KENYA MEDICAL TRAINING COLLEGE
KISII CAMPUS

RESEARCH LECTURE NOTES

Duration: **50 Hours**

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Qualifications: MPH/Hons. BALM/HND. Epid./Dip. KRCHN

Research T/L Content

A. INTRODUCTION

1. Concept and definition of research
2. Characteristics of a good research
3. Importance and benefits of research
4. Classification of research
5. Conceptual and Theoretical framework
6. Research problem identification
7. Background of the study
8. Statement of the problem
9. Research objectives
10. Hypothesis
11. Justification (Rationale)
12. Classification of variables
13. Important assumptions
14. Limitations of the study
15. Scope of the study
16. Significance of the study

B. INTELLECTUAL SKILLS

11. Reading and Writing
12. Argument formation
13. Critical thinking

C. LITERATURE REVIEW

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15. Sources of literature
16. Purpose for literature review
17. Scope of literature review
18. Performing literature search
19. Steps in literature review
20. Tips on good literature review
21. Organization of literature review
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37. Principles of bioethics
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THE CONCEPT AND DEFINITION OF RESEARCH

The Concept:

- The word research is composed of two syllables "*Re*" and "*Search*".
- "*Re*" is the prefix meaning '*Again* or *over again* or *a new*' and,
- "*Search*" is; '*to examine closely and carefully*' or '*to test and try*'.
- Together the words form: a careful, systematic, study and investigation in some field of knowledge undertaken to establish principles (policies), or facts.
- Research is primarily committed to establishing systematic, reliable and valid knowledge about the world or problem.

Cont…. **The Concept and Definition of Research**

The definition:

- Is a process of arriving at effective solutions to problems through systematic collection, analysis and interpretation of data.
- Is a methodological investigation into a subject in order to discover facts, to establish or revise a theory, or to develop a plan of action based on the facts discovered.
- Carrying out a diligent inquiry or a critical examination of a given phenomenon (a fact or occurrence that can be observed). It implies exhaustive study, investigation or experimentation following some logical sequence.

Cont…. **The Concept and Definition of Research**

- The organized quest for new knowledge based on curiosity or perceived needs.
- Research is a form of disciplined inquiry that generates knowledge. It upholds objectivity and evidential test.

CHARACTERISTICS OF A GOOD RESEARCH

The following are qualities of a good research:

1. Purposiveness
2. Rigor
3. Clarification of variables
4. Replicability
5. Precision and confidence
6. Objectivity
7. Hypothesis formation
8. Testability
9. Generalizability
10. Parsimony

NB: In your study groups discuss the above - Handout.

Cont…. Characteristics of a Good Research

1. **Purposiveness**

- Research must have an aim.
- This means that research must be problem-based, unified and directed.
- To achieve this, testable hypothesis is developed to determine the exact purpose of study.
- The purpose helps to plan the project to a manageable size and completion in a limited time.
- This begins with a research question that is meaningful, narrow and clear.

Cont…. Characteristics of a Good Research

2. Rigor

- Refers to carefulness, scrupulousness and the degree of exactitude in research investigation.
- The research project should have sound methodological design.
- It should be scientific and logical, that is, conclusions must follow from accepted premises that are defended and tested in the course of the research.
- One cannot base conclusions on a few interviews with company employees but a reasonable sample.
- Rigor is also ensured by an appropriately wide search and discussion of the literature in the area.
- This not only helps in making the study rigorous but avoids problems others might have made and also ensures that the study is unique.

Cont…. Characteristics of a Good Research

3. Variables Clarification

- A variable is a measurable value (property or characteristic) that varies from person to person, group to group, or even within one person over time.
- Being clear about your variables is critical in research.
- Examples of variables include:
  - ✓ Dependent variable
  - ✓ Independent variable
  - ✓ Moderator variable
  - ✓ Intervening variable
  - ✓ Control variable
  - ✓ Antecedent variable
  - ✓ Suppressor variable
  - ✓ Distorter variable
  - ✓ Exogenous variable
  - ✓ Endogenous variable etc.

Cont…. Characteristics of a Good Research

4. Replicability

- A good research should be replicable in another/same setting by other researchers.
- The aims, objectives and procedures should be sound and the report is written in clear and comprehensible manner.
- The methodology must be clearly outlined in the study.

5. Precision and Confidence

- ***Precision*** refers to the closeness of the findings to reality while ***confidence*** refers to the probability that our estimations are correct.
- Research must exhibit the highest degree of precision and confidence to demonstrate the scientific method and usefulness of the results.
- This simply means that the results must be as close as possible (precise) to the actual state of affairs under study and that results can be relied upon to a high degree.

Cont…. Characteristics of a Good Research

6. Objectivity

- Refers to clearly outlining what the study intends to achieve through the objectives/aim/goal.
- The conclusions should be based on the facts of the findings derived from actual data, and not on our own subjective or emotional values.
- Conclusions should not be based on subjective or emotional values but rather the facts resulting from the data analysis.

7. Hypothesis formation

- The researcher's anticipated opinion with regard to the study outcome needs to be clearly outlined.
- A clear hypothesis, even if not explicitly stated in the dissertation, will ensure that your dissertation has a focus or purpose and direction.
- The study/project will not be a failure simply because the results do not support your hypothesis.

Cont…. Characteristics of a Good Research

- It also ensures that you answer a research question of some kind, rather than ramble from one topic to another.
- Hypotheses are the connecting membranes that hold the research together.

8. Testability

- The study aim must be testable especially in quantitative study.
- It have a clear purpose that is statistically testable testable.
- Use multiple measurements/tests on the same data to avoid misleading results and to enhance precision validity.

9. Parsimony

- Economy of explanation/words is preferred in research work.
- Uncover a small but meaningful result in the research work not something vast and complex.

Cont…. Characteristics of a Good Research

- Make a small, simple but significant point forcefully (using a number of independent tests) is better than trying to do too much and over-extending yourself.
- Parsimony also refers to simplicity in explaining the phenomena and generating solutions for the problem.

9. Generalizability/Inference

- Refers to the scope of applicability of the research findings in a setting to other settings.
- The more a given research project results can be generalized to other situations the better.
- The aim of generalizability is a regulative ideal rather than one that is essential.

Cont…. Characteristics of a Good Research

Other Characteristics:

1. **Systematic approach:** Good research follows a systematic approach to capture accurate data. Researchers need to practice ethics and a code of conduct while making observations or drawing conclusions.
2. **Logical reasoning analysis:** The analysis is based on logical reasoning and involves both inductive and deductive methods.
3. **Based on actual observations:** Real-time data and knowledge is derived from actual observations in natural settings.
4. **In-depth data analysis:** There is an in-depth analysis of all data collected so that there are no anomalies associated with it.
5. **Generates more research opportunities:** It creates a path for generating new questions and more research opportunities using existing data.

Cont…. **Characteristics of a Good Research**

6. **No ambiguity in making inference:** It is analytical and uses all the available data so that there is no ambiguity in inference.
7. **Accuracy and correctness:** is one of the most critical aspects of research. The information must be accurate and correct.

   For example, laboratories provide a controlled environment to collect data.

   Accuracy is measured in the instruments used, the calibrations of instruments or tools, and the experiment's final result.

Importance of Research

1. Corrects perceptions as well as expands them.
2. Gathers information on subjects or phenomena we lack or have little knowledge about.
3. Develops and evaluates concepts, practices and theories.
4. Research also develops and evaluates methods that test concepts, practices and theories.
5. Obtains knowledge for practical purposes like solving problems on population explosion, drug addiction, juvenile delinquency and the like.
6. Provides hard facts which serve as bases for planning, decision-making, project implementation and evaluation.

Benefits of Research

1. Fostering critical thinking and analytical skills through hands-on learning.
2. Defining academic, career and personal interests.
3. Expanding knowledge and understanding of a chosen field outside of the classroom.
4. Developing one-on-one connections with distinguished faculty in their field.
5. Building community with peers, faculty and organizations on- and off-campus

CLASSIFICATION OF RESEARCH

Research can be classified in five ways, by:

1. Approaches
2. Purpose
3. Type
4. Method of analysis
5. Time dimension

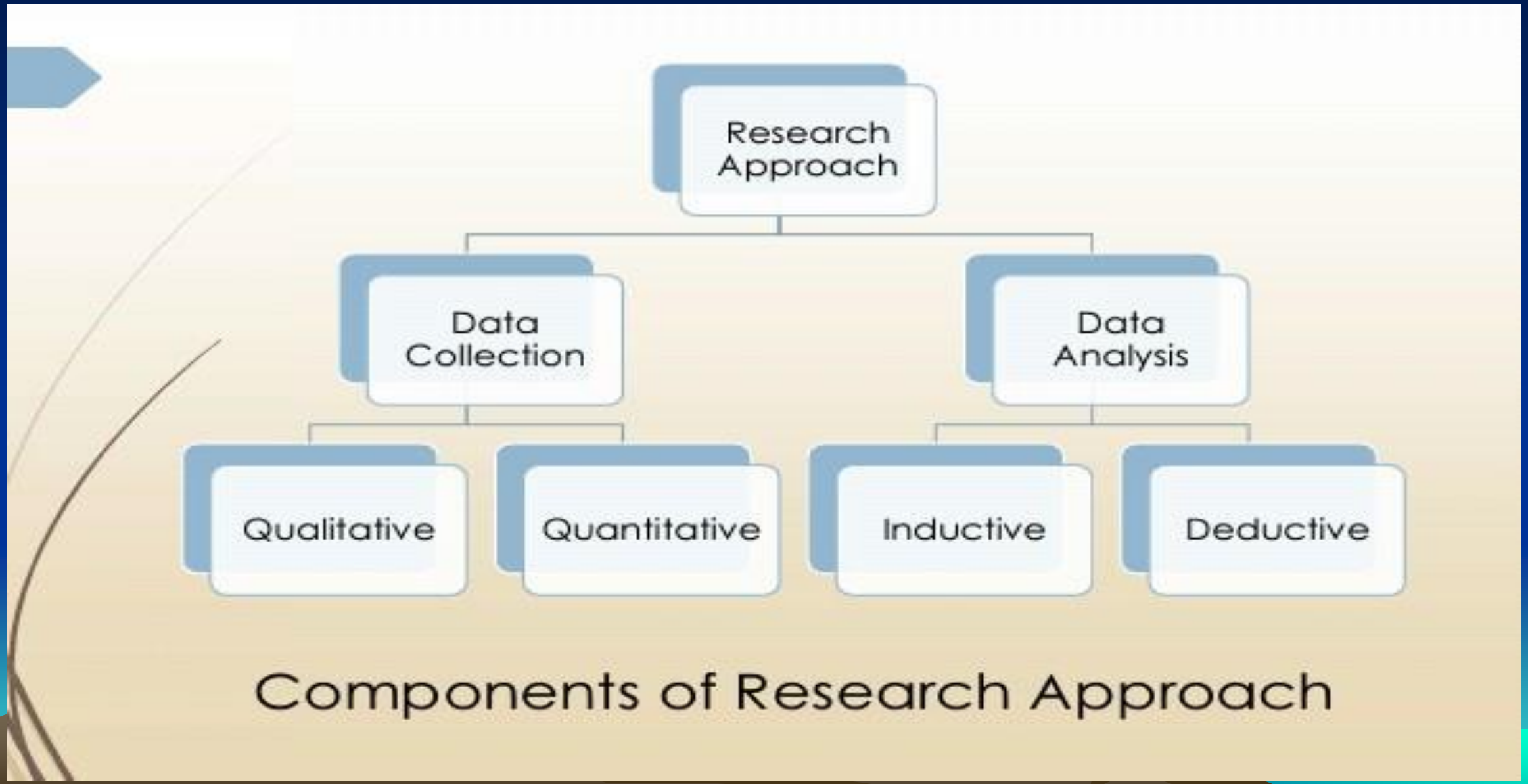
Assignment:

Using the handout and other relevant materials, read and write brief notes on the above.

Research Approaches

- A research approach is a plan and procedure that consists of the steps of broad assumptions to detailed method of data collection, analysis and interpretation.
- It is therefore, based on the nature of the research problem being addressed.
- Research approach is essentially divided into two categories:
  - Approach of data collection and
  - Approach of data analysis or reasoning.

Research Approaches



Classification By Approaches

The major approaches in research are:

1. Quantitative approach
2. Qualitative approach
3. Mixed approach

NB: Deductive and Inductive approaches

Cont…. **Classification By Approaches**

1. Qualitative Research Approach

- It includes designs, techniques and measures that do not produce discrete numerical data.
- Qualitative data can be collected through direct observation, participant observation, interview or recording method.
- It is often regarded as a precursor to quantitative research in that it is often used to formulate realistic and testable hypotheses.
- Qualitative research approach emphasizes on personal experiences, interventions and self-knowledge.
- It can give recommendations based on how a researcher feels are populations being observed.

Cont…. **Classification By Approaches**

Advantages of Using Qualitative

1. Qualitative studies are extremely useful when a subject is too complex to be answered by a simple yes or no hypothesis.
2. Qualitative study designs are much easier to plan and carried out and are useful when budgetary decisions have to be taken into account.
3. Qualitative studies are not dependent upon sample size as are quantitative studies. For example, a case study can generate meaningful results with a small sample group.

Cont…. **Classification By Approaches**

Disadvantages of qualitative research

1. Requires careful thoughts and plan to ensure the results contained are as accurate as possible.
2. Does not use statistical techniques, thus, involves subjective judgment hence can be prone to error. It is open to personal opinion and judgment hence can only give observation rather than results.
3. Qualitative data cannot be mathematically analyzed in a comprehensive manner as quantitative data. Hence, only gives a guide to general trends.
4. It is unique and cannot be recreated meaningfully. Two researches done in two different populations using different methods may not be able to give the same result.

Cont…. **Classification By Approaches**

2. Quantitative Research

- It includes designs, techniques and measures that produce discreet numerical or quantifiable data e.g numbers, ratio, percentage etc.
- The approach attempts to reduce social phenomena to quantifiable data which can be statically analysed, focusing on the links and attributes across several cases.
- The hypotheses formulated are comprehensively tested and mathematically analyzed using standard quatitative research methods.
- Unlike qualitative design where reality is socially constructed in quantitative research, social facts have objective reality, that is, occurrences are observed severally and measured.

Cont…. **Classification By Approaches**

- Variables are identified and their relationships are measured.
- Random sampling is done to ensure representativeness of the sample to the target population.
- Some of the research designs which may be categorized as quantitative include experimental, causal-comparative and correlation research.

Advantages of Quantitative Research

1. Testing the hypotheses: quantitative research is an excellent way of finding results and proving or disproving the hypotheses.
2. Results can be discussed or published. It filters out external factors hence results are real, objective and unbiased.

Cont…. **Classification By Approaches**

3. After statistical analysis of the results, a comprehensive answer is reached and the results can be legitimately discussed and published.
4. Useful for testing the results gained, that is, the results are tested through a series of experiments leading to a final answer and narrowing down to possible conclusions being made.

Cont…. **Classification By Approaches**

Disadvantages of Quantitative Research

1. Difficult, time consuming and expensive: experiments can be difficult, time intensive and expensive to perform.
2. Quantitative studies usually require extensive statistical analysis which can be difficult because many researchers are not statisticians.
3. Quantitative research design tends to generate only proved or unproven results with there being very little room for grey areas and uncertainty.

Cont…. **Classification By Approaches**

3. **Mixed Research Approach**

- A good research blends from a combination of *quantitative* and *qualitative* approaches concurrently.
- The two approaches complement each other, hence, yields the best results in any study.

Advantages of using Mixed Methods

1. Since in many cases a researcher has several objectives, some of these objectives are better assessed using quantitative methods.
2. Both methods supplement each other i.e. qualitative methods provide the in-depth explanations while quantitative methods provide the data needed to test hypothesis.

Cont…. **Classification By Approaches**

3. Since both methods have a bias, using both types of research helps to avoid such bias in that each method can be used to check the other.

Disadvantages of using Mixed Methods

1. It is expensive.
2. Researchers may not have sufficient training in both methods to be able to use them effectively.

Examples of Deductive Research in Action

Imagine you wanted to learn what the word '*Adult learning*' meant to a range of people.

Deductive Approach

- If you want to have a clear theoretical position prior to collection of data.
- You might research the subject and discover a number of definitions , from a number of Adult learners.
- Test this definition, using a questionnaire, structured interviews or group discussion.
- Sample people on the basis of age, gender, occupation etc.
- The data gathered is then be analyzed and presented.
- This approach offers researchers an easy and systematic way of testing established ideas.

Examples of Inductive Approach

Inductive Approach

- If you adopted this approach you might start by talking to people asking for their ideas and definitions of Adult learning'.
- From these discussions you could start to assemble the common elements and then start to compare these with definitions gained from Adult learners'.
- The data gathered could then be analyzed and presented.
- This approach might lead you to arrive at a new definition of the word – or it might not.
- This approach can be very time-consuming, but the reward might be in terms of arriving at a fresh way of looking at the subject.

CLASSIFICATION BY PURPOSE OF RESEARCH

Research serves many purposes. These are:

1. Exploration
2. Description
3. Explanation
4. Prediction
5. Control
6. Theory development

However, a given study may have more than one of these purposes.

Cont….. Classification by Purpose

1. Exploration

- Exploration is an investigation or the study of something such as data, or the consideration and testing of something such as possible courses of action.
- It is conducted to explore a topic (phenomenon), to provide a beginning familiarity with that topic (phenomenon).
- It is used when examining a new interest or when the subject of the study is relatively new and unstudied.
- It helps to discover new knowledge ie. discovery of new facts, their correct interpretation and practical application.

Cont….. **Classification by Purpose**

- These studies are appropriate in a case of persistent phenomenon or when the researcher is breaking a new ground, and they can almost always yield new insights into a topic/phenomenon for research.

The purposes of exploratory research are:

i. Satisfying researcher's curiosity and desire for better understanding
ii. Testing the feasibility of undertaking a more careful study
iii. Developing the methods to be employed in a more careful study.

Cont….. **Classification by Purpose**

- **Goals of Exploratory Research:**

1. Become familiar with the basic facts, setting, and concerns;
2. Develop well grounded picture of the situation;
3. Develop tentative theories, generate new ideas, conjectures, or hypotheses;
4. Determine the feasibility of conducting a more careful study;
5. Formulate questions and refine issues for more systematic inquiry;
6. Develop techniques and a sense of direction for future research.

Cont….. Classification by Purpose

Advantages of Exploratory Studies

– Give hints at answers to research questions.

– Provide insights into the research methods that could provide definitive answers.

Disadvantages of Exploratory Studies

– They never provide unsatisfactory answers to research questions.

– Are not definitive because they are not representative of the population.

Cont….. **Classification by Purpose**

2. Description

- The purpose for many scientific studies is to describe a situations or events.
- The researcher observes and then describes what was observed.
- Since scientific observation is careful and deliberate, however, scientific descriptions are typically more accurate and precise than casual descriptions.
- Accurate identification of any event involves thorough description, for instance, of size, shape, age, weight, colour, height, change over time, etc.

Cont….. **Classification by Purpose**

Goals of Descriptive Research

- Describe the situation in terms of its characteristics i.e. provide an accurate profile of a group.
- Give a verbal or numerical picture (%) of the situation.
- Present background information.
- Create a set of categories or classify the information.
- Clarify sequence, set of stages, and,
- Focuses on `***who***,' `***what***,' `***when***,' `***where***,' and `***how***' but not why?

Cont….. Classification by Purpose

3. Prediction

- This is the ability to estimate phenomenon A, given phenomenon B.
- For example, our knowledge about the relative movement of the moon, earth and sun helps us predict with accuracy the occurrence of lunar eclipses.
- Sometimes a set of variables may be used to predict a given variable.
- In predictive inquiry, the researcher is interested in studying naturally occurring associations between phenomenon.
- Predictive inquiry may be used to study: socio-class structures, race, research in astronomy, mob behaviour and personality among others.

Cont….. Classification by Purpose

4. Explanation Research

- This kind of study deals with *'WHY'*.
- It seeks to establish why phenomenon is as it is or why it occurs. For instance, why a student demonstration ended in a violent confrontation with the police, as opposed to simply describing how it happened.
- It involves accurate observation and measurement of a given phenomenon.
- Explaining a phenomenon involves describing it, predicting its occurrence and observing factors that cause its occurrence with certainty and accuracy.

