advisor as to appropriate numerical guidelines against which you can compare your results.

**Compare your results within your data set:**

These questions help you use your own data to focus on upstream to downstream comparisons and comparisons over time.

- Which sites had the highest or lowest readings?
- Which dates had the highest or lowest readings?

Compare your results with other data sets: Monitoring data from other sources might help you put your results in perspective. Be aware, however, that the data must have been collected using comparable methods, or the comparison is not valid.

- How do your findings compare with other data sets (e.g. state reports)?
- What were the flow and rainfall like on your sampling dates? Was there heavy rain? Was the flow rising or falling?

Analyze your Quality Assurance/Quality Control Results: Quality assurance/quality control measures are undertaken to determine how reliable your data are. Spiked, known, and unknown samples: For this check, you compare actual with expected results.

How close were they? Did they meet your expectations?

- **Blanks:** For this quality check, the result should be “0.”

#### **Step 4: Develop Recommendations**

Recommendations are based on your findings and conclusions. They can take two forms: action that should be taken and further information that should be gathered.

#### **Examples of recommendations for action:**

- ◆ Consider fencing the farm animals (including the horses) out of the brook and reestablishing a buffer of natural vegetation to grow between the fence line and The brook.
- ◆ Carry out educational activities for residential owners about the effects of pesticides and fertilizers from lawn treatment and provide examples of alternatives.
- ◆ Organize an educational workshop for waterfront landowners about the benefits of Best management practices to control erosion.
- ◆ The town should install a sediment trap basin at the storm drain outlet on West Street.

#### **Examples of recommendations for further information:**

- ◆ Sample the storm water drains at Main and Elm streets to determine if they contribute to elevated bacteria levels.
- ◆ Monitor dissolved oxygen over a 24-hour period at sites 1, 2, and 6 to determine the daily range of dissolved oxygen levels.
- ◆ Conduct wet weather water sampling and analysis for E. Coli, total phosphorus, and turbidity at all sites.
- ◆ Monitor for total and ortho phosphate at sites 8 and 9 to determine if increased algae growth is caused by fertilizers.
- ◆ Add a monitoring site upstream of the pasture as a background reference site.
- ◆ Carry out a diagnostic sanitary survey to see if there are failing septic systems between sites 2 and 3.
- ◆ Continue monitoring the benthic macroinvertebrate community at all sites on an annual basis to document whether the improvement is long-term.
- ◆ Continue dry weather monitoring for E. Coli following implementation of the corrective actions.
- ◆ Conduct wet weather water sampling and analysis for E. Coli, total phosphorus, and turbidity to document the impacts of storm water runoff for combined sewer overflows.
- ◆ Measure instream embeddedness or do a benthic macroinvertebrate survey to see if sedimentation is causing habitat impairment.
- ◆ Carry out a pollution source inventory to locate and test discharge pipes.



# Long Questions

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### Unit 1

1. Define research and explain its importance in modern times.
2. “Creative management, whether in public administration or private industry, depends on methods of inquiry that maintain objectivity, clarity, accuracy and consistency”. Discuss this statement and examine the significance of research”.
3. Throw light on the different types of research in detail.
4. Explain research problem with the help of an illustration.
5. “The task of defining a research problem follows sequential pattern”. Explain
6. Describe the necessity of defining a research problem.
7. Elaborate on scientific method of research process.
8. What are the problems encountered by the researchers in India? Give suggestions to overcome the same.
9. “Research is much concerned with proper fact-finding, analysis and evaluation.” Give reasons in support of your answer.
10. Write short notes on
  - A. Components of research problem.
  - B. Approaches to handle research problem.

### Unit 2

1. What do you understand by research design. Explain its features and concept.
2. Explain the meaning of the following in context of Research design.
  - A. Extraneous variables;
  - B. Confounded relationship;
  - C. Research hypothesis;
  - D. Experimental and Control groups;
  - E. Treatments.
3. Elaborate on the meaning of sample design? What points should be considered while developing a research design for research works.
4. Differentiate between probability sampling and non-probability sampling with the help of examples.
5. Write short notes on the following
  - A. Quota sampling
  - B. Stratified sampling
  - C. Snowball sampling
  - D. Judgemental sampling
  - E. Convenience sampling
  - F. Systematic, stratified sampling

6. Throw light on the procedure of selecting a random sample research design.
7. Describe the meaning of measurement in research. Explain the different types of scale.
8. Are the following nominal, ordinal, interval or ratio data? Explain your answers.
  - A. Temperatures measured on the Kelvin scale.
  - B. Military ranks.
  - C. Social security numbers.
  - D. Number of passengers on buses from Delhi to Mumbai.
  - E. Code numbers given to the religion of persons attempting suicide.
9. Write short notes on the following
  - A. Itemised rating scale
  - B. Summated rating scale
10. Differentiate between the following
  - A. Nominal scale & Ordinal scale
  - B. Interval scale & Ratio scale

**Unit 3**

1. Describe the various methods of data collection with their merits and demerits.
2. What is interview method of data collection? Explain its types.
3. Throw light on the steps in formulation of a good questionnaire.
4. Distinguish between a questionnaire and schedule.
5. What are the different projective techniques of data collection?
6. What are the different factors which will be considered while selecting the method of data collection?
7. How does the case study method differ from the survey method? Analyse the merits and limitations of case study method in sociological research.
8. Elaborate on the role of ICT in research.
9. Differentiate between a survey and experiment with the help of an illustration.
10. Write short notes on the following
  - A. Good Questionnaire
  - B. Depth Interview
  - C. Thematic Apperception Test (TAT)

**Unit 4**

1. Explain the term hypothesis? Describe null and alternate hypothesis of a research problem.
2. How can you measure the power of a hypothesis? Illustrate.
3. Differentiate between parametric and nonparametric test a hypothesis testing.
4. The heights of six randomly chosen sailors are, in inches, 63, 65, 58, 69, 71 and 72. The heights of 10 randomly chosen soldiers are, in inches, 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Do these figures indicate that soldiers are on an average shorter than sailors? Test at 5% level of

significance.

5. Write short notes on the following

A. Features of chi-square test

B. Conditions in applying chi-square test

6. Suppose that a public corporation has agreed to advertise through a local newspaper if it can be established that the newspaper circulation reaches more than 60% of the corporation's customers. What  $H_0$  and  $H_1$  should be established for this problem while deciding on the basis of a sample of customers whether or not the corporation should advertise in the local newspaper? If a sample of size 100 is collected and 1% level of significance is taken, what is the critical value for making a decision whether or not to advertise? Would it make any difference if we take a sample of 25 in place of 100 for our purpose? If so, explain.

7. Explain the steps while formulating a research hypothesis.

8. Discuss the different precautions that a researcher should undertake while making interpretation of his research

9. Explain the layout of a research report in detail. 10. Differentiate between technical reports and popular report.

# Multiple Choice Questions

**Q 1. What are the conditions in which Type-I error occurs?**

- A. The null hypotheses get accepted even if it is false
- B. The null hypotheses get rejected even if it is true
- C. Both the null hypotheses as well as alternative hypotheses are rejected
- D. None of the above

**Q 2. How to judge the depth of any research?**

- A. By research title
- B. By research duration
- C. By research objectives
- D. By total expenditure on research

**Q 3. Which of the following is not the method of Research?**

- A. Survey
- B. Historical
- C. Observation
- D. Philosophical

**Q 4. Research is**

- A. Searching again and again
- B. Finding solution to any problem
- C. Working in a scientific way to search for truth of any problem
- D. None of the above

**Q 5. In the process of conducting research ‘Formulation of Hypothesis’ is followed by**

- A. Statement of Objectives
- B. Analysis of Data
- C. Selection of Research Tools
- D. Collection of Data

**Q 6. The main objective of ..... studies to acquire knowledge**

- A. Exploratory
- B. Descriptive
- C. Diagnostic
- D. Descriptive and Diagnostic

**Q 7. .... is concerned with discovering and testing certain variables with respect to their association or disassociation**

- A. Exploratory
- B. Descriptive
- C. Diagnostic
- D. Descriptive and diagnostic

**Q 8. One of the terms given below is defined as a bundle of meanings or characteristics associated with certain events, objects, conditions, situations, and the like**

- A. Construct
- B. Definition
- C. Concept
- D. Variable

**Q 9. Concepts are ..... of Research**

- A. Guide
- B. Tools
- C. Methods
- D. Variables

**Q 10. Concept is of two types**

- A. Abstract and Coherent
- B. Concrete and Coherent
- C. Abstract and concrete
- D. None of the above

**Q 11. A statement of the quantitative research question should:**

- A. Extend the statement of purpose by specifying exactly the question researcher will address
- B. Help the research in selecting appropriate participants, research methods, measures, and materials
- C. Specify the variables of interest
- D. All the above

**Q 12. Why do you need to review the existing literature?**

- A. To make sure you have a long list of references
- B. Because without it, you could never reach the required word-count
- C. To find out what is already known about your area of interest
- D. To help in your general studying