Cont….. Classification by Purpose

- The process entails examination of many different aspects of a situation, or event simultaneously.
- In its design, it is essential that all those aspects be incorporated in the plan for observation and analysis.

Goals of Explanatory Research

- Explain things not just reporting. Why? Elaborate and enrich a theory's explana tion.
- Determine which of several explanations is best.
- Determine the accuracy of the theory; test a theory's predictions or principle.
- Advance knowledge about underlying process.
- Build and elaborate a theory; elaborate and enrich a theory's predictions or principle.
- Extend a theory or principle to new areas, new issues, new topics:
- Provide evidence to support or refute an explanation or prediction.

Cont….. Classification by Purpose

5. Control

- Control is concerned with the ability to regulate the phenomenon under study.
- It involves experimental studies.
- Usually a phenomenon is manipulated to exert control over another. For example, in a laboratory experiment, a drug that suppresses body growth is administered to a group of rats to investigate its effect on weight gain in rats.
- Another group of rats is fed on normal diet without the drug. All other conditions are controlled or held constant for both groups of rats, e.g. food, water etc.
- After some time, the average weight of each group of rats is calculated and compared.
- If the average weight of the rats receiving the drug is significantly less than the average weight of rats which did not receiving the drug, then one can confidently say that the drug controls weight gain in rats.

Cont….. **Classification by Purpose**

6. Theory development

- This involves formulation of concepts, laws and generalizations about a given phenomenon.
- It is conducted in an attempt to confirm or validate or invalidate existing theories.
- This is sometimes referred to as ‘falsification of theory’. For example, the law of floatation states that ***‘a floating object displaces its own weight of the fluid in which it floats’.***
- So, a study can be undertaken to confirm or validate this theory.

CLASSIFICATION OF RESEARCH BY TYPE

This is by the following key themes:

1. Exploratory Research
2. Basic Research
3. Action Research
4. Applied Research
5. Evaluation Research
6. Historical Research
7. Experimental research
8. Case Study
9. Survey Research
10. Observation research

Cont…. Classification by Type

1. Exploratory research (study)

- They are mainly used in qualitative studies.
- They are non-experimental scientific investigations aimed at discovering the relation and interaction between variables in real social structures.
- The investigation in a field study first looks at a social or institutional situation and then studies the relation among the attitude, values, perceptions and behaviours of individuals and groups in the situation. Data is mainly collected through observation and interviews.
- It provides insight into, an understanding of, and the problem confronting the researcher.

Cont…. Classification by Type

- Exploratory research addresses the need that certain inquiries focus on questions that require answers in order to understand people, events and situations.
- It is often used when the researcher does not have enough information on the topic and wants the flexibility to explore the issue.
- This design is mainly qualitative as it allows flexibility in all the aspects of the process.

Purpose of exploratory study

1. To discover significant variables in the field situation under investigation.
2. To discover relationship among variables.
3. To lay groundwork for later, more systematic and vigorous testing of hypothesis.

Cont…. Classification by Type

2. Basic Research

- It is also referred to as ‘pure’ or ‘fundamental’ research.
- The main purpose is to acquire new knowledge in order to refine or expand existing theories.
- Primary concern of basic research is to add to the universe of scientific knowledge.
- The researcher is normally motivated by intellectual curiosity and need to come up with a particular solution.
- There is no consideration of the practical application of the findings to actual problems or solutions.

Cont…. Classification by Type

3. Action Research

- The main purpose is to solve a specific, immediate and concrete problem in a local setting.
- It is *NOT* concerned with whether results are generalized to any other setting since its major goal is to seek a solution to a given problem, thus, limited in its contribution to theory.
- For instance, a researcher could investigate ways of reducing cholera in a village or find solutions to low Family Planning Methods uptake in a Location.

Cont…. Classification by Type

4. Applied Research

- The main purpose is to apply or test theory and to evaluate its usefulness in solving a problem.
- It aims at developing knowledge that is directly useful to practitioners in a local setting and beyond, i.e. the findings can be generalized.
- In Public Health, applied research can be used to determine effectiveness of various sanitation interventions in the reduction of incidence and prevalence of diarrhoeal diseases.
- Applied research provides data to support theory, guide theory revision or suggest the development of new theory.

Cont…. Classification by Type

5. Evaluation Research

- Evaluation is a systematic process of collecting and analyzing data for decision-making.
- The main purpose is to investigate whether intended results of a programme were achieved.

Types of Evaluation Research

i. Needs Assessment: Is done to find the foundation for new programmes and for making changes in the existing programmes.

ii. Formative Evaluation: Is used to study progress of a programme for modification if need be or stopping it altogether before scaling up.

iii. Summative Evaluation: Is undertaken after the programme has been fully developed (completed). It is used to evaluate (find out) how worthwhile the final programme has been.

Cont…. Classification by Type

iv. Situation Analysis studies.

- These are designed to investigate the viability or practical relevance of intended projects or programmes.
- They seek to establish the needs, problems and resource requirements of the intended programme/ project. They also check on whether the programme/ project will succeed or not.
- Examples include: Feasibility studies, Training Needs Assessment study, among others.

Cont…. Classification by Type

v. Performance Evaluation study

- Represent another type of evaluation research.
- This is initiated when the projects or programme is already in place. It determines the extent to which the methods, resources and personnel used are performing according to expectations.
- For example, you may want to assess the extent to which Free-Education programmes are performing in schools.
- This type of evaluation is sometimes referred to as formative Evaluation.

Cont…. Classification by Type

vi. Impact Assessment study

- This is the type of evaluation research that seeks to establish the impact of a specified programme/ project.
- It is carried out after the completion of the project, or after a long period of programme implementation.
- The aim is to determine the extent to which the programme/ project objectives have been attained.
- It is sometimes referred to as Summative Evaluation.

Cont…. Classification by Type

vii. Participatory evaluation

- In this type of study, the researcher seeks to assess the viability, performance or impact of the project/programme from the perspectives of the participants or beneficiaries involvement.
- More feedback is drawn from the perceptions and interpretations of the participants to judge on the relevance, and success of the programme/project.
- Participatory evaluation approaches have become very popular with NGO's and donor related programmes or projects.
- They are considered to promote higher sustainability levels after project/programme completion.
- It gives the participants an opportunity to define their own agenda about their needs and expectations. This is synthesized with the project/ programme implementors' plans to enhance collaboration and success.

Cont…. Classification by Type

6. Historical Research

- Involves the study of a problem that requires collecting information from the past (retrospectively).

Purpose of historical research

- Aims at arriving at conclusions concerning causes, effects or trends of past occurrences that may help present events and anticipate future events.
- Attempts to interpret ideas or events that had previously seemed unrelated.

Cont…. Classification by Type

- Synthesizes old data or merges old data with new historical facts that the researcher or other researchers have discovered.
- Helps re-interpret past events that have been studied.

Steps involved in historical research

- Identifying and delineating the problem
- Developing hypothesis or hypotheses that one is interested in testing.
- Collecting and classifying resource materials, determining facts by internal and external criticism.
- Organizing facts into results.
- Interpreting data in terms of stated hypothesis or theory.
- Synthesizing and presenting the research in an organized form.

Cont…. Classification by Type

7. Experimental research

- Experimental research involves collection and analysis of quantitative data to establish CAUSE-EFFECT relationship (association) between/among variables.
- In experimental study the researcher specifies two or more variables and formulates hypotheses about the presumed cause-effect relationship amongst them.
- One variable is presumed to cause or influence the other variable(s) to change. This is called the independent variable. The other variable is presumed to be the effect by responding to changes in the previous variables. This is called the dependent variable.
- During the experimental study, the researcher deliberately manipulates the independent variables by changing or altering its values or levels, or its specified categories. At the same time, the researcher carefully observes and measures any resulting changes in the dependent variables.

Cont…. Classification by Type

- This is examined and analyzed to establish the cause-effect relationship. In most experimental studies, the researcher selects two or more groups of subjects.
- Subjects are the population units or individuals selected to participate in a research study. A group of subjects constitute a sample.
- The subjects are then assigned to two major groups called:
  i. *Experimental group*
  ii. *Control group*

Cont…. Classification by Type

a) Experimental group

- Comprises the subjects who will be exposed to experimental treatment, that is, to the influence of the independent variable(s).

b) Control group

- Comprises subjects who will not be exposed to the influence of the independent variable.
- Instead, they are used as a baseline measure or a comparison group to measure the extent of change resulting from the independent variable.
- It is important to note at this stage that, some experimental studies use only one group (*experimental group*) while others could use two, four or more groups.
- However, this depends on the nature and complexity of the experimental design.

Cont…. Classification by Type

c) Randomization:

- Is a procedure used in selecting subjects using probability techniques.
- In this case the subjects are selected at random from the target population.
- Random selection and random assignment of subjects to either of the groups is expected to minimize the influence of extraneous variables.
- The next stage is to assign the subjects to experimental and control groups at random assignment is highly likely to equally distribute the characteristics in the two groups, as shown below.
- This type of research is referred to as *randomized study*.

Cont…. Classification by Type

8. Case Study

- Case study is a method of investigation that involves in-depth collection and analysis of data to determine the characteristics of a unit, such as an individual, a group or organization/institution.
- The rationale of a case study is that the selected unit has some unique or special characteristics that need to be unveiled or understood.
- A case study in education may target a school, a group of students with special characteristics or individual learners whose characteristics differ significantly from others.
- Since a case study is specific to a unit or specific location, generalization of results may not be possible or extensive.
- Majority of case studies in education use qualitative methods.
- Data collection techniques commonly used in case study is an in-depth interviews, key informant interviews, focus group interviews and participants observation.

Cont…. Classification by Type

9. Survey Research

- Surveys are used to study large and small populations (universe) by selecting and studying samples chosen from the population to discover the relative incidence, distribution and interactions of variables.
- The flow plan starts with the objectives of the survey, lists each step to be taken and ends with a final report**.** The steps are:
  1. *Formulation of objectives*
  2. *Sampling design and sampling*
  3. *Designing methods of data collection and constructing instrument*
  4. *Collection of data*
  5. *Data analysis - processing, coding, tabulation/entry and analysis of data*
  6. *Data interpretation and reporting of findings.*

Cont…. Classification by Type

Purpose of survey research

1. It seeks to obtain information that describes existing phenomena by asking individuals about their perceptions, attitudes, behaviour or values.
2. Can be used for explaining or exploring the existing status of two or more variables, at a given point in time.
3. It is the most appropriate to measure characteristics of large populations.

Cont…. Classification by Type

Limitations of survey research

i. They are dependent on the cooperation of respondents.

ii. Information unknown to the respondents cannot be tapped in a survey. e.g. savings per year.

iii. Requesting information which is considered secret and personal, encourages incorrect answers.

iv. Surveys cannot be aimed at obtaining forecasts of things to come.

Cont…. Classification by Type

11. Observation research

- Research where the researcher observes what is going on and documents the observations.
- It is also defined as the current status of phenomenon determined by observation. Its aim is to collect objective information.

Types of observational research

i. Participant observation - observer takes an active part of the people under observation. Researcher begins to collect data once participants have forgotten that they are being observed and behaving as they do usually.

ii. Non-participant observation - Researcher does not take an active part in participating. Observer is silent. Participants are aware that they are being observed, and may modify there behaviour.

iii. Naturalistic observation - Researcher does not control what is happening.

Cont…. Classification by Type

Advantages observation design

1. Observers and records things the way they occur.
2. It is least expensive research design
3. It takes shorter time and can cover a large number of people, items or events.
4. It is also free from response bias whereby the respondent's answer to a question is erroneous due to failure to clearly understand question or concept.

Disadvantages of observational research

i. It limits the scope of inquiry and is not free from the observation error that may be contributed by the investigator.
ii. Useful when dealing with natural state but not humans.
iii. The design may be used to describe characteristics of people, events and situations without probing.

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CLASSIFICATION BY TIME DIMENSION

- Time plays a number of roles in the design and execution of research, quite aside from the time it takes to do research.
- Studies involved in determining causation, time is a critical element to consider.
- Time is also involved in the issue of generalizability of research findings.
- The following studies are time related:
  1. *Retrospective studies (backward looking)* e.g. Case control Study
  2. *Prospective studies (forward looking)* e.g. Cohort study
  3. *Cross sectional studies (at appoint in time) e.g.* Survey, Needs assessment

Illustration: Classification by Time Dimension

The present time
(A Point in Time)

1. ***Retrospective studies***
   e.g. Case control Study

2. ***Prospective studies***
   e.g. Cohort study

3. ***Cross sectional studies***
   i). Survey
   ii). Needs assessment
   iii). Community diagnosis

Classification by Method of Analysis

This comprise the three key methods below:

1. Descriptive Study
2. Correlation study
3. Causal-comparative **research**

Cont…. Classification by Method of Analysis

1. **Descriptive Study**

- It is used to describe a particular phenomenon.
- This involves collection and analysis of quantitative data in order to determine the current status of some phenomenon.
- In a descriptive study, the researcher determines the status, relative incidence and conditions of a problem at the present time. In some cases, casual relationships may be analyzed.
- Descriptive research uses survey designs as a strategy for collecting and analyzing data to answer research questions about the current status of the stated problem.

Cont…. Classification by Method of Analysis

- In the data collection process, questionnaires, interviews and observations are predominantly used.
- Descriptive study primarily uses the quantitative research methodology. However, qualitative data is sometimes collected and used.

2. **Correlation study**

- It is a scientific investigation which involves collection and analysis of quantitative data to determine relationships between variables.
- In a Correlational study, the researcher specifies two or more variables and formulates hypotheses about the presumed relationships among/between them.

Cont…. Classification by Method of Analysis

- Then data is collected using structured questionnaires, structured interviews schedules or structured observation methods of data collection that generate quantitative data.
- The resulting data is then analyzed using statistics of correlation to determine how a change in one variable is associated with changes in another variable. However, it does not, however, imply cause-effect relationship.
- Correlational research uses a survey design.
- The use of correlation statistics is designed to provide two measures namely:
  i. The magnitude or strength of relationship
  ii. The direction of relationship.

Cont…. Classification by Method of Analysis

3. Causal-comparative research

- It is used to explore relationships between variables by determining reasons or causes for the current status of the phenomenon under study.
- The variables of interest cannot be manipulated unlike in experimental research.

Steps In Causal-comparative Research

i. Define the research question
ii. Select a group that possesses the characteristics (of interest) which the researcher wants to study.
iii. Select a comparison group which does not display the characteristics under study but which is similar to the group in other respects.
iv. Collect data on both the experimental and control groups.
v. Analyze and present the data.

Cont…. Classification by Method of Analysis

Advantages of causal-comparative study

1. Allows a comparison of groups without having to manipulate the independent variables.
2. It can be done solely to identify variables worthy of experimental investigation.
3. They are relatively cheap.

Disadvantages of causal-comparative study

1. Interpretations are limited because the researcher does not know whether a particular variable is a cause or result of a behaviour being studied.
2. There may be a third variable which could be affecting the established relationship but which may not be established in the study.

CONCEPTUAL AND THEORETICAL FRAMEWORK

1. Conceptual Framework

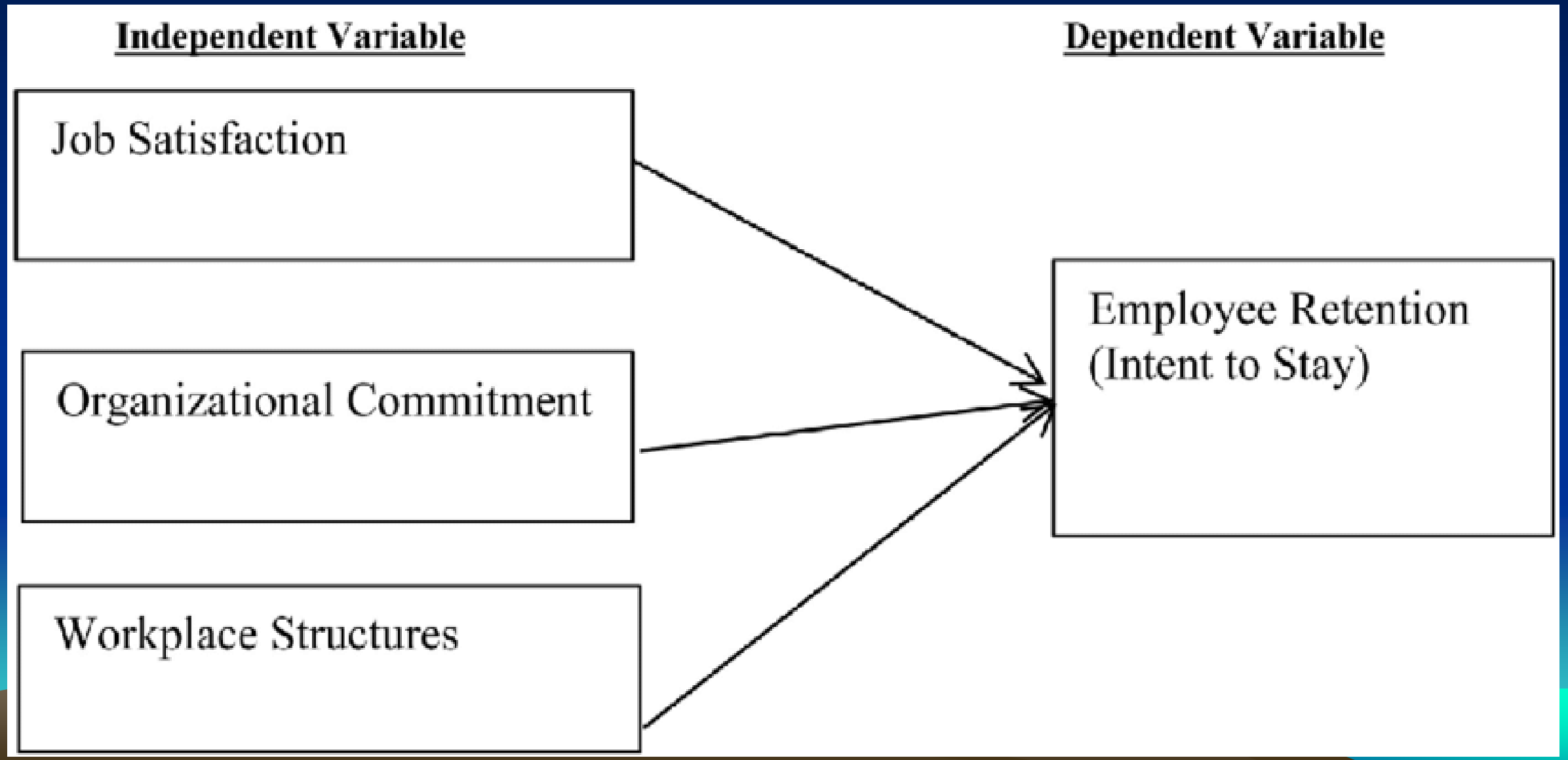
- Conceptual framework represents way of thinking about a problem or a study or way of representing how complex things are (Bordage, 2009).
- A conceptual framework provides a logical, unified and orderly way of seeing related events or processes that relevant to a study/ research and less formal than theories
- The conceptual framework “sets the stage” for the presentation of the particular research question that drives the investigation being reported based on the problem statement (McGaghie et al., 2001)
- The conceptualization part of the research process might well be called the thinking part of the research while the factual part of the research process is more related to the doing aspect.

Cont… **Conceptual Framework**

- Conceptual framework should cover:
- Establishment of the tentative relationships between the dependent and independent variables included in the study.
- Visualizing conceptual causal threads to form a representation of inter-relatedness among the identified issues or variables.
- What are the assumptions? What are the relationships?
- Identification of possible answers to the research questions? How are the possible answers to the question explained and defended?

Cont… **Conceptual Framework**

An example of a conceptual framework:



Cont… **Theoretical Framework**

2. Theoretical Framework

- The theoretical framework is the structure that can hold or support a theory of a research study.
- The theoretical framework introduces and describes the theory which explains why the research problem under study exists.
- Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge, within the limits of the critical bounding assumptions.

Cont… **Theoretical Framework**

Purpose of theoretical framework

- It helps the researcher see clearly the variables of the study
- It can provide him with a general framework for data analysis;
- It is essential in preparing a research proposal using descriptive and experimental methods.
- The theory provides a point of focus for attacking the unknown in a specific area.
- If a relationship is found between two or more variables a theory should be formulated to explain why the relationship exists.

Cont… **Theoretical Framework**

- A theoretical framework consists of concepts, together with their definitions, and existing theory/theories that are used for your particular study.
- The theoretical framework must demonstrate an understanding of theories and concepts that are relevant to the topic of your research paper and that will relate it to the broader fields of knowledge in the class you are taking.
- Examples of theoretical frameworks:
  1. *Social Cognitive Theory (SCT),*
  2. *Health Belief Model, and,*
  3. *Empowerment Theory (ET) etc.*

THE RESEARCH PROCESS

Definition:

Research process refers to the overall skim of activities in which researcher engages in order to produce new knowledge.

Phases of the Research Process

1. Conceptual/Thinking/Planning Phase
2. Construction of the design Phase
3. Empirical/Implementation/Doing phase
4. Analysis and Interpretation Phase
5. Dissemination/Communication Phase

Phases of the Research Process

- The research process can generally be divided into **5 phases**:

1. Conceptual/ Thinking/Planning Phase

It can be divided into 4 steps as follows:

a) Formulation of research problem or research questions, set bounds of them, determine the purpose of the study

b) Searching and review the literature relating to the regarding research problem and develop a framework.

c) Development of the theoretical construction of the future research

d) Creation of hypothesis which should be verified/falsified in future research.

2. Construction of the design Phase

The aim of this phase of research is to prepare general plan of real research.

This phase is composed of following parts:

- Identification of variables
- Construction of operational definitions for variables
- Selection of design for data analysis
- Selection of research respondents
- Selection of research methods
- Selection of technology
- Protocol of research (the research process and methodology)
- Study administration and ethical issues.
- Pilot study

3. Empirical/Implementation/Doing phase

It is in this phase the research proposal is implemented.

The following are done during implementation:

- ❑ Development of data collection instruments.
- ❑ Recruitment and training of data collectors/interviewers.
- ❑ Actual data collection from respondents
- ❑ Data cleaning and processing
- ❑ Preparation for data analysis.

4. Analysis and Interpretation Phase

- Data is carefully examined for completeness and accuracy.
- The data are organised in an orderly, coherent fashion so that he/she can discern patterns and relationships.
- Data analysis is done using appropriate methods and techniques to yield the desired results.
- They must be summarised and subjected to various types of analysis and interpretation.
- Interpretation is made on the results of the analyzed data.

5. Dissemination/Communication Phase

- The research process is completed in this phase when the researcher communicates the findings of the study to the users (stakeholders).
- Dissemination means process when results of the research are presented or published as:
  - ✓ Final research report from research project
  - ✓ Lectures and/or posters at the congresses and conferences
  - ✓ Papers in journals
  - ✓ Using the result in clinical practice

Alternative I: The Research Process

1. Problem identification
2. Purpose
3. Objectives
4. Hypothesis
5. Literature Review
6. Research design
7. Sampling design
8. Measurement of Variables
9. Data collection
10. Data analysis and interpretation
11. Generalization/Inference

Alternative II: The Research Process

RESEARCH PROBLEM IDENTIFICATION

Definition

A research problem is a question that researcher wants to answer, *OR*,

A problem that a researcher wants to solve, *OR*,

A situation for which we have no ready and effective response by instinct or by previously acquired habit or knowledge.

- A problem is an interrogative sentence or statement that asks what relationship exists between two or more variables.
- The answer to the question will provide what is being sought in the research.
- In other words, ‘a research problem is an area of concern where there is a gap in the knowledge base needed for professional practices.

- Identification and formulation of a research problem is the first step of the research process.
- Depending on the complexity and breadth of the study, there could be more than one research questions.
- Identifying a research question will provide greater focus to the research.
- It will clarify the direction of the search may it be a descriptive or experimental in nature.
- A well-written research question will also shed light on appropriate research methods.

Elements of a Research Problem

There are five distinct *elements*/*components* of a research problem:

1. What?
2. When?
3. Where?
4. Who?
5. Why?

1. **What?** Refers to the topic or theme which needs to be investigated. It answers the question "What". That is, What is to be studied?“
2. **When?** Refers to the time dimension. The period or time of the study when the data are to be gathered. This answers the question "When? "When is the research to be performed?

3. **Where?** The area (setting) or location where the study is to be conducted. This answers the question "Where? "Where we need to conduct the study?
4. **Who?** Population or universe from whom the data needs to be gathered. This answers the question "Who?" or "from whom?"

   Who are the respondents from whom the data will be collected?

   These may include persons, groups of persons, wound dressings, syringes, each activity etc.
5. **Why?** Refers to objective (aim) of studying the problem.

   It answers the question "Why" of a research problem.

   This means why there is a need of carrying out this study.

Criteria for Research Problem Selection

- The criteria (factors to be considered) used in the selection of the research problem is, "***FINER***". Where:
  - ✓**F** – Feasible: Is it likely doable easily/conveniently?
  - ✓**I** – Interesting: Does it arouse curiosity or hold or catch attention?
  - ✓**N** – Novel: Is it so new and original, never been done before?
  - ✓**E** – Ethical: Is it right or wrong to do it (*beneficence or maleficence*)?
  - ✓**R** – Relevance: Is it appropriate or pertaining to the matter at hand (does it address the existing problem)?

Conditions Satisfying Existence of Research Problem

The conditions are:

1. There must be an individual or a group which has some difficulty or the problem.
2. There must be some objective(s) to be attained.
3. There must be alternative courses of action for obtaining the objective(s) one wishes to attain.
4. There must be some doubt in the mind of a researcher with regard to the selection of alternatives.
5. There must be some environment(s) to which the difficulty pertains.

Characteristics of an Important Research Problem

1. **Lead to findings that have widespread implications in a particular area:**

- They can be used in decision making and would affect different stakeholders.
- Hence, improvements in various departments/sections in an organization or community.

2. **Challenge some commonly held truism:**

- There is information that exists on a given area.
- The results should challenge the existing position.
- For example, it is known that employees who earn low salaries may leave for another job given an opportunity, but not all would leave.

- Those who would not leave are challenging the existing truism.
- Those who earn less would leave their jobs for new more paying jobs.

3. **Review the inadequacies of existing laws, views or policies:**

- The study should be provide a clear stand based on established facts concerning the existing laws, views or policies.
- Collect appropriate data from those affected by the problem and establish gaps that exist for appropriate interventions.
- This may then challenge status quo leading to improvements in the existing laws, views or policies.

4. Cover a reasonable scope

- The problem should neither be too narrow nor too wide or general.
- For example, studying traffic jam, poverty or insecurity constitutes a too general area for the study.
- However, choosing traffic jam in the City of Nairobi; insecurity at night in Daraja Mbili Estate; or, poverty alleviation programme at Kima Village would provide a reasonable scope for the study.

Selecting a Research Topic

- All research studies begin with a problem. There must be a problem.
- Accordingly, anything that is social and empirical is a relevant topic for research. This may be:

i. Entities e.g. an organization, individuals, groups or communities.

ii. What aspects or characteristics of these entities are of interest (constitute gaps/problems).

iii. What kinds of relationship among the characteristics are anticipated.

- A good research topic should give the scope of the study, and concepts to be studied (independent and dependent variables).

- **Examples of research topics:**

✓ ***Factors Affecting Implementation of Community Based Projects in Kenya, 2017 - 2020: A Case of Kajiado County***

- Independent variable: Are the factors.
- Dependent variable: implementation of community-based projects
- Scope: Kajiado County, Kenya. January 2017 – September 2020

✓ ***Factors Contributing to Premarital Pregnancies Among Adolescents in Kijipwa Village, Mtwapa Sub-county, Kilifi County***

- **Independent variable:** Are the factors.
- **Dependent variable:** Premarital pregnancies
- **Scope:** Adolescents, Kijipwa Village, Mtwapa Sub-county, Kilifi County

- ✓ ***Determinants of Condom Use During Sex Among Commercial Sex Workers on Koinange Street, Nairobi Commercial Business District***
  - Independent variable: Are the determinants.
  - Dependent variable: Condom use.
  - Scope: commercial sex workers, Koinange street, Nairobi
- ✓ ***Triple Trouble: The Role of Malnutrition, Tuberculosis and HIV infection on Effectiveness of HAART in Sub-Saharan Africa***
  - Independent variable: Are Malnutrition, Tuberculosis and HIV infection.
  - Dependent variable: Effectiveness of HAART.
  - Scope: Triple trouble, HAART, Sub-Saharan Africa

Factors Affecting Topic Selection in Research

The factors influencing selection of research topic include:

1. The structure and state of the scientific discipline: Most researchers select topics suggested by the on-going development of theory and research in their particular fields of study.
2. Social problems: Problems associated with the human conditions e.g. urban crowding, racism, social evils etc. can be sources of research problems.
3. Personal values of the researcher: Personal motivations and interest also guide a researcher in selecting a research problem.

4. Social premiums: How a researcher socializes and interests.
5. Practical considerations: Availability of resources e.g. manpower, money, materials, equipment, researcher's personal skills and the availability of relevant data will shape both the nature and scope of the research problem.
6. Subject which is overdone: Should not be normally chosen, for it will be a difficult task to bring out any new light in such a case.

BACKGROUND OF THE STUDY

- The background of the study provides context to the information that you are discussing in your paper.
- Thus, the background of the study generates the reader's interest in your research question and helps them understand why your study is important.
- The background information should indicate the root of the problem being studied, appropriate context of the problem in relation to theory, research, and/or practice, its scope, and the extent to which previous studies have successfully investigated the problem, noting, in particular, where gaps exist that your study intends to establish.

- It has to talk about the broader research area, what the current literature says about the research area, what are some of the gaps in existing studies, and how this led to the gap or need you intend to examine in your study.
- Sufficient background information helps your reader determine if you have a basic understanding of the research problem being investigated and promotes confidence in the overall quality of your analysis and findings.
- It also illustrates the key predictors (drivers) of the problem under study.

In Summary

Present the problem under investigation as follows:

1. The perspective (globally, regionally and locally) of the problem with figures to support your claim.
2. Show the gap warranting the study to be conducted.
3. It also illustrates the key predictors (drivers) of the problem under study.
4. Illustrates the key effects of the problem under study, thus, under scores the need for investigation.
5. Demonstrates the significance of the study in solving the problem under investigation.
6. The setting and its key indicators relevant to the study.

STATEMENT OF THE PROBLEM

Is a set of declarative sentence that illustrates the thesis (the main idea/issue under investigation) of the study.

- It describes an undesirable gap between the current-state level of performance and the desired future-state level of performance.
- A problem statement should include absolute or relative measures of the problem that quantify that gap, and includes possible causes or solutions.
- Problem statements often have three elements:
- the problem itself, stated clearly and with enough contextual detail to establish why it is important;
- the method of solving the problem, often stated as a claim or a working thesis;
- the purpose, statement of objective and scope of the document the writer is preparing.

- It shows a current issue or problem that requires timely action to improve the situation.
- It concisely explains the barrier the current problem places between a functional process and/or product and the current problematic state of affairs.
- It is completely objective, focusing only on the facts of the problem and leaving out any subjective opinions.
- Ask who, what, when, where and why to create the structure for your problem statement to make the problem more comprehensible and, therefore, solvable.
- In addition to defining a pressing issue, is a lead-in to a proposal of a timely, effective solution.

Summary:

Statement of the problem indicates (components):

- The thesis of the study
- The seriousness of the problem (globally, regionally and locally)
- Key contributing factors to the problem under investigation
- The main effects of the problem
- Provides the existence of an important gap warranting the study
- How significant the study will be in solving the problem.

NB: Written as one paragraph and only 300 words or half page.

RESEARCH OBJECTIVES

Definition

Objective is a concise description of what the study intends to achieve.

Types of Objectives

- Objectives can be general (aim) or specific.
- The general objective of your study states what you expect to achieve in general terms.
- Specific objectives break down the general objective into smaller, logically connected parts that systematically address the various aspects of the problem.
- Your specific objectives should specify exactly what you will do in each phase of your study, how, where, when and for what purpose.

Characteristics of a Research Objective

When writing the objectives, make sure they are SMART.

1. **S**pecific: Write precisely and clearly about what you are going to do.
2. **M**easurable: How will you know when you have achieved your aim?
3. **A**chievable: Make sure that you are not overly ambitious.
4. **R**ealistic: Recognize the resource constraints that may arise.
5. **T**ime bound: determine when each objective needs to be completed.

Importance of Clear Research Objectives

Writing your research objectives clearly helps to:

1. Defines the focus of the study.
2. Clearly identify variables to be measured in the study.
3. Indicates the various steps to be involved in the study.
4. Establishes the limits of the study.
5. Avoids collection of any data that is not strictly necessary.

Examples:

Title:

Factors Influencing Uptake of Skilled Delivery Services Among Pregnant Women Attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital

Aim:

- To determine the factors influencing uptake of skilled delivery services among pregnant women attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital

Specific Objectives:

1. To identify socio-demographic factors influencing uptake of skilled delivery services among pregnant women attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital

2. To assess the level of knowledge on skilled delivery services among pregnant women attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital.
3. To establish attitudes on skilled delivery services among pregnant women attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital.
4. To determine practices influencing uptake of skilled delivery services among pregnant women attending Lady Grigg Maternity Unit, Mombasa County Referral Hospital.

RESEARCH QUESTIONS

Definition

It is 'a question that a research project sets out to answer'.

A clearly defined research question consists of study participants, intervention (or exposure) along with a comparator, and outcomes.

Steps on writing a research question

1. Choose a broad topic.
2. Do some preliminary reading to find out about topical debates and issues.
3. Narrow down a specific niche that you want to focus on.
4. Identify a practical or theoretical research problem that you will address.

Characteristics of a Research Question

These include:

1. Each question should be clear and specific.
2. It should refer to the problem or phenomenon under study.
3. It should reflect an intervention in experimental work.

For example:

- *Does the socio-demographic factors relate to exclusive breastfeeding for infants aged 0 – 6 months?*
- *What are the factors influencing exclusive breastfeeding for infants aged 0 – 6 months?*
- *What are the predictors of academic performance in FQE among among students at KMTC Kisumu Campus students?*

Types of Research Questions

There are three basic types of questions that research projects can address:

1. Descriptive questions
2. Relational questions
3. Causal questions

Descriptive:

- When a study is designed primarily to describe what is going on or what exists.
- Public opinion polls that seek only to describe the proportion of people who hold various opinions are primarily descriptive in nature.

For instance, if we want to know what percent of the population would vote for a Democratic or a Republican in the next presidential election, we are simply interested in describing something.

Relational:

- When a study is designed to look at the relationships between two or more variables.
- A public opinion poll that compares what proportion of males and females say they would vote for a Democratic or a Republican candidate in the next presidential election is essentially studying the relationship between gender and voting preference.

Causal:

- When a study is designed to determine whether one or more variables (e.g., a program or treatment variable) causes or affects one or more outcome variables.
- If we did a public opinion poll to try to determine whether a recent political advertising campaign changed voter preferences, we would essentially be studying whether the campaign (cause) changed the proportion of voters who would vote Democratic or Republican (effect).

Examples of research questions:

1. What are the socio-demographic factors influencing uptake of skilled delivery services among women attending Lady Grigg maternity Unit, Mombasa County Referral Hospital?
2. What is the level of knowledge of breastfeeding women on exclusive breastfeeding?
3. What are the attitudes of adolescents on condom use during sex?
4. What are the practices of pregnant women on uptake of delivery services?
5. What are the policy and service provision influencing uptake of VCT services?

HYPOTHESIS

- This refers to the researcher's anticipated opinion (prediction) on the possible outcome of the study.
- It is a prediction or explanation of the possible outcome of the study based on sound review of literature and existing theories.
- It states possible causes, associations (relationships), or differences between two variables. Commonly the dependent and independent variables.
- Hypotheses are derived from existing theories, personal observations or experience.
- A study can have one or multiple hypotheses depending on the number of variables being studies simultaneously.

Types of Hypothesis

There are two main types of hypotheses, namely:

a) Null hypothesis
b) Alternate hypothesis

The Null hypothesis

- It is also referred to as statistical hypothesis.
- A null hypothesis always states that there is no relationship or difference existing between the dependent and independent variables.
- Therefore, any relationship or difference between any two variables is merely by chance or error.
- *For example*:
  a) Resource allocation has no effect on project implementation among CBOs in Kajiado County.
  b) There is no difference in the performance in Nursing FQE between students at KMTC Homa Bay Campus and Migori campus.

Alternate Hypothesis

- This hypothesis that states that there is a relationship or differences between the dependent and independent variables.
- However, the nature of such a difference or relationship is not stated.

Types of alternate hypothesis

1. Directional alternate hypothesis
2. Non-directional alternate hypothesis

Directional alternate hypothesis

- It specifies the nature of the relationship or differences between variables.
- A relationship may, therefore, be stated as being greater than, less than, increased, decreased, higher than or lower than, among others.

- *For example:*

a) High alcohol content in the blood decreases reaction time of drivers in Kenya.

b) The use of fertilizers increases maize yield per acre in Uasingishu County.

Non-directional alternate hypothesis

- It does not specifies the nature of the relationship or differences between variables.

For example:

a) Alcohol consumption affects reaction time among drivers in Kenya.

b) The use of fertilizers is related to maize yields per acre in Uasingishu County.

c) Resource allocation has effect on project implementation among CBOs in Kajiado County.

JUSTIFICATION

Definition

It is the reason why the research is being conducted, taking into consideration the methods of the study.

- It explains the rationale for the study, and is gleaned from the existing literature on the subject.
- Research justification refers to the rationale for the research, or the reason why the research is being conducted, including an explanation for the design and methods employed in the research.

- The following must come out clearly:
  a) Declare the problem and why the study is being done now (why it is important).
  b) State the uniqueness of the study based on the problem and population affected.
  c) Outline how the study will add to the universe of existing knowledge.
  d) Indicate the beneficiaries of the study.

CLASSIFICATION OF RESEARCH VARIABLES

- There are six common variable types:

i. Dependent Variable

- It comprises the things we are looking at, for example, the presenting problem/issue.
- It is referred to as the ***result*** or ***outcome variable***.
- It shows the effects of independent variables.
- For example, if the independent variable is the use or non-use of a new language in teaching a procedure, then the dependent variable might be students' scores on a test of the content taught using that procedure.

Cont…. Classification of Research Variables

- In other words, the variation in the dependent variable depends on the variation in the independent variable.

ii. Independent variable

- Is a variable that the researcher has control over.
- It is referred to as the cause or predictor variable or a variable that identifies forces or conditions that act on something else or lead to a particular result/outcome.
- Whatever the case may be, the researcher expects that the independent variable(s) will have some effect on (or relationship with) the dependent variables.

Cont.… Classification of Research Variables

iii. Intervening Variable

- Refers to a variable that links the independent and dependent variables.
- The variable acts as dependent variable with respect to independent variable and also acts as independent variable towards dependent variable.
- For example: Suicide theory states that married people are less likely to commit suicide compared to single people.
- In this case, the assumption is that married people have greater social integration (for instance, feelings of belonging to a group or family).
- Hence, in a study, a major cause of one type of suicide was that people lacked sense of belonging to a group (family).

Cont…. Classification of Research Variables

- Thus, this theory can be re-stated as a three variable relationship: ***Marital status*** (*independent variable*) causes the degree of ***social integration*** (*intervening variable*), which affects ***suicide*** (*dependent variable*).

iv. Moderator Variable

- It modifies the original relationship between the independent and dependent variables.
- For example, a strong relationship has been observed between the quality of library facilities (X) and the performance (Y) of the students in the College Final Qualifying Examination.
- This is a function of the *interest and inclination* of the students to use the library. So, it is the student's *interest* and *inclination* that is a moderating variable.
- Unlike extraneous variables, moderator variables are measured and taken into consideration.

Cont.… Classification of Research Variables

v. Control Variable

- Is a variable that must be held constant/controlled /neutralized/ balanced/ eliminated in a study to avoid bias (is a process where the scientists performing the **research** influence the results, in order to portray a certain outcome types - ***information bias***, ***selection bias***, and ***confounding***).
-
- It is not possible to consider every variable in a single study. Therefore, the variables that are not measured in a particular study must be held constant, neutralized/balanced, or eliminated, so they will not have a biasing effect on the other variables.
- Variables that have been controlled in this way are called control variables.