**Q 13. What do you mean by Unit of Analysis?**

- A. Main parameter
- B. Variables
- C. Sample
- D. Constructs

**Q 14. In a survey there is an enumerator and a .....**

- A. Guide
- B. Respondent
- C. Supervisor
- D. Messenger

**Q 15. The first purpose of a survey is to .....**

- A. Description
- B. Evaluation
- C. Pration
- D. Provide Information

**Q 16. Questions in which only two alternatives are possible is called**

- A. Multiple choice questions
- B. Dichotomous questions
- C. Open ended questions
- D. Structured questions

**Q 17. What are the core elements of a Research Process?**

- A. Introduction; Data Collection; Data Analysis; Conclusions and Recommendations
- B. Executive Summary; Literature Review; Data Gathered; Conclusions; Bibliography
- C. Research Plan; Research Data; Analysis; References
- D. Introduction; Literature Review; Research Methodology; Results; Discussions and Conclusions

**Q 18. Second step in problem formulation is**

- A. Statement of the problem
- B. Understanding the nature of the problem
- C. Survey
- D. Discussions

**Q 19. What does the term 'longitudinal design' mean?**

- A. A study completed far away from where the researcher lives.
- B. A study which is very long to read.
- C. A study with two contrasting cases.
- D. A study completed over a distinct period of time to map changes in social phenomena.

**Q 20. Which of the following is true regarding research objectives?**

- A. Research objectives, when achieved, will provide sufficient earnings to obtain a reasonable return on investment.



- B. Research-objectives, when obtained, will ensure the viability of the marketing research department.
- C. Research objectives, when achieved, provide the information necessary to solve the problem
- D. Research objectives are seldom achieved but should be stated as goals to be sought.

**Q 21. Your colleague is confused about using the marketing research process, as he knows that something is wrong but is not sure of the specific causes to investigate. He seems to be having problems with, which is often the hardest step to take.**

- A. Developing the research plan
- B. Determining a research approach
- C. Defining the problem and research objectives
- D. Selecting a research agency

**Q 22. Which technique is generally followed when the population is finite?**

- A. Systematic Sampling Technique
- B. Purposive Sampling Technique
- C. Area Sampling Technique
- D. None of the above

**Q 23. Which one is called non-probability sampling?**

- A. Quota sampling
- B. Cluster sampling
- C. Systematic sampling
- D. Stratified random sampling

**Q 24. The \_\_\_ scale measurement has a natural zero.**

- A. Ratio
- B. Nominal
- C. Ordinal
- D. Interval

**Q 25. Cluster sampling, stratified sampling and systematic sampling are types of**

- A. Direct sampling
- B. Indirect sampling
- C. Random sampling
- D. Non random sampling

**Q 26. A complete list of all the sampling units is called:**

- A. Sampling design
- B. Sampling frame
- C. Population frame
- D. Cluster

**Q 27. A \_\_\_\_\_ is a subset of a \_\_\_\_\_.**

- A. Sample, population
- B. Population, sample
- C. Statistic, parameter
- D. Parameter, statistic

**Q 28. Random sampling is also called \_\_\_\_\_.**

- A. Availability sampling
- B. Probation sampling
- C. Probability sampling
- D. Prospect sampling

**Q 29. Which test is the part of the parametric test?**

- A. Sign Test
- B. Run Test for Randomness
- C. Kruskal-Willis Test
- D. z-test

**Q 30. SPSS is an acronym of the following?**

- A. Statistical Predictions for Social Sciences.
- B. Sexual Preferences for the Sixties and Seventies.
- C. Statistical Package for the Social Sciences.
- D. Sexual Performance and SAD Syndrome.

**Q 31. Final stage in the Research Process is**

- A. Problem formulation
- B. Data collection
- C. Data Analysis
- D. Report Writing

**Q 32. A comprehensive full Report of the research process is called**

- A. Thesis
- B. Summary Report
- C. Abstract
- D. Article

**Q 33. The first page of the research report is**

- A. Appendix
- B. Bibliography
- C. Index
- D. Title Page

**Q 34. The chi-square test is:**

- A. A mean
- B. A multi-question tests.
- C. A statistical mistake.
- D. A statistic

**Q 35. ANOVA is \_\_\_\_\_**

- A. A government body which collects social statistics.
- B. The name of a statistical software package.
- C. A one-way analysis of variance.
- D. A two-way analysis of variance.

**Q 36. Which of the following is not one of the seven major parts to the research report?**

- A. Results
- B. Abstract
- C. Method
- D. Footnotes

**Q 37. In SPSS, what is the "Data Viewer"?**

- A. A table summarizing the frequencies of data for one variable
- B. A spreadsheet into which data can be entered
- C. A dialog box that allows you to choose a statistical test
- D. A screen in which variables can be defined and labeled

**Q 38. What type of chart is useful for comparing values over categories?**

- A. Pie Chart
- B. Column Chart
- C. Line Chart
- D. Dot Graph

**Q 39. A feature that displays only the data in column (s) according to specified criteria**

- A. Formula
- B. Sorting
- C. Filtering
- D. Pivot

**Q 40. Functions in MS Excel must begin with \_\_\_\_**

- A. An () sign
- B. An Equal Sign
- C. A Plus Sign
- D. A > Sign

**Q 41. The \_\_\_\_ feature of MS Excel quickly completes a series of data**

- A. Auto Complete
- B. Auto Fill
- C. Fill Handle
- D. Sorting

**Q 42. How many sheets are there, by default, when we create a new Excel file?**

- A. 1
- B. 3
- C. 5
- D. 10

**Q 43. In Excel, which one denoted a range from B1 through E5**

- A. B1 - E5
- B. B1:E5
- C. B1 to E5
- D. B1\$E5

**Q 44. What type of chart is useful for showing trends or changes over time?**

- A. Pie Chart
- B. Column Chart
- C. Line Chart
- D. Dot Graph

**Q 45. In “RESEARCH” “R” means**

- (A) Role
- (B) Retain
- (C) Rely
- (D) Round

**Q 46. In the word “RESEARCH” “A” means**

- (A) Articulate
- (B) Artist
- (C) Article
- (D) None of the above

**Q 47. Research is derived from**

- (A) Latin
- (B) Indian
- (C) Greek
- (D) Japanese

**Q 48. Who defined “Research” as “systematized effort to gain new knowledge”**

- (A) Tom & Zerry
- (B) Redman and Mory
- (C) F.W Taylor
- (D) Ross Taylor

**Q 49. Which of the following is the Objective of the Research?**

- (A) To become familiar with a phenomenon
- (B) To test a hypothesis of a causal relationship between variables
- (C) To determine the frequency with which something occurs or with it is associated with something else.
- (D) All of the above

**Q 50, Research is basically**

- (A) A methodology of enquiry
- (B) Search of truth
- (C) A systematic exploration of facts
- (D) All of the above

**Q 51. A test of research aptitude for candidates of the UGC NET, is aimed at**

- (A) providing basic idea of search to the candidates
- (B) Screening the persons having scientific bent of mind
- (C) providing a database of ‘future ’scientists of the country to the Government
- (D) putting obstacles to the candidates

**Q 52. The main purpose of research in education is to**

- (A)-help in individual’s personal growth
- (B) increase the social prestige of an individual
- (C) increase individual’s market value of jobs
- (D) help the individual to become an eminent educationist

**Q 53. Where is the objective observation used?**

- (A) In conducting experiments
- (B) In research
- (C) In normal behaviour
- (D) In almost all the situations

**Q 54. Inferring about the whole population on on the basis of the observations made on a small part is called**

- (A) deductive inference
- (B) inductive inference

(C) objective inference

(D) pseudo-inference

**Q 55. A hypothesis is a**

(A) Tentative statement whose validity is still to be tested

(B) Supposition which is based on the past experiences

(C) Statement of fact

(D) All of the above

**Q 56. What do you mean by synopsis of a research project**

(A) The blue print of research

(B) Extracts from the research observations

(C) A plan of the research

(D) Summary of the findings of the research

**Q 57. Can a problem be stated?**

(A) By putting forward a question

(B) Making a statement which is declarative in nature

(C) Both 'A' and 'B'

(D) None of the above

**Q 58. What do you mean by an assumption?**

(A) It is a framework in which research work has to be done

(B) It simplifies the logical process of arriving at the solution

(C) It is a restrictive condition

(D) None of the above

**Q 59. A null hypothesis is**

(A) hypothesis of no difference

(B) Hypothesis that assigns value of zero to the variable

(C) Hypothesis of zero significance

(D) None of the above

**Q 60. The preparation of a synopsis is**

(A) an art

(B) a science

(C) Both 'A' and 'B'

(D) None of these

**Q 61. The advantage of sampling is**

- (A) time-saving
- (B) capital-saving
- (C) increased accuracy
- (D) Both 'A' and 'B'

**Q 62. In case of destructive testings, the best method of research is**

- (A) Sampling
- (B) Complete enumeration
- (C) Census survey
- (D) None of the above

**Q 63. The method of Randomization involves**

- (A) lottery
- (B) Coin method
- (C) Tippit's table of random digits
- (D) All of the above