Cont.… Classification of Research Variables

vi. Extraneous Variable (confounding factor)

- Are those factors in the research environment which may have an effect on the dependent variable(s) if not controlled.
- Some extraneous variables may be treated as independent or moderating variables but most must be assumed or excluded from the study as they are dangerous.
- They may damage a study's validity, making it impossible to know whether the effects were caused by the independent or moderator variables or some extraneous factor.
- True relationship between independent and dependent variables can only be established if the extraneous variables are controlled.
- If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.

IMPORTANT ASSUMPTIONS

Definition

Assumptions are statements in research that are taken for granted or are considered true, even though they have not been scientifically tested. ***OR***,

An assumption is a belief that forms one of the bases for the research. This belief is not to be tested or supported with empirical data.

– Very often belief is not stated in a research proposal by researchers.

– Assumption are principles that are accepted as being true based on logic or reasons, but without proof or verification.

Example:

- *It is assumed that the Departments of Health, will permit unlimited access to the records, staff and patients, information offered will be honest and true, and that weather will be favourable to permit easy movement through the terrains during data collection exercises.*

Cont…. **Important Assumptions**

Uses of Assumptions in Research

- Research is built upon assumptions since a foundation is needed to move forward. One must assume something to discover something.
- Assumptions listed in research paper may be good sources of the research topics.
- Assumption provide basis to conduct of the research study.
- Tested assumptions through research studies expand the professionals' body of knowledge.

Cont…. **Important Assumptions**

Types of Assumptions

1. Universal assumption: Are beliefs that are assumed to be true by a large part of society, but testing such assumptions is not always possible. For example, ‘there is a supernatural power which governs this universe’.
2. Theories based assumptions: These are drawn from theories. If a research study is based on a theory, the assumption of the particular theory may become assumption of that particular research study.
3. Research conduct assumptions: Some of the common-sense assumptions may be developed to conduct a particular study. For example, ‘prevalence of coronary artery disease is more common among urban people as compared to rural people’

Cont…. **Important Assumptions**

4. Warranted assumption: These are stated along with evidence to support. For example, ‘regular prayers bring success because they boost morale’.
5. Unwarranted assumptions: These are stated without any supportive evidence. For example, ‘Almighty God exists everywhere in this universe’.

LIMITATIONS OF THE STUDY

Definition

Limitations are restrictions of the study due to theoretical or methodological reasons, which may decrease the credibility & generalizability of the research findings.

Example:

Some respondents may withhold important or offer false information to interviewers. However, it is hoped that the sampled respondents will offer true and correct information after being offered explanation on the purpose of the study, assured of ***anonymity*** *and confidentiality.*

Cont… **Limitations of The Study**

Types of limitations

Usually, there are two types of limitations in research studies which may reduce the credibility & generalizability of the research findings they are:

1. Theoretical limitations
2. Methodological limitations

Cont… **Limitations of The Study**

Theoretical Limitations:

They restrict the ability of research findings to generalizes due to the use of specific theoretical concepts in study, or limiting the study of variables through operational definitions.

Methodological Limitations:

Methodological limitations usually result from some of the methodological factors such as unrepresentative sample, weak design, single setting, limited control over extraneous variables, poor data collection procedure, ineffective use of statistical analysis etc.

Therefore, researchers usually mention limitations of their study, so that the readers can have idea about the credibility and generalizability of the research findings.

SCOPE OF THE STUDY

The scope of the study basically means all those things that will be covered in the research project, that is, all aspects that will be considered in your research project, for example, setting, respondents, ages, and period etc.

- It means the extent to which the research area will be explored in the work (project) and specifies the parameters within which the study will be operating.
- It defines clearly the extent of content that will be covered by the means of the research in order to come to more logical conclusions and give conclusive and satisfactory answers to the research.

Example:

The study will be done in Homa Bay county and will involve all confirmed malaria patients aged ≥15 years registered in all the Sub-county Hospitals between January 2017 and December 2021. It will also include purposively selected clinical staff working in the hospital.

SIGNIFICANCE OF THE STUDY

Definition

It is a written statement that explains why your research is/was needed.

- It justifies the importance of your work and impact it has on your research field, its contribution to new knowledge and how others will benefit from it.

Importance of the significance of study

- Enables the reader to know the importance of study.
- It is the proof of the worth of study, effort and time.

Example:

The study will determine the predictors of cervical cancer, thus, making practical intervention recommendations that will be used by the policy makers and key stakeholders to design and implement specific, and evidence-based interventions that will effectively reduce the incidence and prevalence of cervical cancer in Kisii County.

INTELLECTUAL SKILLS

Definition:

- Refers to the ways of thinking and problem-solving used by professionals in a field. ***OR***,
- The ability to distinguish, combine, classify, analyze, and quantify objects, events, and symbols.

Types of intellectual skills

1. Knowledge and Understanding
2. Creative Skills
3. Reading
4. Writing
5. Memory
6. Reasoning
7. Analyzing
8. Argument
8. Critical thinking
9. Comprehension
10. Problem solving etc.

NB: *A general intellectual skill that is important to all fields of study is critical thinking.*

Reading Skills

Definition:

Reading is a cognitive (mental) process that involves decoding symbols to arrive at meaning or It is an active process of constructing meanings of words.

Importance of Reading

- Reading is important because it develops the mind
- It is how we discover new things
- Reading develops the imagination-develops creative side of people
- The pen is mightier than the sword words - spoken and written - are the building blocks of communication fundamental in developing a good self-image.

- Reading is a very good exercise for our minds. It keeps our mental faculties constantly engaged.
- Reading hones our language skills and improves our vocabulary.
- Creativity stems from diverse reading and the ability to think out of the box.
- We need to do a variety of reading at our workplace.

Techniques of Reading

- Critical reading involves presenting a reasoned argument that evaluates and analyses what you have read, that is, ***What the text says***; ***What the text describes;*** and, ***Interpretation of the text***.
- Being critical, therefore - in an academic sense - means advancing your understanding, not dismissing and therefore closing off learning. The techniques of reading are:

1. **Skimming**
2. **Scanning**
3. **Intensive Reading**
4. **Extensive Reading**

1. **Skimming –**

- To understand the essence of a given topic. Skimming is used to quickly gather the most important information, or 'gist'.
- Run your eyes over the text, noting important information.
- Use skimming to quickly get up to speed on a current business situation. It's not essential to understand each word when skimming.
- Read the titles, sub titles, subheadings and illustrations.
- Read the first and the last paragraphs and headings and summaries.
- Read the first sentence (topic sentence) of each paragraph.
- You ignore the details and look for the main idea.
- Skimming is done at least 3 to 4 times faster than your normal speed.

2. Scanning –

- It is done to find out the specific words or details or to find a particular piece of information.
- Run your eyes over the text looking for the specific piece of information you need.
- Use scanning on schedules, meeting plans, etc. in order to find the specific details you require. If you see words or phrases that you don't understand, don't worry when scanning.
- Examples of Scanning: The "What's on TV" section of your newspaper; a train / airplane schedule; A conference guide.
- This is a method where in you read a particular list, sentence, paragraph, passage, or chapter with the intention of searching for specific facts related to a particular subject. When you scan a particular piece of written passage you are not actually reading the material line by line, but you are searching the passage for a particular piece of information very quickly.

3. Intensive Reading

- It is used to get specific details or information from a written material.
- It is usually slow reading done with a lot of concentration.
- It includes very close accurate reading for detail. Use intensive reading skills to grasp the details of a specific situation. In this case, it is important that you understand each word, number or fact.
- Examples of Intensive Reading: A bookkeeping report; An insurance claim; A contract.

4. Extensive Reading

- To read at/for leisure. Extensive reading is used to obtain a general understanding of a subject and includes reading longer texts for pleasure, as well as business books. Use extensive reading skills to improve your general knowledge of business procedures. Do not worry if you understand each word.
- Examples of Extensive Reading: The latest marketing strategy book; a novel you read before going to bed; Magazine articles that interest you.

The SQ3R Reading Technique

This refers to: Survey – Question – Read – Recite – Review

- The process involves five different steps, which are as follows:

1. Survey

- The survey involves getting a quick idea on the whole writing piece.
- For example, reading the introduction or summary of a book will be enough to get an idea on that book.

2. Question

- We are not just reading the words or looking at the words but are actually trying to make out the underlying meaning of the text.
- So we should prepare questions in our mind and look for the answers while reading the text.

3. Read

– The reader reads selectively if he is looking for any specific information.

4. Recite

– The reader answers the questions in his own words using only the keywords that are required to sum up the complete idea.

5. Review

– The reader reviews the entire things/information in his mind.

Methods of Applied Reading

This involves doing the following:

1. Differentiate between facts and figures
2. Understand the purpose behind the writing
3. Recognize the tone and the persuasive elements
4. Analyze and synthesize the given information
5. Evaluate the accuracy of the given information
6. Apply the information derived from a thorough understanding of a situation to a new one.

Writing Skills

Definition

Academic writing is clear, concise, focussed, structured and evidence-based use of symbols to develop a message either as hard copy or electronic copy that the receiver can read to get the message sent by the sender.

Purpose of Academic Writing

1. General purpose: To inform, persuade or entertain.
2. Specific purpose: Addresses assigned subject or question.
3. Argument and Persuasion: Presents reasoned approach with supporting data to convince the reader.

4. Narration: To tell a story about something.
5. Exposition: To explain or clarify situation or something
6. Expository writing: is an explanation of a topic by answering the questions: • *Who* • *What* • *When* • *Where* • *Why* • *How.* It is meant to aid the students' understanding.
7. Description: To provide an account of something.

Types of Academic Writing

The categories/types of academic writing are:

1. Expository
2. Descriptive
3. Persuasive
4. Narrative
5. Analytical
6. Critical

1. Expository

- Expository writing's main purpose is to inform and explain an issue.
- It is a subject-oriented writing style, in which authors focus on telling you about a given topic or subject without voicing their personal opinions.
- These types of essays or articles furnish you with relevant facts and figures but do not include their opinions.
- Usually explains something in a process. Is often equipped with facts and figures. Is usually in a logical order and sequence.
- Expository Writing is used in: Textbook writing; How-to articles; Recipes; News stories (not including opinion or editorial pieces); and, Business, technical, or scientific writing.
- For Example: Many people associate the taste of pumpkins with fall. In October, companies from Starbucks to McDonalds roll out their pumpkin-flavoured lattes and desserts. Here is how to make an easy pumpkin pie using only five ingredients. First, make sure you have all of the ingredients.

2.Descriptive

- Descriptive writing focuses on describing, that is, communicating the details of a character, event, or place.
- In good descriptive writing, the author will not just say: “The vampire killed his lover.”
- He or she will change the sentence, focusing on more details and descriptions, like: “The bloody, red-eyed vampire, sunk his rust-coloured teeth into the soft skin of his lover and ended her life."
- It is often poetic in nature. It describes places, people, events, situations, or locations in a highly-detailed manner. The author visualizes what he or she sees, hears, tastes, smells, and feels.
- Descriptive Writing is used in Poetry; Journal or diary writing; Nature writing; and, Descriptive passages in fiction.

For Example: The iPhone 6 is unexpectedly light. While size of its screen is bigger than those of the iPhones that came before, it is thinner, and its smooth, rounded body is made of aluminium, stainless steel, and glass. The casing comes in whitish silver, gold, or a colour the company calls “space grey,” the colour of the lead of a pencil, with darker grey accents.

3. Persuasive

- Persuasive writing tries to bring other people around to your point of view. Convincing the audience to accept your idea.
- Unlike expository writing, persuasive writing contains the opinions and biases of the author. To convince others to agree with the author's point of view, persuasive writing contains justifications and reasons.

- It is often used in letters of complaint, advertisements or commercials, affiliate marketing pitches, cover letters, and newspaper opinion and editorial pieces.
- Persuasive writing is equipped with reasons, arguments, and justifications.
- In persuasive writing, the author takes a stand and asks you to agree with his or her point of view.
- It often asks for readers to do something about the situation (this is called a call-to-action).
- Persuasive Writing is used in Opinion and editorial newspaper pieces; Advertisements; Reviews (of books, music, movie, restaurants, etc.);

- Letter of recommendation; Letter of complaint; and, Cover letters.
- For example: Following the 2012 Olympic Games hosted in London, the UK Trade and Investment department reported a £9.9 billion boost to the economy.
- Although it is expensive to host the Olympics, if done right, they can provide real jobs and economic growth. This city should consider placing a bid to host the Olympics.

4. Narrative

- Narrative writing's main purpose is to tell a story.
- The author will create different characters and tell you what happens to them (sometimes the author writes from the point of view of one of the characters—this is known as first person narration).

- Novels, short stories, novellas, poetry, and biographies can all fall in the narrative writing style. Simply, narrative writing answers the question: “What happened then?”
- In a narrative, a person tells a story or event; Has characters and dialogue; Has definite and logical beginnings, intervals, and endings; and, Often has situations like actions, motivational events, and disputes or conflicts with their eventual solutions.
- Persuasive writing: novels, short stories, novellas, poetry, autobiographies or biographies, anecdotes and oral histories.
- For example:
  - “I don’t think that’s a good idea,” said Jaelyn.
  - “You never used to be such a girl!” retorted Orin, pushing open the door. Reluctantly, Jaelyn followed.

5. Analytical

- Analytical writing pulls out facts and discusses, or analyzes, what the information means. Based on the analyses, a conclusion is drawn, and through persuasive techniques, the writer attempts to convince the reader to see her point of view.
- Analytical writing does not just present facts, instead the reader discovers what the information means through the writing.
- When writing an analytical essay, the writer should aim for appropriate brevity, readability, objectivity, a direct tone and text-based evidence.
- Most academic writing are analytical.

- Analytical writing includes descriptive writing, but also requires you to re-organize the facts and information you describe into categories, groups, parts, types or relationships.
- Sometimes, these categories or relationships are already part of the discipline, while in other cases you will create them specifically for your text.
- If you’re comparing two theories, you might break your comparison into several parts, for example: how each theory deals with social context, how each theory deals with language learning, and how each theory can be used in practice.

6. Critical

- Critical writing is common for research, postgraduate and advanced undergraduate writing.
- It has all the features of persuasive writing, with the added feature of at least one other point of view.
- While persuasive writing requires you to have your own point of view on an issue or topic, critical writing requires you to consider at least two points of view, including your own.
- For example, you may explain a researcher's interpretation or argument and then evaluate the merits of the argument, or give your own alternative interpretation.

- Examples of critical writing assignments include a critique of a journal article, or a literature review that identifies the strengths and weaknesses of existing research. The kinds of instructions for critical writing include: 'critique', 'debate', 'disagree' and 'evaluate'.
- **You need to:**

a) Accurately summarise all or part of the work. This could include identifying the main interpretations, assumptions or methodology.

b) Have an opinion about the work. Appropriate types of opinion could include pointing out some problems with it, proposing an alternative approach that would be better, and/or defending the work against the critiques of others.

c) Provide evidence for your point of view. Depending on the specific assignment and the discipline, different types of evidence may be appropriate, such as logical reasoning, reference to authoritative sources and/or research data.

Characteristics of Academic Writing

- **Planned and focused:** answers the question and demonstrates an understanding of the subject.
- **Structured:** is coherent, written in a logical order, and brings together related points and material.
- **Evidenced:** demonstrates knowledge of the subject area, supports opinions and arguments with evidence, and is referenced accurately.
- **Formal in tone and style:** uses appropriate language and tenses, and is clear, concise and balanced.
- **Point-of-view -** The point of view in the third person, as the focus of academic writing is to educate on the facts, not support an opinion.

- **Outline -** A proper outline is a must for academic writing. An outline will not only help you formulate your thoughts, but will sometimes make you aware of certain relationships between topics. It will help you determine the pertinent information to be included in your paper.
- **Tone -** A formal tone is used. You do not use slang words, jargon, abbreviations, or many clichés.
- **Language -** The language in your paper needs to be clear and words need to be chosen for their precision. A thesaurus is a good tool to help you pick just the right words to explain the issues.
- **Approach -** Deductive reasoning is a big part of academic writing as your readers have to follow the path that brought you to your conclusion.

Method of Writing Academically

- **Start by introducing your topic**. Try using a series of questions about the topic, using startling or unusual facts or figures, defining an important, subject-related term or quoting a well-known expert on your topic or a literary work.
- **State your main idea clearly**. This is your thesis statement. It contains the focus of your essay and tells your reader what the essay is going to be about. The thesis statement is usually located at the end of your introduction.

- **State the main idea of each paragraph.** These are the topic sentences. They contain the focus of your paragraphs and tell your reader what each paragraph is going to be about. Topic sentences are usually located at the beginning of each paragraph. Each paragraph should flow smoothly from one to the next (e.g. the first sentence in each new paragraph should serve as a link to the paragraph before it).
- **Use supporting examples and details** to make complicated ideas easier to understand. Do not assume that your reader will understand what you are trying to say.
- **Use third person point-of-view** (e.g. he, she, it and they). No first and second person points-of-view (e.g. I, you, we) are used in academic writing.

- **Use formal voice**. This means no slang, colloquialism (common expressions of ordinary speech), contractions, etc.
- **End by restating your main idea**, or summarizing important points, and then drawing a final conclusion for your reader.
- **Proofread your work,** making any necessary corrections to sentence structure, punctuation, spelling and grammar. Use a dictionary and a writer's guide if you are unsure about the rules.

Structure of Academic Writing

An academic paper has three distinct sections - the introduction, body and conclusion:

1. Introduction

- In the introduction, you must grab the reader's attention and identify the thesis (the main idea) of the paper. You can do this by starting with:

– Asking several questions
– Making a quote from a famous work or person
– Bringing some interesting facts or information
– Defining an important term related to the work

2. Body

- This is the main part of the work and the paragraphs must be clearly written and be arranged in a logical order, like chronologically or in order of importance. Each initial sentence links the preceding paragraph and the whole section flows smoothly.

– Within each paragraph:
– The sentences need to flow and refer back to the topic.
– Cohesion is achieved by repeating important words, using synonyms for the main subject, and using transitional words like: however, such as, therefore, and for example.

-

3. Conclusion

- In the conclusion, you re-emphasize the thesis and summarize all the main points. The conclusion consists of one paragraph which shows the final conclusion to the reader.

Forms of Academic Writing

Examples of academic writing include:

1. Literary analysis

- A literary analysis essay examines, evaluates, and makes an argument about a literary work. As its name suggests, a literary analysis essay goes beyond mere summarization. It requires careful close reading of one or multiple texts and often focuses on a specific characteristic, theme, or motif.

2. Research paper

- A research paper uses outside information to support a thesis or make an argument.

- Research papers are written in all disciplines and may be evaluative, analytical, or critical in nature. Common research sources include data, primary sources (e.g., historical records), and secondary sources (e.g., peer-reviewed scholarly articles). Writing a research paper involves synthesizing this external information with your own ideas.

3. Dissertation

- A dissertation (or thesis) is a document submitted at the conclusion of a Ph.D. program. The dissertation is a book-length summarization of the doctoral candidate's research.
- Academic papers may be done as a part of a class, in a program of study, or for publication in an academic journal or scholarly book of articles around a theme, by different authors.

ARGUMENT FORMATION

Definition:

Argumentation is the act or process of forming reasons and drawing conclusions and applying them to a case in discussion.

- An argument is a claim (or conclusion) that is supported or justified by at least one reason.
- The supporting statements of an argument are called premises.
- An argument is valid if the truth of the premises implies that the conclusion is valid.

Types of Argument

1. Deductive argument
2. Inductive argument
3. Toulmin argument
4. Rogerian argument

1. **Deductive Argument**

- A deductive argument is based on a strong premise for the conclusion.
- It’s a top-down approach in which you reach a conclusion based on a premise that is assumed to be true.
- Police generally solve cases with this approach: They have a suspect in mind based on previous information not directly connected to the case and then use it to build their hypothesis to prove the guilt of that suspect.

2. Inductive Argument

- An inductive argument is the opposite of a deductive argument.
- It is a bottom-up approach that allows you to arrive at conclusions based on his observations.
- Of the two types of arguments, inductive arguments go from the specific to the general.
- They use data and observations to draw a pattern.