**Q 64. The advantages of random sampling is that**

- (A) It is free from personal biases
- (B) It produces reasonably accurate results
- (C) It is an economical method of data. Collection
- (D) All of the above

**Q 65. Tippit table is**

- (A) A table of random digits
- (B) Used in statistical investigations
- (C) Used in sampling methods
- (D) All of the above

**Q 66. The demerits of sampling methods is**

- (A) Existence of sampling errors
- (B) Requirements of adequately trained personnel for sample survey
- (C) Non-uniformity in sample units
- (D) All of the above

**Q 67. What is the meaning of Randomization?**

- (A) Each and every unit of the population has an equal chance of selection in the sample
- (B) The selection or non-selection of a unit of population does not affect the selection or non-selection of the other unit of the population in the sample
- (C) It is a method of selection which is free from subjective biases.
- (D) All of the above

**Q 68. Type-1 Error occurs when**

- (A) The null hypothesis is rejected even when it is true
- (B) The null hypothesis is accepted even when it is false
- (C) The null hypothesis as well as Alternative hypothesis, both are rejected
- (D) None of the above

**Q 69. What is/are the base(s) of formulation of a Hypothesis?**

- (A) Reflection
- (B) Deduction
- (C) Observation
- (D) All of these

**Q 70. Which is not the characteristic of research**

- (A) Basic Research
- (B) Holistic Perspective
- (C) Context Sensitivity
- (D) Ex-Post Facto Research

**Q 71. The different between the Ex-Post Facto Research and Experiments research is**

- (A) Expose
- (B) Control
- (C) Search
- (D) None of the above

**Q 72. Ex-Post Facto Research could be**

- (A) Large
- (B) Small
- (C) Both
- (D) None of the above

**Q 73. Part of social research is**

- (A) Laboratory experiment
- (B) Field Experiment
- (C) Survey research
- (D) All of the above

**Q 74. Kotz has been divided field studies into**

- (A) Exploratory
- (B) Hypothesis testing
- (C) Both of the above



(D) None of the above

**Q 75. Which of the following is a step of research design?**

(A) Defining the problem and formulating a hypothesis

(B) Collecting data

(C) Drawing inferences from the data

(D) All of the above

**Q 76. Which of the following is the chief characteristic of sampling methods?**

(A) Economy

(B) Reliability

(C) Feasibility

(D) All of the above

**Q 77. Scientific methods are used in**

(A) only research projects in pure sciences

(B) social science researches

(C) Both 'A' and 'B'

(D) Neither 'A' nor 'B'

**Q 78. Which of the following is a type of hypothesis?**

(A) Interrogative hypothesis

(B) Declarative hypothesis

(C) Directional hypothesis

(D) All of the above

**Q 79. Which of the following is a non-probability sampling method?**

(A) Simple random sampling

(B) Systematic sampling

(C) Cluster sampling

(D) Quota sampling

**Q 80. In which of the following cases, the formation of hypothesis may not be necessary?**

(A) Investigative historical studies

(B) Experimental studies

(C) Normative studies

(D) Survey studies

**Q 81. A researcher divides the whole population in different parts and then fixes the no. of units from each of the parts that are to be included in the sample. The method of sampling used by him is**

- (A) Stratified random sampling
- (B) Cluster sampling
- (C) Quota sampling
- (D) All of the above

**Q 82. For the population with finite size which of the following sampling method is generally preferred?**

- (A) Cluster sampling
- (B) Area sampling
- (C) Preposive sampling
- (D) Systematic sampling

**Q 83. A research is based on**

- (A) Ideas of the scientists
- (B) Experiments
- (C) Scientific method
- (D) Some general principles

**Q 84. The scientific study of the historical back ground of the events to determine its bearing on the present conditions is called**

- (A) Philosophical research
- (B) Action research
- (C) Experimental research
- (D) Historical research

**Q 85. Research and Development (R&D) has now become the index of development of country because**

- (A) R&D reflect the true economic and social conditions prevailing in a country
- (B) R&D targets the human development
- (C) R&D can improve the standard of living of the people in a country
- (D) All of the above

**Q 86. The word 'unscientific means**

- (A) Prejudices and biases
- (B) Useless arguments
- (C) Not being in harmony
- (D) All of the above

**Q 87. Who put forward the statement, “Research is an honest effort carried out through insight”?**

- (A) Watson
- (B) Binet
- (C) Best
- (D) Cook

**Q 88. The Data of research is, generally**

- (A) Qualitative only
- (B) Quantitative only
- (C) Both ‘A ’and ‘B’
- (D) Neither ‘A ’nor ‘B’