3. Toulmin Argument

- The Toulmin argument is another tool for constructing arguments created by British philosopher *Stephen Toulmin*.
- It involves breaking an argument down into components:
  1. *Claim*
  2. *Grounds*
  3. *Warrant*
  4. *Reason*
  5. *Qualifier*
  6. *Rebuttal*
  7. *Backing*.
  8. *Evidence*
  9. *Counter-claim*
- The three most important elements in a Toulmin argument are:
  1. The claim or the statement of opinion
  2. Grounds or the facts or data on which the claim is based, and
  3. The warrant or what links the grounds to the claim.

- The argument with the strongest evidence claims success.
- But for that, the arguer has to present the data and the facts to show that the logic behind their argument is real and theoretically sound.
- Let’s say you want to ban junk food in an office canteen.
- That’s your main statement or claim and the ground is that junk food is unhealthy for employees and banning it would improve their health.
- The warrant is that unhealthy food will lead to health problems.

4. Rogerian Argument

- The Rogerian argument comes into play when you have to find the best possible solution.
- Essentially, it is a negotiating strategy in which you identify a common goal and try to establish common ground.
- Many of us are familiar with and have used Rogerian arguments in our life without being aware.
- Think of the team meeting your manager calls every time before starting the new project.
- The team discusses the best possible solutions to the client's requirements. What kind of software, or product or sales pitch would work?
- You acknowledge your team members' standpoints as well as make your own. The main goal is to find a mutually satisfactory solution.

Elements of an Argumentation

1. **Claim**

- An argument states a claim and supports it with reasons and evidence from sources.
- Arguing your side makes you the proponent.

2. **Counterargument/Counterclaim**

- An argument that stands in opposition to your argument/claim.
- The counterargument is your opponent's (the other side's) argument that tries to explains why you are wrong.

3. **Refutation**

- Simply disproving an opposing argument.
- It is an important skill because it is how a writer successfully convinces the audience of the validity of his/her own argument.

4. **Logic-based**

- Convinces audience through merit and rationality of the claim and evidence offered to support the position.

The Seven C's of Building an Argument

– When you need to build an argument, use the seven C's to develop and support a position about a specific topic:

1. **Consider the situation.** Think of all aspects of the communication situation What are the subject and purpose of your message? What medium will you use? Who is the receiver? What is the context?
2. **Clarify your thinking.** Think about the pros and cons of each side of the issue, and do some preliminary research so that you understand the subject well.

3. **Construct a claim**

- Write a single statement that gives your position and the main reason that you hold that position.

4. **Collect evidence**

- Research the issue in depth, using primary, secondary, and tertiary sources.
- Investigate to make sure your claim holds up, and change it if it doesn’t.
- Gather a variety of key evidence to support your claim.

5. Consider key objections

- Think about other viewpoints related to the argument.
- What reasons could people cite to support opposing positions?
- What major problems could they see with your argument?
- Decide how you will answer those objections—by countering them (saying why they are unimportant) or by conceding them (saying they are important but can be overcome).

6. Craft your argument

Use your claim statement and the evidence you have gathered to argue persuasively for your position. Appeal to the needs of your reader, and answer any key objections.

Evidence in Argumentation

6. Confirm your main point

- Wrap up your argument by stating your claim in a new way, connecting it to real life and to the future.
- To support your proposition, you must present evidence.
- There are two (**2**) types of evidence used in argumentation, that is, fact(s) and opinion(s): Consists of items that are verifiable/proven.
- There are at least four (**4**) categories of facts:

i. By Scientific Measurement:

- For example, one measures the extent of an earthquake not by how "it felt," but rather how it measured on the Richter Scale.
- In track and field, one commonly finds the Accutron used to time running events in thousandths of a second and the more accurate

ii. By the Way Nature Works: We know that the sun rises in the east and sets in the west; that water flows downhill, not uphill; that cloud formations indicate specific weather patterns;

iii. By Observation: In courts of law, this would consist of eyewitness testimony. In research, this might consist of a longitudinal study of a phenomenom carried out over a period of 3-5 years involving several hundreds or thousands of cases looking for and recording similarities and differences; and

iv. By Statistics: To note that for the year 1988, crimes of violence in the United States increased 9.2 percent from 1987 -- from 112,598 reported cases to 122,957 (a gain of 10,359 crimes). While this is a hypothetical example, one sees the approach used.

Standards of Judgment to Commitments in an Argument

1. Convention of Bilaterality:

- Argument is explicitly bilateral: it requires at least two people or two competing messages.
- The arguer, implicitly or explicitly, is saying that he or she is presenting a message that can be examined by others.

2. Convention of Self-Risk:

- In argument, there is always the risk of being proven wrong.
- For example, when you argue that a county public school system is preferable to a national or local-based public school system, you invite the possibility that your opponent will convince you that local or neighborhood-controlled schools present fewer bureaucratic problems and more benefits than does county controlled school system.

3. The Fairness Doctrine:

- Our system of government, from the village elders level up to the national level itself, is based upon the "*fairness doctrine*."
- This, in itself, presents the following concept:
  - The idea that debate (argument) ought to be as extended and as complete as possible in order to guarantee that all viewpoints are aired, considered, and defended.
  - In a classroom debate, equal time is given to both sides even if one side chooses not to use all the time allotted, or fails to use all the available time it is up to them.
- This is different, however, from how that time is used, that is, the effectiveness with which a party is able to utilize the time it is given.

4. Commitment to Rationality:

- When you argue or debate, a commitment is made to proceed with logic.
- When you make an assertion, you are saying, "This is what I believe and these are my reasons for that belief."
- As a debater, your commitment is to giving evidence, examples, data in support of your assertion -- reasons that you believe fully support your claim and should be accepted by the audience or the doubtful.
- For example, when you argue that handguns should be banned by law, someone else has the right to say "No" (the convention of bilaterality) and the right to put forth a contrary (i.e., "Con") proposition (the fairness doctrine).
- Furthermore, all parties to the argument -- the doubtful, the audience, the person or parties you are debating with -- have the right to ask, "Why do you believe that?"

The Three Main Parts of an Argument are:

1. **The Introduction**
2. **The Body**
3. **The Conclusion**

The Structure of an Argument

1. Title
2. Introduction
3. Body
4. Conclusion (*and recommendations*)

REASONING

Definition

– It is a realistic and controlled thinking consciously towards solving of a given problem,

OR,

– It is a process of thinking during which the individual is aware of a problem, identifies, evaluates, and decides upon a solution to the problem.

Types of Reasoning

These are:

1. **Deductive reasoning**
2. **Inductive reasoning**

Deductive reasoning:

- It is the ability to draw some logical conclusions from known statement or evidences.
- Here one starts with already known or established generalized statement or principle and applies it to specific cases.
- Also called "deductive logic," this act uses a logical premise to reach a logical conclusion.
- For example, all human beings are mortal you are a human being, therefore, you are mortal.

Inductive reasoning:

- It is a specialized thinking aimed at the discovery or construction of a generalized principle by making use of particular cases, special examples and identifying of elements or relations.
- For example, Mohan is mortal, Radha is mortal, Karim is mortal; therefore, all human beings are mortal.

Critical Thinking

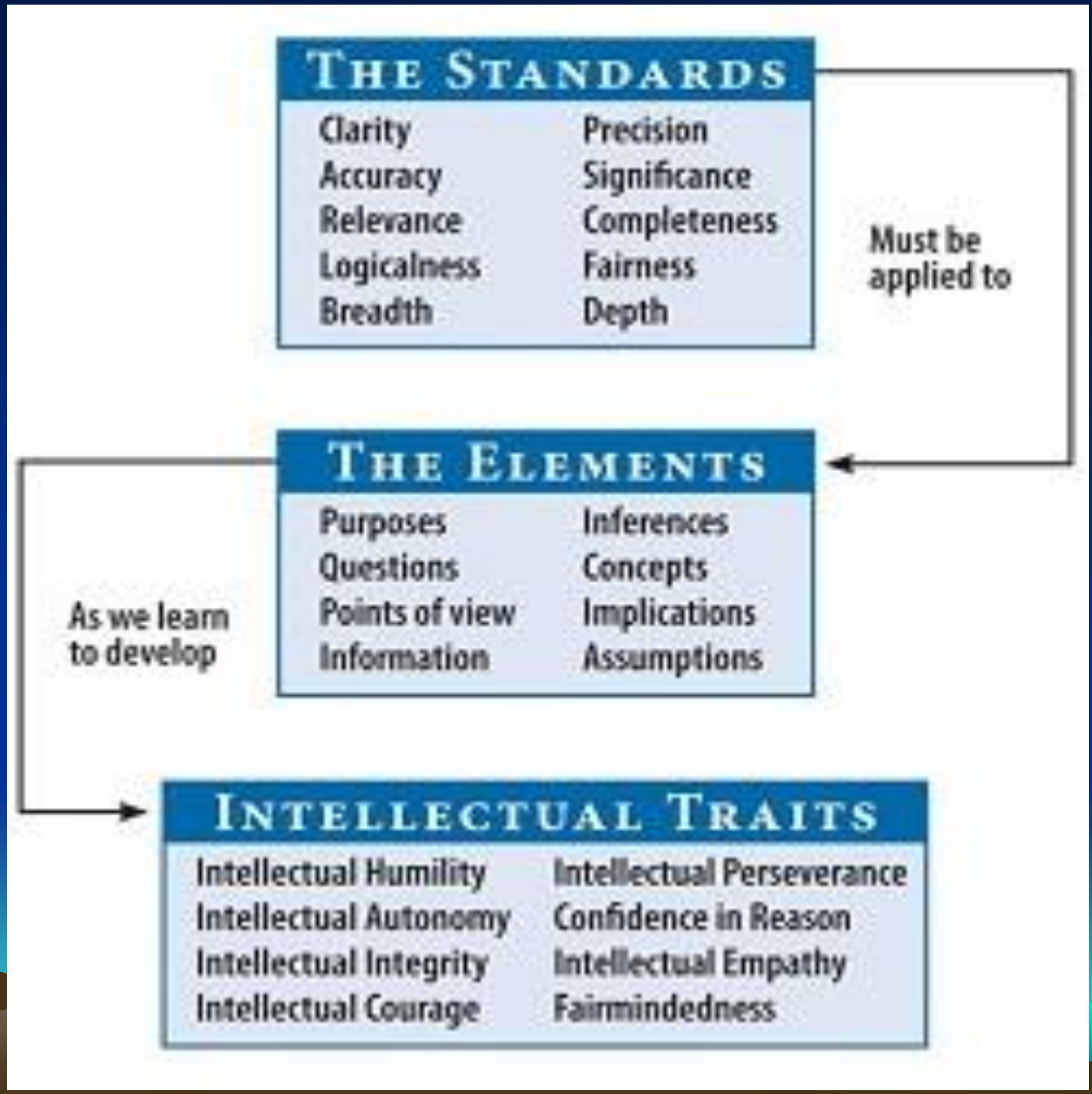
Definition

It is the intellectual process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

The key critical thinking skills

These are:

1. Analysis
2. Explanation
3. Evaluation
4. Open-mindedness
5. Interpretation
6. Reasoning
7. Inference
8. Decision making
9. Self-regulation
10. Problem-solving


THE STANDARDS
Clarity
Accuracy
Relevance
Logicalness
Breadth
Precision
Significance
Completeness
Fairness
Depth
Must be applied to
THE ELEMENTS
Purposes
Questions
Points of view
Information
Inferences
Concepts
Implications
Assumptions
As we learn to develop
INTELLECTUAL TRAITS
Intellectual Humility
Intellectual Autonomy
Intellectual Integrity
Intellectual Courage
Intellectual Perseverance
Confidence in Reason
Intellectual Empathy
Fairmindedness

LITERATURE REVIEW

Definition

- Literature review is a systematic and organized examination of relevant literature whether published or unpublished to discover pertinent issues concerning the study.

- It surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated.

Sources of Literature

- Literature (information) may be obtained from the following sources:
  1. **Primary sources**
  2. **Secondary sources**
  3. **Tertiary sources**
  4. **Others sources:**
     a) Experience
     b) Tradition
     c) Intuition
     d) Authority

1. Primary sources of knowledge:

- A primary source is an original document containing first-hand information about a topic.
- Different fields of study may use different types of primary sources.
- Primary source literature allows researchers to get as close as possible to original ideas, events, and empirical research as possible.
- It includes creative works, first hand or contemporary accounts of events, and the publication of the results of empirical observations or research.
- *Examples of primary sources of literature (information)*:

i. Diaries ii. Interviews iii. Letters iv. Original works of art
v. Photographs vi. Original works of literature viii. Theses
ix. Dissertation x. Research xi. Original speech

2. Secondary sources

- A secondary source contains commentary on or discussion about a primary source.
- The most important feature of secondary sources is that they analyzes, reviews, or summarizes information in primary resources or other secondary resources.
- Even sources presenting facts or descriptions about events are secondary unless they are based on direct participation or observation.
- Moreover, secondary sources often rely on other secondary sources and standard disciplinary methods to reach results, and they provide the principal sources of analysis about primary sources.

i. Biographies ii. Dissertations iii. Indexes iv. Abstracts
v. Bibliographies vi. Journal articles vii. Monographs

•

3. Tertiary sources of literature

These are sources that compile, digest, index, abstract or organize other sources of literature (*largely secondary sources and, to a least extent, primary literature*).

These include:

- Dictionaries - Encyclopaedia - Fact books
- Wikipedia - Directories - Manuals
- Textbooks - Indexing - Abstracts
- Library catalogue - Databases - Research guides
- Digital archives

4. Other Sources of Literature

i. Experience ii. Tradition iii. Intuition iv. Authority

a) Experience

- Is based on information learnt through experience by a person(s) in life-time. For example, a farmer after growing beans for several years may come to the conclusion that beans do best during the season of short rains.
- This conclusion may be based on the fact that yield per acre are higher during the sort rains than during the long rains.

b) Tradition

- All human beings inherit a culture that is a reflection of an adopted system of rules, norms, standards and values.
- The socio-cultural system embodies accepted knowledge of how things are and should be.
- Acquisition of this knowledge is through indoctrination and socialization. Transmitters of cultural knowledge include: Parents, peers, adults, teachers, and the clergy.

c) Authority

- This takes the form of an expert, in a specialized area, giving his opinion on a given issue.
- The acceptance of such an opinion by others depends on the status of the person giving the opinion.
- For example, we are likely to accept that HIV is not transmitted through handshakes if the person stating the fact is a qualified doctor and not an engineer.
- But we may also be misled when we depend on the authority of persons speaking outside their realm of expertise, for example, the popular athlete who states that a certain brand of soap makes your skin soft and smooth in a television commercial.

- As such, authority then may not be a legitimate source of knowledge, particularly because the experts may err in their own special areas or overreach their domain with no one to challenge them.

d) Intuition

- Intuition is the perception, or explanation or insight into a phenomenon by instinct.
- In other words, it is the ability to gain new knowledge without conscious reasoning or rational process.

Purpose of Literature Review

1. Determine what has been done already related to the research problem being studied, thus, avoiding unnecessary and unintentional duplication
2. It forms a framework within which the research findings are to be interpreted.
3. It allows researchers to demonstrate familiarly with the existing body of knowledge thus increasing the researcher's confidence in their professional ability.
4. Reveals strategies, procedures and useful measuring instruments in investigating the problem, hence, avoidance of problems made by earlier researchers.
5. They also help clarify how to apply some procedures in the current study.

6. Suggests other procedures and approaches especially it they will improve the research study.
7. Determines new approaches and stimulating new ideas based on areas overlooked in the past.
8. Determines effective approaches that may be used.
9. Helps to integrate and summarize what is known in an area of study.
10. Enables familiarity with previous studies which is helpful in the interpretation of findings.
11. Suggests other procedures and approaches that need to be applied to make the study successful.
12. Helps the researcher to define, narrow down or limit the research problem, especially on topics that have not been narrowed down.

Scope of Literature Review

It is also important to determine the precise scope of the literature review. For example,

- What exactly will you cover in your review?
- How comprehensive will it be?
- How long? That is, about how many citations will you use?
- How detailed? Will it be a review of ALL relevant material or will the scope be limited to more recent material, e.g., the last five years.
- Are you focusing on methodological approaches; on theoretical issues; on qualitative or quantitative research?
- Will you broaden your search to seek literature in related disciplines?
- Will you confine your reviewed material to English language only or will you include research in other languages too?

Performing Literature Search

Do the following:

1. Develop a research question in a specific subject area
2. Make a list of relevant databases and texts you will search
3. Make a list of relevant keywords and phrases
4. Start searching and make notes from each database to keep track of your search
5. Review the literature and compile all the results into a report
6. Revise your original research question if necessary

Tips on Good Literature Review

- A good literature review will not only summarize the information, but also point out weaknesses in the experimental procedures as well as possible theoretical conflicts.
- It builds on the current knowledge by identifying gaps in the available literature and suggesting future directions for research.

1. Define a topic and audience
2. Search and re-search the literature
3. Take notes while reading
4. Choose the type of review you wish to write
5. Keep the review focused, but make it of broad interest

6. Be critical and consistent
7. Find a logical structure
8. Make use of feedback
9. Include your own relevant research, but be objective
10. Be up-to-date, but do not forget older studies

Importance of Literature Review

In your literature search you will help you to:

1. Discover what statistical knowledge exists related to you research topic
2. Increase your statistical knowledge in your research area
3. Find gaps (and possibly errors) in published research
4. Generate new original ideas (avoid plagiarism)
5. Avoid duplicating results of other statisticians
6. Justify the relevance of your proposed research
7. Sharpen your research focus.

Organization of Literature Review

Different ways to organize your literature review include:

- Topical order (by main topics or issues, showing relationship to the main problem or topic)
- Chronological order (simplest of all, organize by dates of published literature)
- Problem-cause-solution order
- Comparison and contrast order
- General to specific order
- Specific to general order
- Known to unknown order

Steps in Carrying Out Literature Review

1. ***Be very familiar with relevant literature sources***, for example, the library before beginning the literature review.
2. ***Make a list of key words or phrases to guide your literature search***. For example, if the study deals with family conflict, other phrases that could be used to search the literature are 'family violence' or 'abuse', 'family dissolution', separation, divorce etc.
3. ***Using the key words and phrases perform literature search***. Library staff are generally very helpful in offering guidance.
4. ***Summarize the references*** on cards for easy organization of the literature.
5. ***Analyze, organize and report the collected literature as per the study objectives***. Such organization, analysis and reporting represents the hardest part of literature review.

6. ***Make an outline of the main topics or themes in order of presentation***. Decide on the number of headlines and sub-headlines required, depending on how detailed the review is.
7. ***Analyze each reference in terms of the outline made and establish where it will be most relevant***.
8. ***Studies contrary to received wisdom should not be ignored when reviewing literature***. Such studies should be analyzed and possible explanation for the differences given. They should be analysed with a view to accounting for differences of opinion.
9. ***The literature should be organized in such a way that the more general is covered first before the researcher narrows down to that which is more specific to the research problem***. Organizing the literature in this way leads to testable hypotheses.

10. ***You may prefer to have a brief summary of the literature and its implications***. This is however, optional depending on the length of the literature under review.

Referencing and Citation

1. The American Psychological Association (APA)
2. The Harvard citation
3. The Vancouver citation

Referencing

Smith, J. (2002). Power. In R. C. Richardson (Ed.), *The time of the future* (5th ed., Volume 3). Philadelphia, PA: Sage.

The APA Style

Author Rules:

1. Initials are separated and ended by a period eg Mitchell, J.A
2. Multiple authors are separated by commas and an ampersand eg Mitchell, J.A., Thomson, M., & Coyne, R
3. Multiple authors with the same surname and initial: add their name in square brackets eg Mendeley, J. [James].

Date Rules:

1. Date refers to date of publishing
2. If the date is unknown 'n.d' is used in its place eg Mendeley, J.A. (n.d)

Title Rules:

1. The format of this changes depending on what is being referenced.

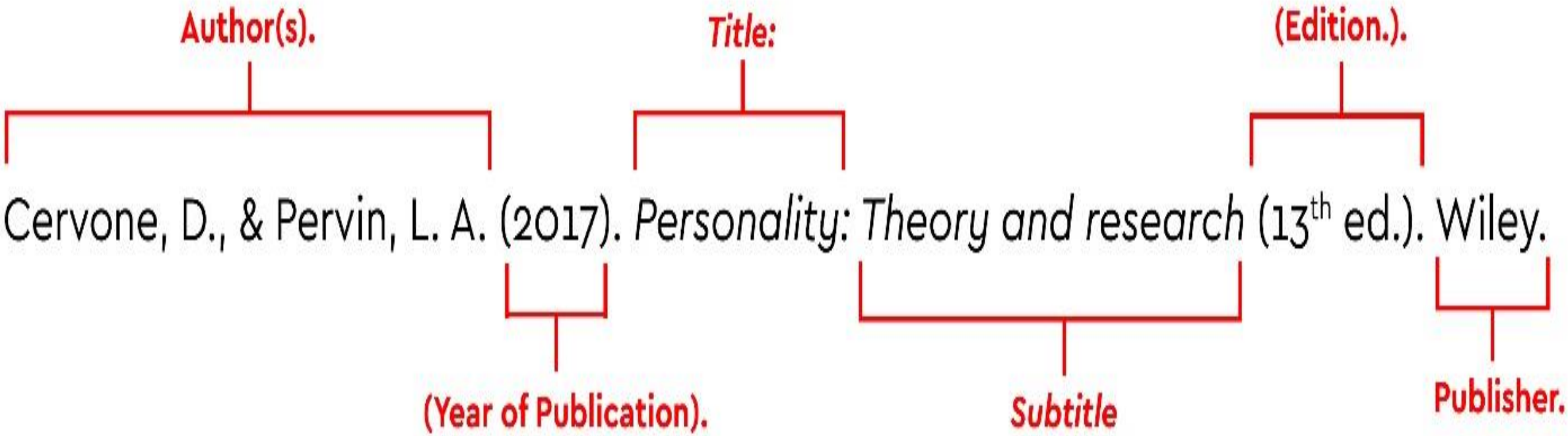
Author's surname, initial(s). (Date Published). Title of source. Location of publisher: publisher. Retrieved from URL

Publisher Rules:

1. If in the US: the city and two letter state code must be stated eg San Francisco, CA
2. If not in the US: the city and country must be stated eg Sydney, Australia

This is used if the source is an online source.

Outline of APA Referencing Style



Citation Examples:

1. According to Gamba, H.A (2019, pg. 24) babies exclusively fed on breast milk for six months experience less episodes of diarrhoea.

2. Studies have shown that babies exclusively fed on breast milk for six months experience less episodes of diarrhoea (Grisco, R.K, 2017).

3. Rallying to restore sanity was a revolutionary undertaking (Stewart & Colbert, 2010).

4. Mitchell, Smith, and Thomson (2017) stated that … Or …(Mitchell, Smith, & Thomson, 2017).

RESEARCH DATA

Definition

Research data is any information that has been observed, collected, generated or created to validate original research findings.

– Although usually digital, research data also includes non-digital formats such as laboratory notebooks and diaries.

Examples of Research Data

- Documents (text, Word), spreadsheets; Laboratory notebooks, field notebooks, diaries; Questionnaires, transcripts, codebooks.
- Audiotapes, videotapes; Photographs, films.
- Protein or genetic sequences; Spectra, Test responses etc.

Types of Research Data

– Data may be grouped into 4 main types based on collection methods:

1. Observational: are captured through observation of a behavior or activity.
2. Experimental: are collected through active experimental intervention.
3. Simulation: are generated by imitating the operation of a real-world process or system over time.
4. Derived: are generated using existing data points, often from different data sources, to create new data from existing formula

Cont…. Types of Research Data

1. **Observational Data**

- Observational data are captured through observation of a behavior or activity.
- It is collected using methods such as human observation, open-ended surveys, or the use of an instrument or sensor to monitor and record information, for example, such as the use of sensors to observe noise levels at the Mpls/St Paul airport.
- Because observational data are captured in real time, it would be very difficult or impossible to re-create if lost.

Cont…. Types of Research Data

2. Experimental Data

- Experimental data are collected through active intervention by the researcher to produce and measure change or to create difference when a variable is altered.
- Experimental data typically allows the researcher to determine a causal relationship and is typically projectable to a larger population.
- This type of data are often reproducible, but it often can be expensive to do so.

Cont…. Types of Research Data

3. Simulation Data

- Simulation data are generated by imitating the operation of a real-world process or system over time using computer test models.
- For example, to predict weather conditions, economic models, chemical reactions, or seismic activity.
- This method is used to try to determine what would, or could, happen under certain conditions.
- The test model used is often as, or even more, important than the data generated from the simulation.

Cont…. Types of Research Data

4. Derived / Compiled Data

- Derived data involves using existing data points, often from different data sources, to create new data through some sort of transformation, such as an arithmetic formula or aggregation.
- For example, combining area and population data from the Twin Cities metro area to create population density data.
- While this type of data can usually be replaced if lost, it may be very time-consuming (and possibly expensive) to do so.

RESEARCH METHODOLOGY

Definition

Research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic.

- In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability.

- PTO: For definitions of validity and reliability of research.

Cont…. Research Methodology

Validity

- The extent to which the results really measure what they are supposed to measure.
- By checking the consistency of results across time, across different observers, and across parts of the test itself.

Reliability

- The extent to which the results can be reproduced when the research is repeated under the same conditions.
- By checking how well the results correspond to established theories and other measures of the same concept.

RESEARCH DESIGN

Definition

- It is a framework of methods and techniques chosen by a researcher to combine various components of research in a reasonably logical manner so that the research problem is efficiently handled using a particular methodology. ***OR***,

- It is the overall strategy a researcher chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring effective handling of the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data. ***OR***,

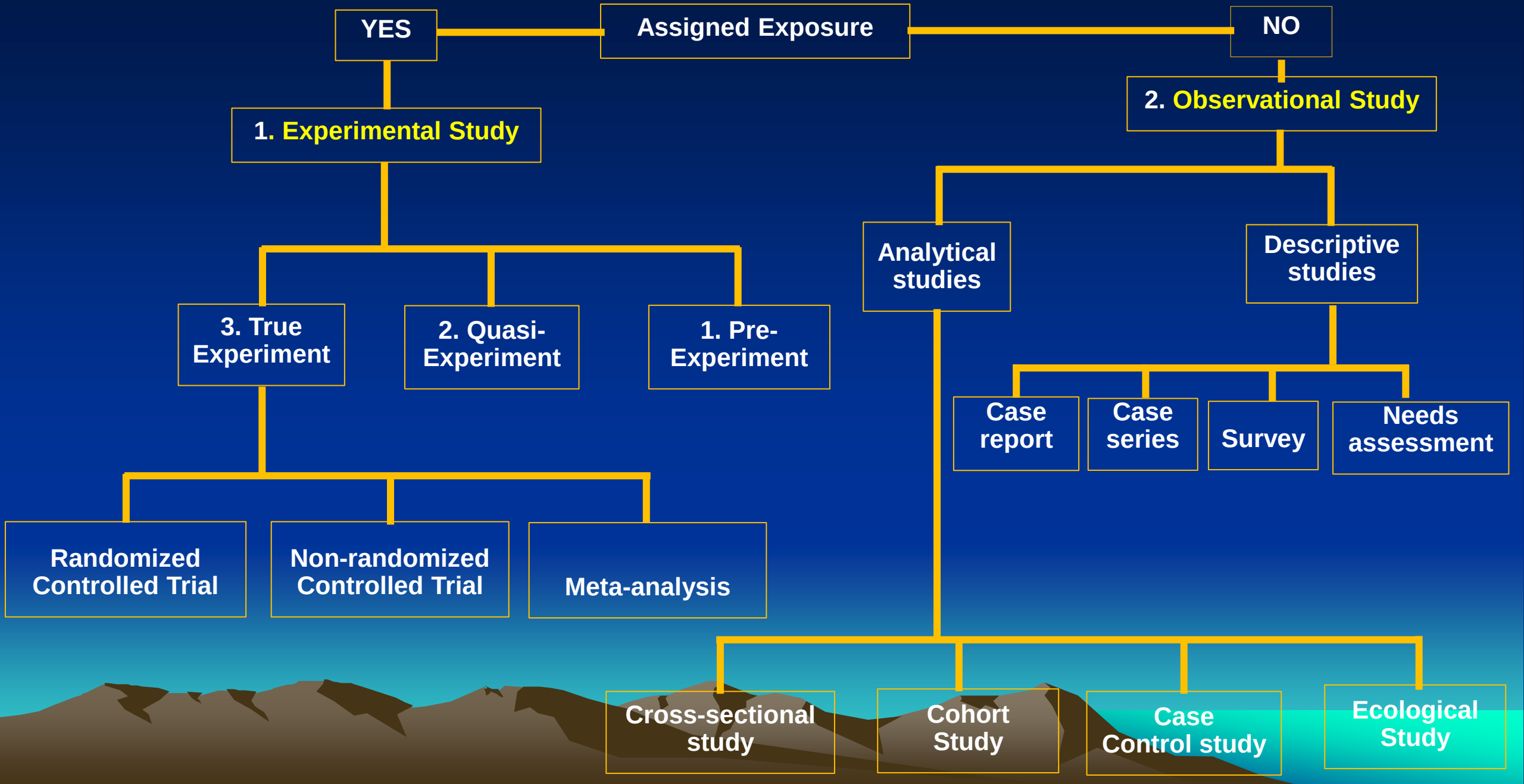
- A study design is a specific plan or protocol for conducting the study, which allows the investigator to translate the conceptual hypothesis into an operational one.

Cont…. Research Design

- ✓ The design of a research topic is used to explain the type of research (e.g experimental, survey, correlational, semi-experimental, review) and also its sub-type (experimental design, descriptive case-study).

- ✓ An impactful research design usually creates minimum bias in data and increases trust on the collected and analyzed research information. Research design which produces the least margin of error in experimental research can be touted as the best.

TYPES STUDY DESIGNS



EXPERIMENTAL STUDY

- Generally involves random assignment of subjects to groups
- Treatment and exposures occur in a "*controlled*" environment
- Planned research designs
- Clinical trials are the most well known experimental design.
- Investigator can "control" the exposure akin to laboratory experiments except living populations are the subjects.
- The ultimate step in testing causal hypotheses
- It is vital to test new ideas or theories.
- Experimental research allows you to test your idea in a controlled environment before taking it to market.
- It also provides the best method to test your theory

1. Randomized Controlled Trial

- A design with subjects randomly assigned to “treatment” and “comparison” groups.
- Provides most convincing evidence of relationship between exposure and effect.
- Not possible to use RCTs to test effects of exposures that are expected to be harmful for ethical reasons.
- The “*gold standard*” of research designs is RCT.
- Provides most convincing evidence of relationship between exposure and effect.
- Trials of hormone replacement therapy in menopausal women found no protection for heart disease, contradicting findings of an earlier study.

Disadvantages of RCT studies

- Expensive
- It may be unethical to assign persons to certain treatment or comparison groups

2. Non-Randomized Controlled Trial

- An experimental study in which people are allocated to different interventions using methods that are not random. *OR*,
- A clinical trial in which the participants are not assigned by chance to different treatment groups.
- Participants may choose which group they want to be in, or they may be assigned to the groups by the researchers.

Meta-analysis

- Meta-analysis is a statistical analysis of a collection of studies.
- Meta-analysis methods focus on contrasting and comparing results from different studies in different studies in anticipation of identifying consistent patterns and sources of disagreements among these results.

Advantages of RCT studies

- Ability to randomize subjects
- Temporal sequence of cause and effect
- Can control extraneous variables
- Best evidence of causality

TYPES OF EXPERIMENTAL RESEARCH STUDIES

1. **Pre-experimental design**
2. **True experimental design**
3. **Quasi-experimental design**
4. **Other Types of Experimental Study**
   a) Field trials
   b) Community trials
   c) Animal studies

Pre-experimental Research Design

- A group, or various groups, are kept under observation after implementing factors of cause and effect.
- You'll conduct this research to understand whether further investigation is necessary for these particular groups.
- You can break down pre-experimental research further in three types:
  1. One-shot Case Study Research Design
  2. One-group Pre-test-posttest Research Design
  3. Static-group Comparison

Quasi-experimental Research Design

- The word "*Quasi*" indicates similarity.
- A quasi-experimental design is similar to experimental, but it is not the same because it is not really a true experiment.
- The difference between the two is the assignment of a control group.
- In this research, an independent variable is manipulated, but the participants of a group are not randomly assigned.
- Quasi-research is used in field settings where random assignment is either irrelevant or not required.

True Experimental Research Design

- True experimental research 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 experiment, three 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 which can be manipulated by the researcher
- Random distribution
- This experimental research method commonly occurs in the physical sciences.

CHARACTERISTICS OF RESEARCH DESIGN

These are:

1. Neutrality
2. Reliability
3. Validity
4. Generalization

Cont….. Characteristics of Research Design

1. Neutrality

- The results projected in research design should be free from bias but remain neutral.
- Understand opinions about the final evaluated scores and conclusion from multiple individuals and consider those who agree with the derived results.

Cont….. Characteristics of Research Design

2. Reliability

- If a research is conducted on a regular basis, the researcher involved expects similar results to be calculated every time.
- Research design should indicate how the research questions can be formed to ensure the standard of obtained results and this can happen only when the research design is reliable.

Cont….. Characteristics of Research Design

3. Validity

- There are multiple measuring tools available for research design but valid measuring tools are those which help a researcher in gauging results according to the objective of research and nothing else.
- The questionnaire developed from this research design will be then valid.

Cont….. Characteristics of Research Design

4. Generalization

- The outcome of research design should be applicable to a population and not just a restricted sample. Generalization is one of the key characteristics of research design.

ESSENTIAL ELEMENTS OF RESEARCH DESIGN

These are:

1. Has accurate purpose statement of research design
2. Provides techniques to be implemented for collecting data for research
3. Shows methods applied for analyzing collected data
4. Defines type of research methodology
5. Gives probable objects for research
6. Describes settings for research study
7. Defines timelines for the study
8. Defines measurement of analysis

IMPORTANCE OF A GOOD RESEARCH DESIGN

Sound design will do the following things:

1. Identify the research problem clearly and justify its selection,
2. Review previously published literature associated with the problem area,
3. Clearly and explicitly specify hypotheses [i.e., research questions] central to the problem selected,

Cont….. Importance of a Good Research Design

4. Effectively describe the data which will be necessary for an adequate test of the hypotheses and explain how such data will be obtained, and
5. Describe the methods of analysis which will be applied to the data in determining whether or not the hypotheses are true or false.

STUDY AREA (SETTING)

Definition

The research setting is the physical, social, experimental context and cultural site in which the researcher conducts the study.

- In describing the setting of the study, note any aspects related to the environment in which the study is being conducted.
- The study setting can be non-contrived (natural) or contrived (unnatural controlled) depending on the type of study.

Types of Settings

These consists of:

1. Physical environment
2. Social context
3. Experimental context
4. Cultural site

Types of study settings

Non-contrived

- This is a natural setting where research is conducted.
- Field experiment, e.g., are the rates of interest related to extent of deposits?

Contrived

- This is a controlled (unnatural environment) setting where the study is conducted.
- Independent variable changed (manipulated) to see effect on the dependant variable.
- Lab experiment e.g., to study relationship between mosquito bites and incidence of filariasis in animal studies.

STUDY SETTING: CONTRIVED AND NONCONTRIVED

Noncontrived settings: If organizational research be done in the natural environment where work proceeds normally, the research is in noncontrived settings.

contrived settings: If organizational research be done in artificial environment the research is in contrived settings.

Correlational studies are invariably conducted in noncontrived settings, whereas most rigorous causal are done in contrived lab settings.

CONTRIVED AND NONCONTRIVED SETTINGS

- **FIELD STUDY:** If various factors are **examined in the natural settings in which daily activities going on** as normal with minimal researcher interference, the study is field study **(noncontrived).**
- **FIELD EXPERIMENT:** If cause and effect relationships are **studied with some amount of researcher interference, but still in the natural settings where work continues in the normal environment,** the study is field experiment **(contrived).**
- **LAB EXPERIMENT:** If the researcher explores cause and effect relationship not only **exercising a high degree of control but in an artificial and deliberately created settings (contrived).**

STUDY POPULATION

Define

- The study population is a group of individuals selected on the basis of inclusion and exclusion criteria which relate to the variables being studied.
- It is the population from which the sample population will be randomly or purposively selected for the study.
- The group of individuals in a study. In a clinical trial, the participants make up the study population. The study population might, for example, consist of all children under 2 years of age in a community.

- For instance you want to study a population diagnosed with diabetes Type 2 , inclusion criteria are that they will be females aged between 40 and 60 years in a particular study area.
- From these you will take a random or purposive sample.
- This is not the population at risk of diabetes, which is much larger, it is also not the actual sample of people who will be studied - it is the study population from which the sample will be selected.

Importance of studying a population

- Population studies helps us understand the processes that influence the size, growth, characteristics, and distribution of human population.
- By analyzing birth rates, death rates, immigration patterns and actuarial tables of life expectancy, we hope to explain past trends and accurately predict the future.

TARGET POPULATION

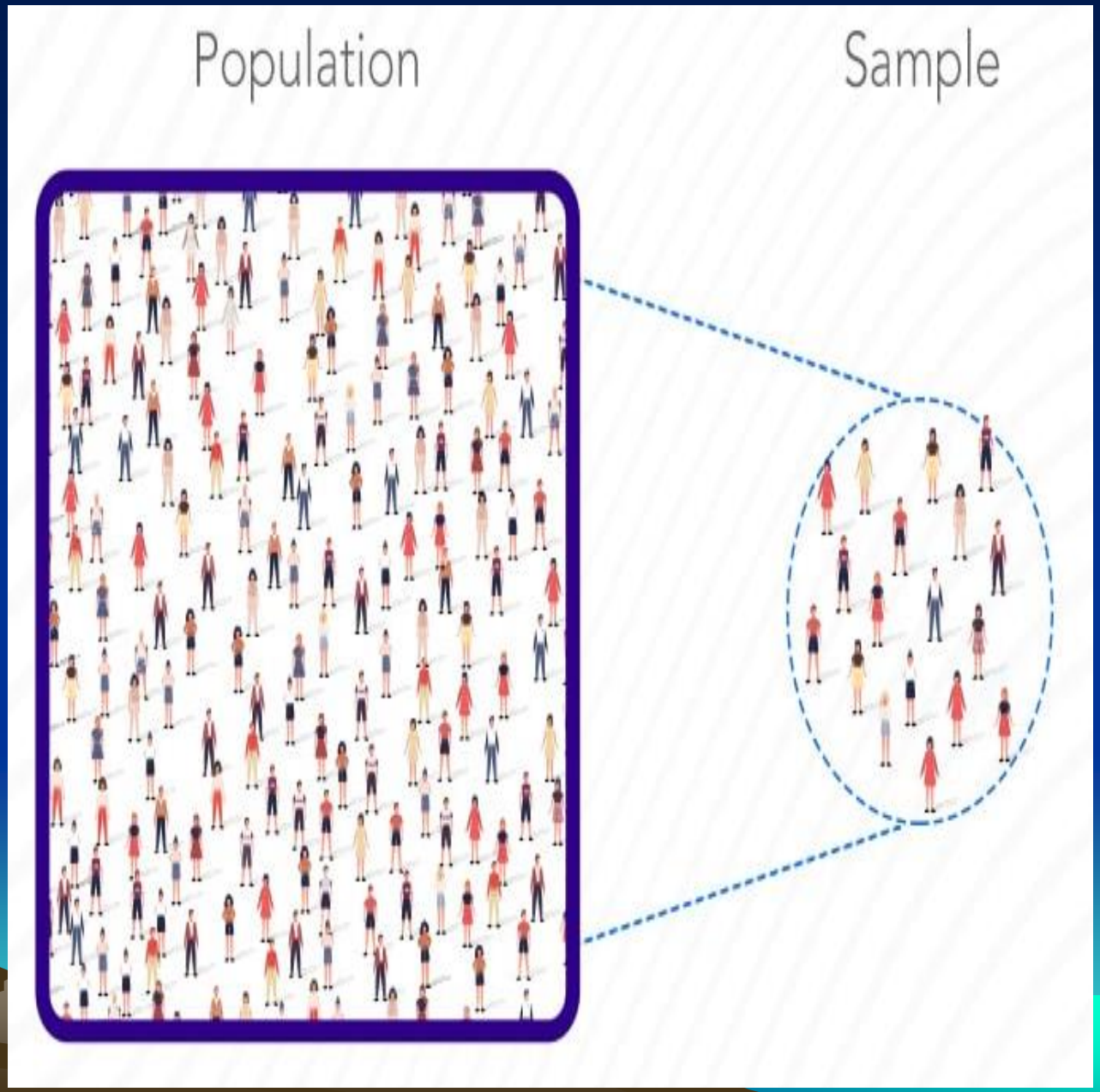
Definition

- Your target population is the group you want to know more about. Target population is an informal term used mostly in epidemiology. It It is general defined to mean a group or set of elements that you want to know more information about.
- In some types of research the target population might be as broad as all humans, but in other types of research the target population might be a smaller group such as teenagers, pre-school children or people who misuse drugs.
- The target population is the group of individuals that the intervention intends to conduct research in and draw conclusions from.
- The target population for a survey is the entire set of units for which the survey data are to be used to make inferences. Thus, the target population defines those units for which the findings of the survey are meant to generalize.