**Q 89. Which of the following is a paramount requirement of a Researcher?**

- (A) Scientific thinking
- (B) Scientific feeling
- (C) Scientific behaviour
- (D) Scientific attitude

**Q 90. A research aims at**

- (A) Verifying the existing knowledge
- (B) Acquiring new knowledge
- (C) Filling the missing links in the existing Knowledge
- (D) All of the above

**Q 91. Longitudinal approach of Research deals with**

- (A) Short-term researches
- (B) Long-term researches
- (C) Horizontal researches
- (D) None of the above

**Q 92. Action research means**

- (A) A longitudinal research
- (B) An applied research
- (C) Research which are initiated to solve the immediate problems
- (D) All of the above

**Q 93. Why Yamuna Action Plan’, is an Action Research Plan?**

- (A) It has a definite goals and objectives
- (B) It is to be finished in a pre-determined schedule
- (C) It has a definite socio-economic objective
- (D) All of the above

**Q 94. Which of the following Researches emphasise primarily the factual aims?**

- (A) Philosophical researches
- (B) Historical researches
- (C) Theoretical researches
- (D) Behavioral researches

**Q 95. A successful research requirement**

- (A) Planning
- (B) Guidance
- (C) Expert
- (D) All of the above

**Q 96. Which of the following is the research purpose?**

- (A) To study a phenomenon or to achieve a new insight in to it
- (B) To determine the frequency with which something occurs or with which it is associated with
- (C) To test a hypothesis of a causal relationship, between variables
- (D) All of the above

**Q 97. Which is the Design of sampling?**

- (A) Probability selection
- (B) Purposive Methods
- (C) Mixed Sample
- (D) All of the above

**Q 98. Survey research methods come under**

- (A) Pre-empirical research methods
- (B) Descriptive research methods
- (C) Experimental research methods
- (D) All of the above

**Q 99. Ethical principle is available in which report**

- (A) Belmont Report
- (B) Finance report
- (C) Research Report
- (D) None of the above

**Q 100. The logic of induction is very much related with**

- (A) The logic of sampling
- (B) The logic of controlled variable
- (C) The logic of observation
- (D) None of the above

**Q 101. The aims of research**

- (A) are descriptive in nature
- (B) are founded on human values
- (C) cause-effect-relatedness
- (D) All of the above

**Q 102. The aims of research is/are**

- (A) Verification
- (B) Fact finding
- (C) Theoretical development
- (D) All of the above

**Q 103. Objective or unbiased observation is most vital in**

- (A) All walks of life
- (B) Performing experiments
- (C) Normal behaviour
- (D) Research methods

**Q 104. The reporting of Research findings should be done**

- (A) by the scientists themselves
- (B) in a scientific and effective way
- (C) through internet
- (D) through scientific journals

**Q 105. Reliability of a research result implies its**

- (A) Verifiability
- (B) Validity
- (C) Uniqueness
- (D) Usefulness

**Q 106. Watson and Mcgrath defined research as**

- (A) An intellectual exercise
- (B) Using exploratory methods
- (C) Using scientific methods
- (D) None of the above

**Q 107. A research is**

- (A) A serious and investigative study
- (B) Being illuminated
- (C) Based on standardized conclusions
- (D) All of the above

**Q 108. A person who is repeating the same mistakes again and again without trying to rectify it, is**

- (A) A foolish person
- (B) An excellent researcher
- (C) An excellent forgetter
- (D) An insane person

**Q 109. In Hindi, the word “Anusandhan’**

- (A) Praying to achieve
- (B) Attaining an aim
- (C) Being goal-directed
- (D) Following an aim

**Q 110. The word “Research” means**

- (A) To know
- (C) To move
- (B) To get
- (D) To innovate

**Q 111. Social research can be divided into**

- (A) Two categories
- (B) Three categories
- (C) Four categories
- (D) Five categories

**Q 112. Which of the following is/are categories of social research?**

- (A) Laboratory experiment
- (B) Field experiment
- (C) Survey research
- (D) All of the above

**Q 113. Which of the following is/are types of field studies?**

- (A) Exploratory testing
- (B) Hypothesis testing
- (C) Both ‘A ’and ‘B’
- (D) None of the above

**Q 114. Survey research studies**

- (A) Events
- (B) Populations
- (C) Circumstances
- (D) Processes

**Q 115. Evaluation research is concerned with**

- (A) What are we doing?
- (B) Why are we doing?
- (C) How well are we doing?
- (D) None of the above

**Q 116. Action research is a type of**

- (A) Applied research
- (B) Quality research
- (C) Working research
- (D) Survey research