SAMPLING

Definition

- It is the action or process of taking a small group (sample) of the study population for analysis.
- A sample is defined as a smaller set of data that a researcher chooses or selects from a larger population by using a pre-defined selection method.



Types of Samples (Sampling)

There are two key (main) sampling methods, namely:

1. **Probability sampling methodologies**

2. **Non-probability sampling methodologies**

Probability Sampling Methodologies

- Involves creating a sample that is drawn from the population following probability principles (randomly selected subjects/units).
- Each element have a known and non-zero probability of selection.
- It provides an efficient system of capturing, in a small group, the variations or heterogeneity that exist in the target population.
- It provides a representative sample for the study.
- It allows the use of statistical inference from data collected i.e. allows generalizability to a larger population with a margin of error that is statistically determinable.
- It is when conducting a quantitative study.

Cont… **Probability Sampling Methodologies**

When to use Probability Sampling

- Desire is to make statistically valid inferences from the sample population to a larger population (usually the case in quantitative data collection exercises such as household surveys).
- Measuring a non-subjective indicator either between places, sub-groups, or over time.
- Key programmatic decisions are to be made based upon survey data, especially when issues involved are controversial.

Cont… **Probability Sampling Methodologies**

Probability Sampling Methods

These are five, namely:

1. Simple Random Sampling
2. Systematic Sampling
3. Stratified Sampling
4. Cluster Sampling
5. Multi-stage Sampling

Simple Random Sampling

- This is referred to as the “Gold Standard “of all the methods as it yields the best results in any study.
- Is a sampling scheme with the property that any of the possible sub-sets of the n (desired sample) distinct elements from the N (population) elements is equally likely to be the chosen sample – i.e.
  - All the elements in a population have equal chance of being selected to participate in the study.

Cont… Simple Random Sampling

Operational procedure:

i. Determine the sample size statistically.
ii. Assign numbers to all the subjects in the study population starting with 1,2,3,4, and so on.
iii. Then select at random the numbers (subjects to participate in the study), from a table of random numbers until the desired sample size is attained.
iv. Interviewed only the numbers (subjects) selected. This constitutes the sample (n) for study.
   - These numbers can be obtained from table of random numbers or generated by a computer programme, or
   - Sometimes lottery method (random draw) may be used in Basic research but not others.

Cont… **Simple Random Sampling**

Lottery Method

- This is an aspect of Simple Random Sampling technique but it is not a" Gold Standard" since the subject in the population do not have equal chances of participating in the study.

Operational Procedure

1. Make the several pieces of papers marked either "Yes" or" No"
2. Put the pieces of paper in a bag/basket
3. Go to the subject or ask them to pick papers from the bag randomly out seeing

- Interview only the subjects who have picked papers marked "Yes"

Systematic Random Sampling

- Is a widely used sampling method.
- It entails the selection of every Kth element in a sampling frame following a random start.
- All the elements in a population have equal chance of being selected to participate in the study.

Operational procedure:

1. Identify the pop of study
2. List the population BY 1, 2, 3, 4, 5, …….
3. Determine the required sample size
4. Calculate the sampling interval (SI) = N / n = K^{th}
5. Select a random start (RS) between 1 and K^{th}. This is the first sample element.

Cont… **Systematic Random Sampling**

6. Add K^{th} to the RS. This is the second sample element.
7. Continue adding the SI to the sum of the previous step and selecting the corresponding element until the sampling frame has been exhausted.

Example:

- Assume that we have a population that has only N = 100 people in it and that you want to take a sample of n = 20 (having been statistically determined as the desired sample size).
- To use systematic sampling the population must be enlisted in a systematic order.
- In this case:

Cont… **Systematic Random Sampling**

1. SI = N/n = 100/20 = 5 (K^{th}).
2. Choose a random start between 1 and 5 e.g. 4 then begin
3. Four (4) I s first subject in the selection.
4. Keep on adding the K^{th} (5) to the next number until the sampling frame is exhausted or the desired sample is obtained.

Stratified Random Sampling

- The goal Stratified Random Sampling is to achieve desired representation from various sub-groups in the population.
- The subjects are selected in such a way that the existing subgroups in the population are more or less reproduced in the sample. This means that the sample will consist of two or more subgroups (strata).
- The criterion for stratification must first be decided by the researcher e.g. by age, sex, level of education, all persons in a city block, a family, socio-economic status.
- Within each strum, the subjects are selected by probability proportional to size or equal using SRS or Systematic sampling technique.

Stratified Random Sampling

Operational procedure:

i. Identify the population

ii. Define criterion for stratification

iii. List the population according to the defined strata or subgroups.

iv. Determine the required sample size and the appropriate representation in each stratum. This can be proportionate or equal.

v. Select using random numbers, an appropriate number of subjects for each stratum.

Cluster Sampling

- This is also known as one-stage cluster sampling.
- Is the selection of sample clusters or groups of elements.
- It is used when it is not possible to obtain a sampling frame because the population is either very large or scattered over a large geographical area.
- The clusters must be randomly selected.
- A cluster may include: hospitals, churches, villages, schools, towns, city estates etc.
- The clusters selected must have similar characteristics.
- All the elements in the selected clusters are included in the study.
- It is not commonly used as it has a larger design effect (deft – which increase overall sample size well beyond that which is necessary).

Multi-Stage Sampling

- Is also known as two-stage (or more clusters) sampling.
- There is more than one type of sampling units.
- It is a process of selecting successively smaller clusters until a sample of desired element is obtained.

Example:

- Consider a sampling process for children aged 1 – 5 years in a district.
- The first or primary stage could be parishes.
- The first sampling frame could be of all the parishes in the district.
- A random sample of parishes would be drawn.

Cont… Multi-Stage Sampling

- Then for each selected Parish a random sample of the children is chosen.
- The children form the second-stage or secondary sampling units.
- Other factors remain as for cluster sampling above.

Operational procedure:

i. Identify the population.
ii. Define the cluster forming the population.
iii. Determine the required sample size.
iv. List all the clusters in a random order and select as follows:

a) Select the Primary Sampling Units (PSU) – Sampling unit listed in the sampling frame (usually the smallest unit for which a relatively complete frame exists), often villages, etc.

Cont… Multi-Stage Sampling

b) Select the Secondary Sampling Units (SSU) – Sampling units listed within the PSU's that are chosen in the second stage of sampling selection e.g. homes etc.

c) Select the Ultimate Sampling Units (USU) – Sampling units within the SSU's that are chosen at the final stage of sample selection e.g. households. Elementary units (for example, females of reproductive age) are then randomly selected.

NON-PROBABILITY SAMPLING METHODOLOGIES

- It is also known as biased sampling.
- Involves selecting judgementally representative or non-random sample from the study population.
- The subjects within the study population do not have equal chances of being selected to participate in the study.
- The sample selected from the study population is not statistically representative and, therefore, the study findings cannot be generalized.
- Most qualitative studies use non-probability samples because the focus is on in-depth information and not making inferences or generalizations.

Cont…. NON-PROBABILITY SAMPLING

When to use Non-Probability Sampling

- Conducting Participatory Rural Appraisal (PRA) or other qualitative research methods
- Cost or time limits the number of households, sites, or individuals to be visited to below the number that would yield a result with acceptable statistical parameters.

Non-Probability Sampling Methods

- In the non-probability sampling techniques, the sample drown from the population may not necessarily have to be representative of the parent population.
- **The Non-Probability techniques:**

1. Accidental/ haphazard/Convenient sampling
2. Purposive sampling
3. Modal instance sampling
4. Expert sampling
5. Quota sapling
6. Snow balling
7. Participatory Rural Appraisal (PRA)/ Rapid Rural Appraisal (RRA)
8. Observation: Participant or Non-participant observation

ACCIDENTAL SAMPLING

This is also referred to as convenient sampling or haphazard.

- This sampling method is rarely used by researchers in conducting studies.
- It involves interviewing non-sampled persons, for example, in a city street to get quick (although non-representative) reading of public opinion.
- It involves selection of cases or units of observation as they become available to the researcher.
- Example: a radio programme may ask a few questions to radio listeners and tell the give instant answers or take the answers to a specific place.

- Such a sample is known as convenient sample and biased because only those people with radios (and listen to them) will answer.
- The use of anecdotal evidence in evaluation research would also fall under this category if the person giving the evidence/information is not purposively sought. In some research context, we sample simply by asking for volunteers.
- Clearly, the problem with all of these types of samples is that we have no evidence that they are representative of the populations we are interested in generalizing to.
- In many cases we may clearly suspect that they are not representative.

PURPOSIVE SAMPLING

- In purposive sampling, we sample with a purpose in mind.
- This technique allows the researcher to cases that have the required information with respect to the objectives of study.
- Cases of subjects are therefore hand picked because they are informative or they posses the required characteristics.
- The criterion for selecting the subjects to participate in the study must be clearly stated.
- For example, a particular age range, religious sect, or educational level.

- Within a purposive sample, you are likely to get the opinions of your target population, but you are also likely to overweight subgroups within the population that are more readily accessible.

MODAL INSTANCE SAMPLING

- In statistics, the mode is most frequently occurring value in a distribution.
- Therefore, in sampling when we do a modal instance sample, we are sampling the most frequent case(s), or the ‘typical’ case.
- Problem: How do we know what the ‘typical or ‘modal’ case is?
- It also not clear that using the average of these is the best approach.
- Clearly, modal instance sampling is only sensible for informal (not officially prepared or sanctioned; suitable for casual or everyday situations) sampling context.

EXPERT SAMPLING

- Is the sampling of persons with known or demonstrable expertise and experience in some area. Often, such a sample is convened under a ‘panel of experts’ or ‘key informants’.
- Rationale:
  - It would be the best way to elicit the views of persons who have specific expertise. This makes expert sampling a subset of purposive sampling.
  - To provide evidence for the validity of another sampling approach you have chosen e.g., justifying why modal instance was used if you do not want to be criticized you can convene an expert panel to examine your modal definitions and comment on the appropriateness and validity.

QUOTA SAMPLING

- Quota means – a proportional share of something that somebody should contribute or receive or; a maximum number or quantity that is permitted or needed.
- The subjects are selected from the study population randomly according to some fixed quota.

Types of Quota Sampling

Proportional Quota Sampling

- This is used when there is need to present major characteristics of a population by sampling a proportional amount (quotas) of each subgroups.

- For example, if a population consists of 40% women and 60% males, and a total sample size of 100 is required for the study, both males and females would therefore be sampled proportional to their size within the population, that is, 40 women and 60 men.
- The specific characteristic (s) on which the quota is based must be stated, for example, gender, education, race, religion etc.

- **Non-Proportional Quota Sampling**

- This is a bit less restrictive as the researcher specifies the minimum number of sampling units in each category.

- The researcher is not concerned with numbers that match the proportions in the population.
- Instead he simply want enough to assume that he will be able to talk about even small groups in the population.
- This method is the version of non-probability of stratified sampling in that it is typically used to assure that smaller groups are adequately represented in the sample.

HETEROGENEITY SAMPLING

- It is also known as sampling for diversity.
- Is done when we want to include all options or view, but the concern is not about representing the views proportionately.
- Diversity (heterogeneity) sampling may be used in some form of brainstorming or nominal group processes because the primary interest is in getting broad spectrum of ideas, not identifying the ‘average’ or ‘modal instance’ ones.
- In effect it is the ideas being samples and not people.
- The imagination is that there is a universe of possible ideas relevant to some topic and that we want to sample this population, not population of people but ideas.
- Clearly, in order to get all of the ideas, and especially the ‘outlier’ or ‘unusual ones’, we have to include broad and diverse range of participants.
- Heterogeneity sampling, in this sense, is almost the opposite of modal instance sampling.

SNOWBALL SAMPLING

- In this method, initial subject with the desired characteristics is identified using purposive sampling technique.
- The identified subject name others that he/she knows have the required characteristics until the researcher gets the number of cases desired.
- This method is useful when the population with the desired characteristic is not well known and there is need to find subjects.
- Example: The researcher wants to conduct a study in a location on women who delivered within the last two weeks. He would first identify 1, 2, or 3, then each one of these will lead him to the next woman with infant in the specified time limit.

SAMPLE SIZE DETERMINATION

Qualitative Research

- In the qualitative research, the researcher decides the sample size without using statistical or mathematical formula.
- He/she decides the number of people to select and interview based on resources available and to an extent the number of cases available for the study.

Quantitative Research

- In the quantitative research, the researcher must use an appropriate statistical formula to derive the sample size depending on the type of design and sampling method to be used to allow generalizability.
- ***For example:*** Fisher's (1991) formula (Mugenda & Mugenda, 2003):

$$n = \left(\frac{z^2\, pq}{d^2} \right)$$

Where:

n	=	Desired sample size when **N** is greater than 10,000.
z	=	Standard normal deviate usually set at 1.96 corresponding to the 95% confidence level.
p	=	Proportion of the study population estimated to have a particular characteristic. If this is unknown, then use 50% equivalent to will be 0.5
q	=	1- p
d^2	=	Is the degree of accuracy required in the study, in this case 0.05.

- Therefore,

$$n = \left(\frac{1.96^2 \times 0.5 \times 0.5}{0.05 \times 0.05} \right) = 384.16 \text{ (or } 385\text{)}$$

- To ensure adequate sample size for the study, always add 10% for non-response, that is: (385 ÷ 100) x 10 = 39 respondents.
- The final sample size when the population is greater than 10,000 is: 585 + 39 = **424** respondents.
- However, where the study population is less than 10,000 people (or units), then use the formular below (next slide):

– nf = $\left(\frac{n}{1 + \frac{n}{N}} \right)$

– Where:

nf = The desired sample size where N is less than 10,000.

n = Is the calculated sample size where N is more than 10,000.

N = Is the study population, in this case, 300 Ca. cervix patients being seen at SOPC, KTRH.

– Therefore:

nf = $\left(\frac{385}{1 + \frac{385}{300}} \right)$

= 169 Plus 10% for non-response, (**169** + **17**) = **186** respondents.

DATA

Definition

- Data are facts and statistics collected together for reference or analysis to inform reasoning or factual decision making.
- Research data, unlike other types of information, is collected, observed, or created, for purposes of analysis to produce original research results.

Types of Data

1. **Primary Data:** Are facts are collected a fresh and for the first time and, thus, happen to be original in character.
2. **Secondary Data:** Are facts which have been collected by someone else and which have already been processed, published or unpublished.

DATA sources

PRIMARY SOURCES	SECONDARY SOURCES		
	INTERNAL SOURCES (Private documents)	EXTERNAL SOURCES (Public documents)	
		Published Sources	Unpublished Sources
People, objects, programmes, institutions, etc	➢ Biographies ➢ Diaries ➢ Letters ➢ Memories	➢ Journals & magazines ➢ Newspaper ➢ Government reports ➢ Statistical abstracts ➢ Census reports ➢ Mass communication ➢ Communication reports	➢ Unpublished thesis ➢ Unpublished dissertation and reports ➢ Officials or patients record

METHODS OF DATA COLLECTION

S.NO.	TYPES OF METHODS/ TECHNIQUES	TOOLS FOR DATA COLLECTION
1.	Interview	➢ Interview Schedule ➢ Opinionnaire
2.	Questioning	➢ Questionnaire ➢ Opinionaire ➢ Attitude Scale/ Composite Scales (Likert Scale/ Semantic Differential Scale) ➢ Visual Analogue Scale
3.	Observation	➢ Rating Scales ➢ Checklists ➢ Anecdotes ➢ Videotapes/ Films ➢ Closed Circuit TV
4.	Biophysiological Methods	➢ In Vivo Biophysiological Methods ➢ In Vitro Biophysiological Methods
5.	Other Methods	➢ Projective Techniques ➢ Q-Sorts ➢ Vignettes

DATA COLLECTION METHODS

- Research data may be collected using any or combination of the following data collection methods:

1. Interviews
2. Questionnaires and surveys
3. Observations
4. Documents and records
5. Focus groups discussion
6. Oral histories

NB: In your study groups read and make brief notes on the above.

Data Collection Tools

What is a Good Questionnaire?

A good data collection tool (questionnaire) must be:

1. Valid
2. Reliable
3. Interesting
4. Succinct

1. Valid

- A valid questionnaire should ask what it intends to ask, i.e. the questions should be phrased in such a way that the respondent understands the objective of the question.
- To achieve this, the questionnaire should be reviewed by the “content expert” during the pilot test (e.g. if the target respondent is a diabetic patient, then a diabetic patient should comment whether he understands the questionnaire).
- Any uncertainties and queries should be clarified till the question is clearly understood.

2. **Reliable**

- A reliable questionnaire should yield the same answer if the same question is posed to the respondent repeatedly in a short span of time.
- This can be achieved by performing a “test-retest”, i.e. administer the same questionnaire to the respondent a second time and check for consistency of the answer.
- Any discrepancy in the answers could be due to lack of clarity of the questions and this should be reviewed and rephrased.

3. **Interesting**

- An interesting questionnaire is more likely to be completed by the respondent and hence yields a better response rate.
- This requires the researcher to put some thoughts into asking questions that are relevant to the respondent and in a logical sequence.

4. Succinct

- A succinct questionnaire asks questions that aim to answer only the research objectives.
- Any questions beyond the scope of the research should be excluded.
- It is common for researchers to “cast the net wider” so that they will collect more data, regardless of whether these data are important or not. This should be avoided.
- This usually happens when the researcher has not properly thought through the research objectives.
- It runs the risk of asking too many questions and the questionnaire runs into many pages.

Guideline in Constructing Questionnaire

1. Use the questionnaire for important topic
2. Give question that can’t be found or answered from other media
3. Focus items on a single topic or idea in short question.
4. Arrange in good order
5. Make the questionnaire attractive and brief
6. Word questions as clearly as possible
7. Avoid leading question
8. Organize items from general to specific
9. Avoid or carefully word items that are potentially controversial or embarrassing

10. Number all items and pages
11. Give you’re your identity in the questionnaire
12. Prepare form to pretest review of the questionnaire
13. Use examples if items format is unusual
14. Avoid the important question in the end of questionnaire
15. Avoid to use term “questionnaire or checklist”, use the other popular name

DATA PROCESSING

Definition

- The collection and manipulation of items of data to produce meaningful information, *OR*,
- It is the method of collecting raw data and translating it into usable information.

Stages of Data Processing

1. **Editing**
2. **Coding**
3. **Classification**
4. **Tabulation**

Data Editing

- Editing is the careful scrutiny of data to ensure that the data are accurate and free of errors as far as possible.
- Editing helps to:
  i. Gather the correct data
  ii. Ensure collected data is relevant and appropriate data
  iii. Examine the data to find errors and modify
  iv. Ensure that the information provided is accurate
  v. Establish the consistency of data
  vi. Determine whether the data are complete
  vii. Obtain the best possible data available.

Data Coding

- It refers to the process of assigning numerals or other symbols to responses so that the response can be put into a limited number of category.
- This is helpful when sample size is large and question consists large no of sub-items
- Coding decisions are considered while developing or designing the questionnaire or any other data collection tool.
- Coding can be done manually or through computer software.

- Data coding:
- Is necessary for efficient analysis of the data collected
- Helps to organize data using codes
- Structures the data into coded form for consistent analysis.
- It facilitates interpretation of analysed data.
- Facilitates translation of analysed data into numerical values.