**Q 117. Which of the following is the key factor in determining the success of group research?**

- (A) People
- (B) Organization
- (C) Researcher
- (D) Creativity

**Q 118. Which of the following have a direct bearing on research tools and techniques?**

- (A) Concepts
- (B) Knowledge
- (C) Aspirations
- (D) Processes

**Q 119. The aim of group research is to achieve integration on**

- (A) Conceptual level
- (B) Technical level
- (C) Human level
- (D) All of these

**Q 120. The evolution of operation research could be associated within well-known development of**

- (A) Industrial organization
- (B) Institutional organization
- (C) Small scale organization
- (D) Traditional organization

**Q 121. The problem and techniques can be classified broadly into**

- (A) Inventory control
- (B) Game theory
- (C) Network analysis
- (D) All of these

**Q 122. Which of the following is/are essential requirement/s to carry out a successful research Process?**

- (A) Planning
- (B) Guidance
- (C) Experts
- (D) All of these

**Q 123. Which of the following has a great impact mind of the researcher?**

- (A) References
- (B) Finance
- (C) Journals
- (D) Library

**Q 124. Which of the following is the first step in a research process?**

- (A) Selecting a topic
- (B) Formulating research problem
- (C) Development of a hypothesis
- (D) None of the above

**Q 125. Hypothesis relate generally or specifically**

- (A) Variables to variables
- (B) Constant to variables
- (C) Variables to constant
- (D) Constant to constant.

**Q 126. The source of hypotheses may be based**

- (A) Chance-intuition
- (B) Expectation
- (C) Both 'A' and 'B'
- (D) None of these

**Q 127. Research design is**

- (A) A plan
- (B) A structure
- (C) An strategy
- (D) All of these



**Q 128. Which of the following is/are purposes of the research design?**

- (A) Providing answers of research questions
- (B) Controlling the variance
- (C) Both 'A' and 'B'
- (D) None of the above

**Q 129. In which of the following selection depends on chance?**

- (A) Probability selection
- (B) Purposive method
- (C) Mixed sample
- (D) None of the above

**Q 130. In the purposive method of sampling design, items are selected according to**

- (A) Law of probability
- (B) Personal judgement
- (C) Law of certainty
- (D) None of the above

**Q 131. If samples are taken concerning all probable characteristics then there are**

- (A) No chances of any error
- (B) More chances of error
- (C) Lesser chances of more errors
- (D) None of the above

**Q 132. Primary data for the research process can be collected through**

- (A) Experiment
- (B) Survey
- (C) Both 'A' and 'B'
- (D) None of these

**Q 133. A belief becomes a scientific truth when it is**

- (A) Established experimentally
- (B) Arrived logically
- (C) Both 'A' and 'B'
- (D) None of the above

**Q 134. In order to study the relationship of family size to income a researcher classifies his population into different income slabs and then takes a random sample from each slab. Which technique of sampling does he adopt?**

- (A) Cluster sampling
- (B) Random sampling

- (C) Stratified random sampling
- (D) Systematic sampling

**Q 135. A researcher uses statistical techniques in his problem to confirm**

- (A) Whether worthwhile inferences could be drawn
- (B) Whether the data could be quantified
- (C) Whether appropriate statistical techniques are available
- (D) Whether analysis of data would be possible

**Q 136. Which of the following qualities do you consider essential for a research scientist?**

- (A) Keeness of observation
- (B) Persistence
- (C) Logical reasoning
- (D) All of the above

**Q 137. With which of the following propositions about research you do not agree?**

- (A) Research improves the quality of teaching
- (B) Research contributes to social progress of the country
- (C) Research is a joy in itself
- (D) Research leads to finding solution

**Q 138. Which of the following is/are essential for communicating a research work?**

- (A) Command over language
- (B) Conclusions drawn
- (C) Procedure followed
- (D) All of the above

**Q 139. A researcher should consider himself as**

- (A) Open minded and radical
- (B) A status-quo maintainer
- (C) Fairly knowledgeable
- (D) Entirely dependent on the teache

**Q 140. A good researcher lays his hands on**

- (A) A specific area and tries to understand it great details in
- (B) A specific area and tries to understand it in minute details
- (C) Several areas and tries to understand them at basic level
- (D) Any area of his interest

**Q 141. The research is always**

- (A) Verifying the old knowledge
- (B) Exploring the new knowledge
- (C) Both 'A' and 'B'
- (D) None of the above

**Q 142. The research that applies the laws at the time of field study to draw more and more clear ideas about the problem is**

- (A) Action research
- (B) Experimental research
- (C) Applied research
- (D) Survey research

**Q 143. Which of the following process is not needed in experimental research?**

- (A) Observation
- (B) Reference collection
- (C) Controlling
- (D) Manipulation

**Q 144. A research problem is not feasible only when**

- (A) It consists of independent and dependent variables
- (B) It is researchable
- (C) It has utility and relevance
- (D) It is new and adds something to knowledge

**Q 145. Research methods can be put into which of the following category?**

- (A) Pre-empirical research
- (B) Descriptive methods
- (C) Experimental method
- (D) All of the above

**Q 146. Choosing a specific behaviour and counting its occurrences comes under**

- (A) Correctional research
- (B) Naturalistic observation
- (C) Survey research
- (D) None of the above

**Q 147. Determining the relationships between two or more variables comes under**

- (A) Naturalistic observation
- (B) Correctional research
- (C) Survey research
- (D) Action research

**Q 148. Participant observation is the process of immersing yourself in the study of**

- (A) Processes
- (B) Organization
- (C) People
- (D) Methods

**Q 149. A Blue print of Research work is called**

- (A). Research Problem
- (B). Research design
- (C). Research tools
- (D). Research methods

**Q 150. A research method 'ethnography' is the process of describing a**

- (A) Culture
- (B) way of life
- (C) Both 'A' and 'B'
- (D) None of the above

# Answers

Sr No	Answer	Sr No	Answer	Sr No	Answer
1	B	16	B	31	D
2	C	17	D	32	A
3	C	18	B	33	D
4	C	19	D	34	D
5	C	20	C	35	C
6	B	21	C	36	D
7	C	22	A	37	B
8	C	23	A	38	B
9	B	24	A	39	C
10	C	25	C	40	B
11	D	26	B	41	B
12	C	27	A	42	B
13	A	28	C	43	B
14	B	29	D	44	C
15	D	30	C	45	B

Sr No	Answer	Sr No	Answer	Sr No	Answer
46	A	61	D	76	D
47	A	62	A	77	C
48	B	63	D	78	D
49	D	64	D	79	D
50	D	65	D	80	C
51	B	66	D	81	C
52	A	67	D	82	D
53	A	68	A	83	C
54	B	69	B	84	D
55	A	70	D	85	D
56	B	71	B	86	D
57	A	72	C	87	A
58	B	73	D	88	C
59	A	74	C	89	D
60	C	75	D	90	D

Sr No	Answer	Sr No	Answer	Sr No	Answer	Sr No	Answer
91	B	106	B	121	D	136	D
92	C	107	D	122	D	137	C
93	D	108	C	123	A	138	D
94	B	109	D	124	B	139	A
95	D	110	A	125	A	140	B
96	D	111	C	126	C	141	C
97	D	112	D	127	D	142	B
98	B	113	C	128	C	143	B
99	A	114	B	129	A	144	A
100	A	115	C	130	B	145	B
101	C	116	A	131	C	146	B
102	D	117	B	132	C	147	B
103	B	118	A	133	C	148	C
104	B	119	D	134	C	149	B
105	B	120	A	135	B	150	C

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## ABOUT THE BOOK

In the book on “**Business Research Methodology**” readers embark on an enlightening journey into the intricate realm of business research. Authored by seasoned experts and academics in the field, this book serves as an indispensable resource for students, researchers, and business professionals seeking to master the art and science of conducting impactful research in the dynamic world of commerce.

The book begins by laying a solid foundation, introducing readers to the essential concepts that underpin effective business research. It delves into the importance of research design, hypothesis formulation, and the critical process of defining research questions.

Recognizing the diverse nature of business challenges, the book explores both quantitative and qualitative research approaches. Readers gain insights into designing and executing surveys, experiments, interviews, and case studies, equipping them with a versatile toolkit for any research scenario.

A significant portion of the book is dedicated to guiding researchers through the intricacies of data collection and analysis. It provides step-by-step instructions on employing statistical tools for quantitative data and employing rigorous techniques for interpreting qualitative data.

Understanding the significance of sampling in research, the book thoroughly covers various sampling techniques. It assists researchers in selecting appropriate methods, whether using probability or non-probability sampling, ensuring the validity and reliability of their findings.

A crucial aspect of any research endeavor is effectively communicating findings. The book provides guidance on scholarly writing, crafting engaging presentations, and utilizing visual aids to convey research results persuasively.

Whether you are a student embarking on your academic journey, a researcher striving for excellence, or a business professional seeking to deepen your understanding of research methodologies, 'Navigating the Business Landscape' is your trusted companion. With its comprehensive coverage, practical insights, and real-world examples, this book empowers individuals to navigate the complexities of business research with confidence and competence."



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