Data Classification (Distribution)

- This may be done quantitatively, for example, the use of:
  1. Frequency distribution
  2. Percentage distribution
  3. Cumulative distribution
  4. Statistical distributions
- It may also be done qualitatively, for example:
  1. People's opinion on eating of eggs by pregnant women.
  2. Beliefs on pre-marital sex by young people.
  3. Attitudes relating to substance use and abuse.

Data Tabulation

Definition

- Tabulation is the orderly and systematic presentation of numerical data in a form designed to elucidate the problem under consideration using a table.
- Simply put: It is the use of tables to illustrate (present) the data.
- Tabulation makes data set concise, logical, orderly arranged in a columns and rows.

Importance of tabulation of data

- Helps to present an overall view of findings in a simpler way.
- Identifies trends in the collected data set.
- Displays relationships in a comparable way between parts of the findings
- Conserves space and reduces explanatory and descriptive statements to a minimum.
- Facilitates the process of comparison between data sets.
- Provides a basis for various statistical computations during analysis.

DATA ANALYSIS

Definition

- *It refers to the act of categorising, ordering, manipulating, and summarizing of data to obtain answers to research question(s), OR,*
- *It is the examination of a set of data to draw conclusions about the information to be able to make decisions or expand the knowledge on various subjects.*

The purpose of Data Analysis

This is to answer the research question(s) and to help determine the trends and relationships among the variables.

Importance of Data Analysis

- Data analysis is important in business to understand problems facing an organisation, and to explore data in meaningful ways.
- Data in itself is merely facts and figures.
- Data analysis organises, interprets, structures and presents the data into useful information that provides context for the data.

Steps in Data Analysis

Before data collection

The researcher should accomplish the following:

- Determine the method of data analysis
- Determine how to process the data
- Consult a statistician
- Prepare dummy tables

After Data Collection

- Process the data
- Prepare tables and graphs
- Analyze and interpret findings
- Consult again the statistician
- Prepare for editing
- Prepare for presentation

METHODS OF DATA ANALYSIS

There are two kinds (methods) of data analysis:

1. Descriptive Analysis
2. Inferential Analysis

Descriptive Analysis

- Refers to the description of the data from a particular sample
- Hence, the conclusion must refer only to the sample
- In other words, these summarize the data and describe sample characteristics.

Descriptive statistics

These are numerical values obtained from the sample that gives meaning to the data collected.

Classification of Descriptive Analysis

1. Frequency Distribution: Is a systematic arrangement of numeric values from the lowest to the highest or highest to lowest.
2. Measures of central tendency: Is a statistical index that describes the average of the set values.
3. Measure of variability: Are concerned with the degree to which the scores in a distribution are different from or similar to each other.
4. Bivariate descriptive statistics: Are derived from the simultaneous analysis of two variables to examine the relationships between the variables.

Measures of Central Tendency: Kinds of Averages

These are:

1. Mode: a numeric value in a distribution that occurs most frequently.
2. Median: an index of average position in a distribution of numbers.
3. Mean: the point on the score scale that is equal to the sum of the scores divided by the total number of scores.

Measures of Variability

- These are statistics concerned with the degree to which the scores in a distribution are different from or similar to each other.
- These statistics are a measure of variability that indicates the average to which the scores deviate from the true mean.
- Examples, are the: *Range*, *Cross tabulation* & *Correlation*:
  1. Range: The difference between the lowest and highest values in a data set, e.g. in {4, 6, 9, 3, 7} the lowest value is 3, and the highest is 9, so the range is 9 − 3 = 6.
  2. Cross tabulation: Also referred to as contingency tables or crosstabs. It is simply a data table that present the results of the entire group of respondents.

Significant benefits of Cross Tabulations

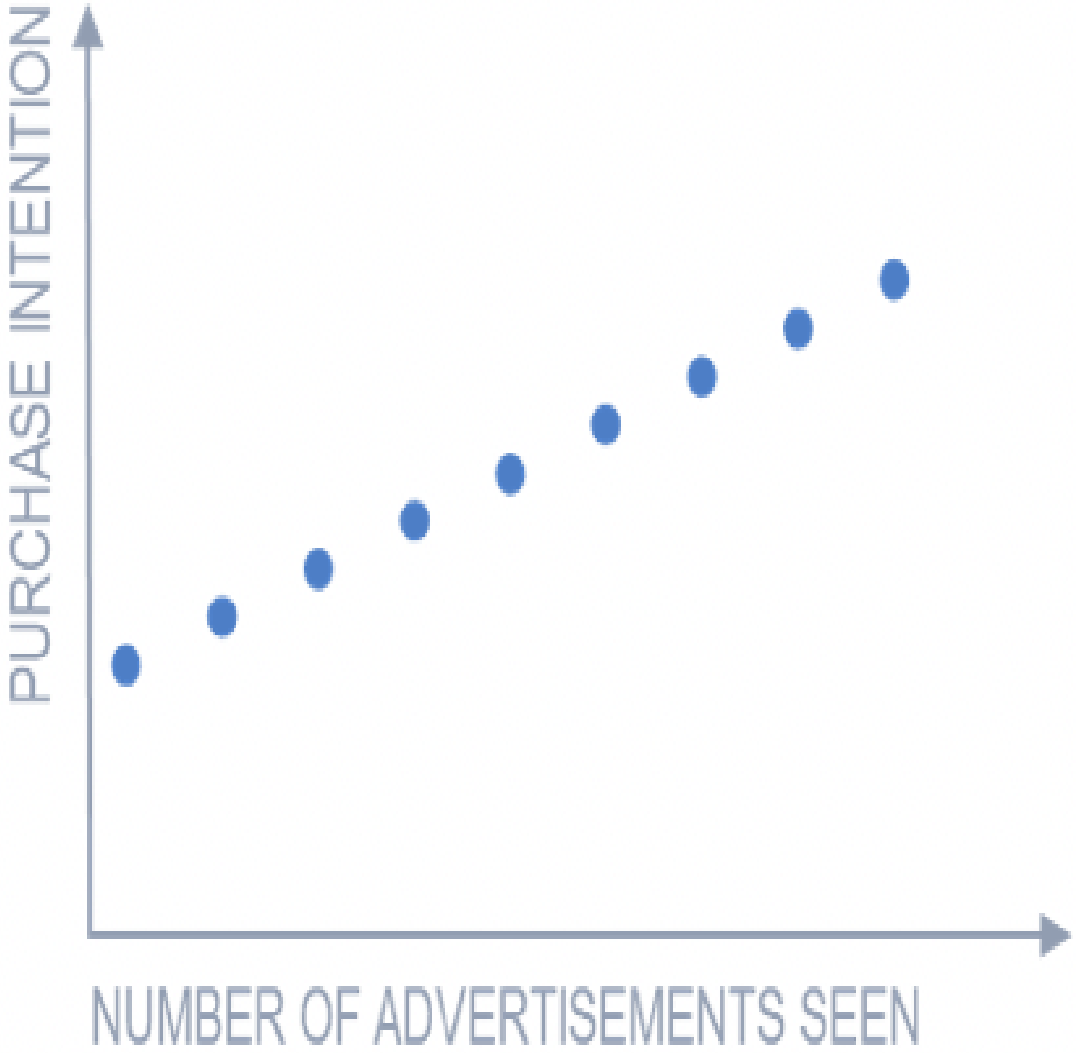
- It is used to quantitatively analyze the relationship between multiple variables.
- Cross tabulation helps to reduce confusion while analyzing data by summarizing the data.
- Cross tabulation allows for profound data insights by reducing data into sub-groups.
- Insights derived from cross tabulation are actionable to achieve the goals.
- *Example of Cross tabulation*, next slide:

Cross tabulation Frequency Percent		What is Your Favorite Baseball Team?			
		Toronto Blue Jays	Boston Red Socks	New York Yankees	Row Totals
In What City Do You Reside?	Boston, MA	11	33	7	51
	Row Percent	21.57%	64.71%	13.73%	34.93%
	Montreal, Canada	23	14	9	46
	Row Percent	50.00%	30.43%	19.57%	31.51%
	Montpellier, VT	22	13	14	49
	Row Percent	44.90%	26.53%	28.57%	33.56%
	Column totals	56	60	30	146
	Column Percent	38.36%	41.10%	20.55%	100.00%

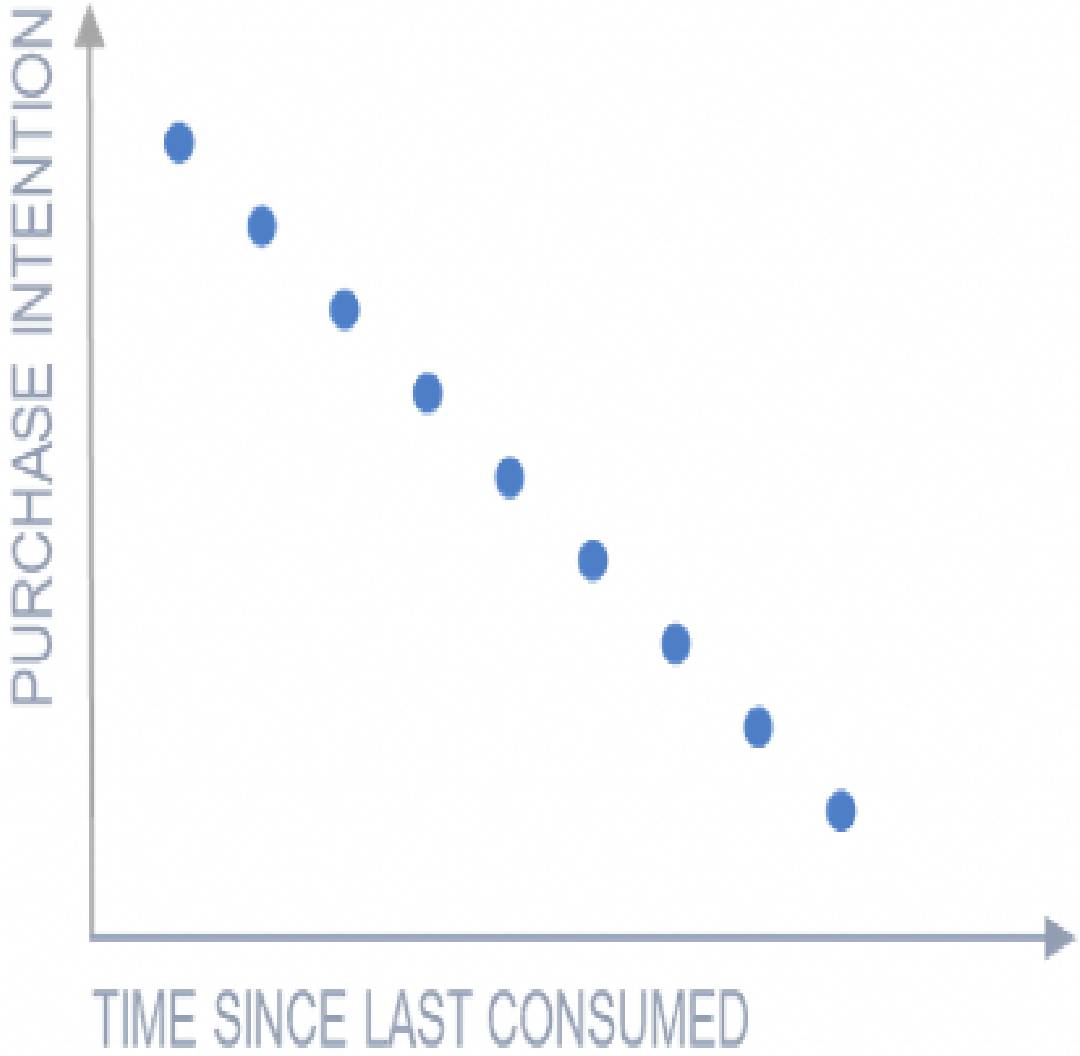
3. **Correlation:**

- It is a statistical measure that expresses the extent to which two variables are linearly related (meaning they change together at a constant rate).
- That is, it a mutual relationship or connection between two or more variables on a linear scale.
- It is a common tool for describing simple relationships without making a statement about cause and effect.
- For example, positive correlation may be that the more you exercise, the more calories you will burn.
- *Example of correlation*, next slide:

Positive correlation



Negative correlation



Examples of Inferential Statistics

These include:

i. **Correlation**
ii. **Chi-square**
iii. **Regression**
iv. **Analysis of variance** (ANOVA)
v. **T-test**

1. Correlation:

- It is a statistical measure that expresses the extent to which two variables are linearly related.
- Perfect correlation: If the value is near ± 1, then it said to be a perfect correlation: as one variable increases, the other variable tends to also increase (if positive) or decrease (if negative).
- High degree correlation: If the coefficient value lies between ± 0.50 and ± 1, then it is said to be a strong correlation.

2. Chi-square:

- It is a statistical method used for assessing the goodness of fit between observed values and those expected theoretically.
- For a Chi-square test, a p-value that is less than or equal to your significance level indicates there is sufficient evidence to conclude that the observed distribution is not the same as the expected distribution.
- You can conclude that a relationship exists between the categorical variables.

3. Regression:

- It is a measure of the relation between the mean value of one variable (e.g. output) and corresponding values of other variables (e.g. time and cost).
- Regression is a statistical method used to determine the strength and character of the relationship between *one dependent* variable (usually denoted by Y) and *a series of independent variables*.

4. Analysis of variance:

- It is a statistical method that separates observed variance data into different components to use for additional tests.
- A one-way ANOVA is used for three or more groups of data, to gain information about the relationship between the dependent and independent variables.
- A two-way ANOVA, there are two independents. For example, a two-way ANOVA allows a company to compare worker productivity based on two independent variables, such as salary and skill set.
- It is utilized to observe the interaction between the two factors and tests the effect of two factors at the same time.

5. T-test:

- A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features.
- A t-test is used as a hypothesis testing tool, which allows testing of an assumption applicable to a population.
- The t-test is a test in statistics that is used for testing hypotheses regarding the mean of a small sample taken population when the standard deviation of the population is not known.
- The t-test is used to determine if there is a significant difference between the means of two groups.

Level of Significance

- This is an important factor in determining the representativeness of the sample population and the degree to which *the chance* affects the findings.
- The level of significance is a numerical value selected by the researcher before data collection to indicate the probability of erroneous findings being accepted as true.
- The values are usually 0.05 equivalent to 95% confidence level, or 0.01 equivalent to 99% confidence level.

Uses of Inferential Analysis

These are:

1. Inferential analysis of data
2. Hypothesis testing
3. Interpretation of data
4. Presentation of findings
5. Deriving conclusions and recommendation

STATISTICAL PACKAGES IN ANALYSIS

These include:

- ✓ Excel, SPSS, PS, nMaster, Stata, Epi-info and EZR has been provided.
- ✓ SAS (software) — comprehensive statistical package
- ✓ SHAZAM— comprehensive econometrics and statistics package
- ✓ Statistica — comprehensive statistics package
- ✓ StatsDirect — statistics package designed for biomedical, public health and general health science uses
- ✓ StatXact — package for exact nonparametric and parametric statistics
- ✓ Systat — general statistics package
- ✓ SPSS Statistics — comprehensive statistics package that stands for "Statistical Package for the Social Sciences"
- ✓ Epi-Info
- ✓ Stata is a syllabic abbreviation of the words statistics and data

PRESENTATION OF DATA

Definition

The process of using various graphical formats to visually represent the relationship between two or more data sets so that an informed decision can be made based on them.

- Data Presentation tools are powerful communication tools that can simplify the data by making it easily understandable & readable at the same time while attracting and keeping the interest of its readers and effectively showcase large amounts of complex data in a simplified manner.

DATA PRESENTATION METHODS

- The three main methods of data presentation are:

a) Textual (narration):

- The data gathered are presented in paragraph form.
- Data are written and read.
- It uses a combination of texts and figures.

b) Tabulation:

- Method of presenting data using the statistical table.
- A systematic organization of data in columns and rows.

c) Graphical:

- This is the use of graphs and pie-charts to present data.

Data tabulation

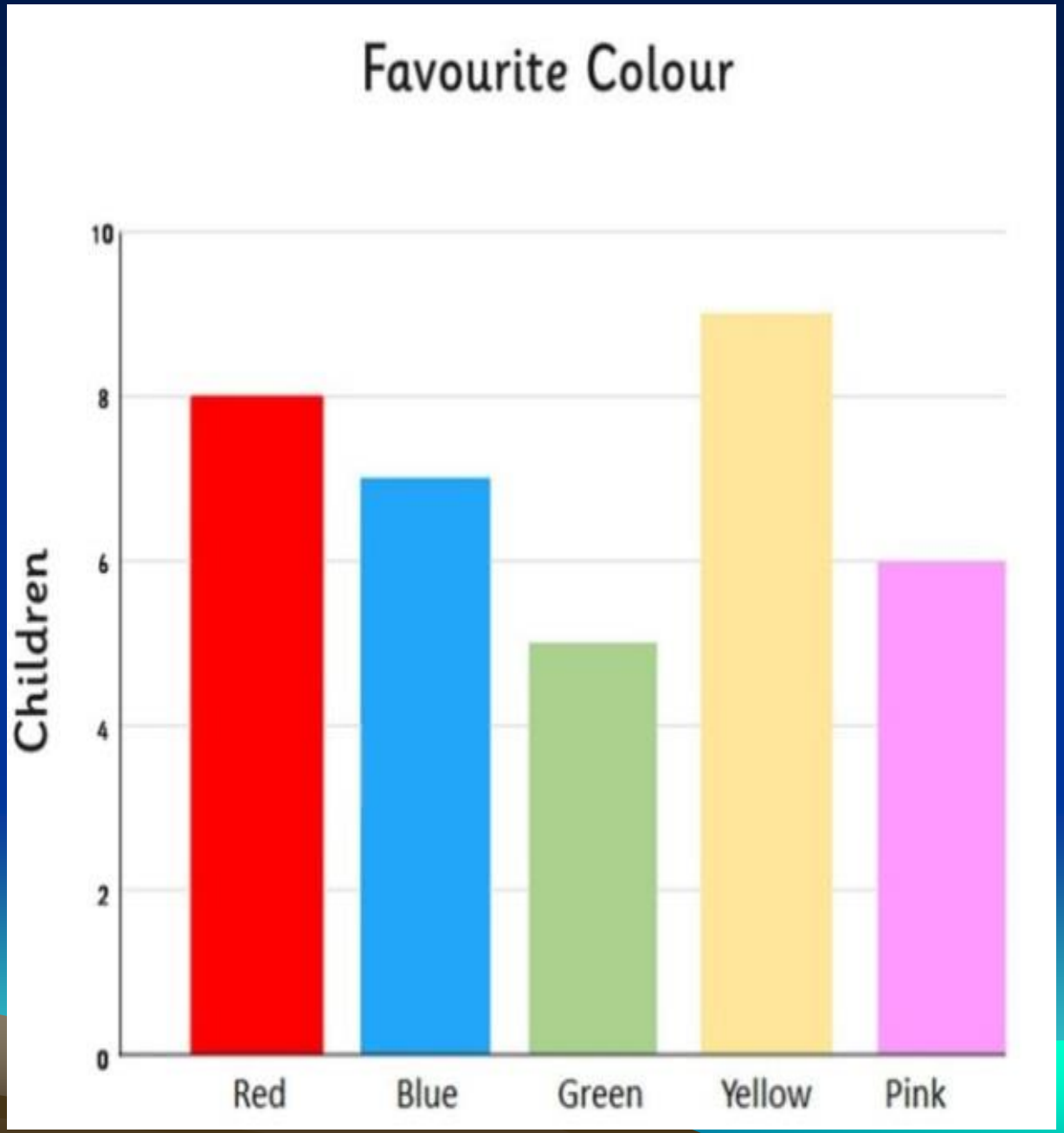
Employs the use of various types of tables (*simple or complex tables*) to present data appropriately. For example, level of education of community members:

Level of education	Number	Proportion (%)
Primary	671	39.4
Secondary	469	27.6
College	388	22.8
University	174	10.2
Total	**1,702**	**100**

Graphical Presentation of Data

1. Bar Graph/Chart

- A bar chart or bar graph is a chart or graph that presents *categorical data* with rectangular bars with heights or lengths proportional to the values that they represent.
- The bars can be plotted vertically or horizontally.
- A vertical bar chart is sometimes called a column chart.



The Pie Charts

- A Pie chart (circle graph) is divided into sectors in which the area of each sector represents the size of the data.

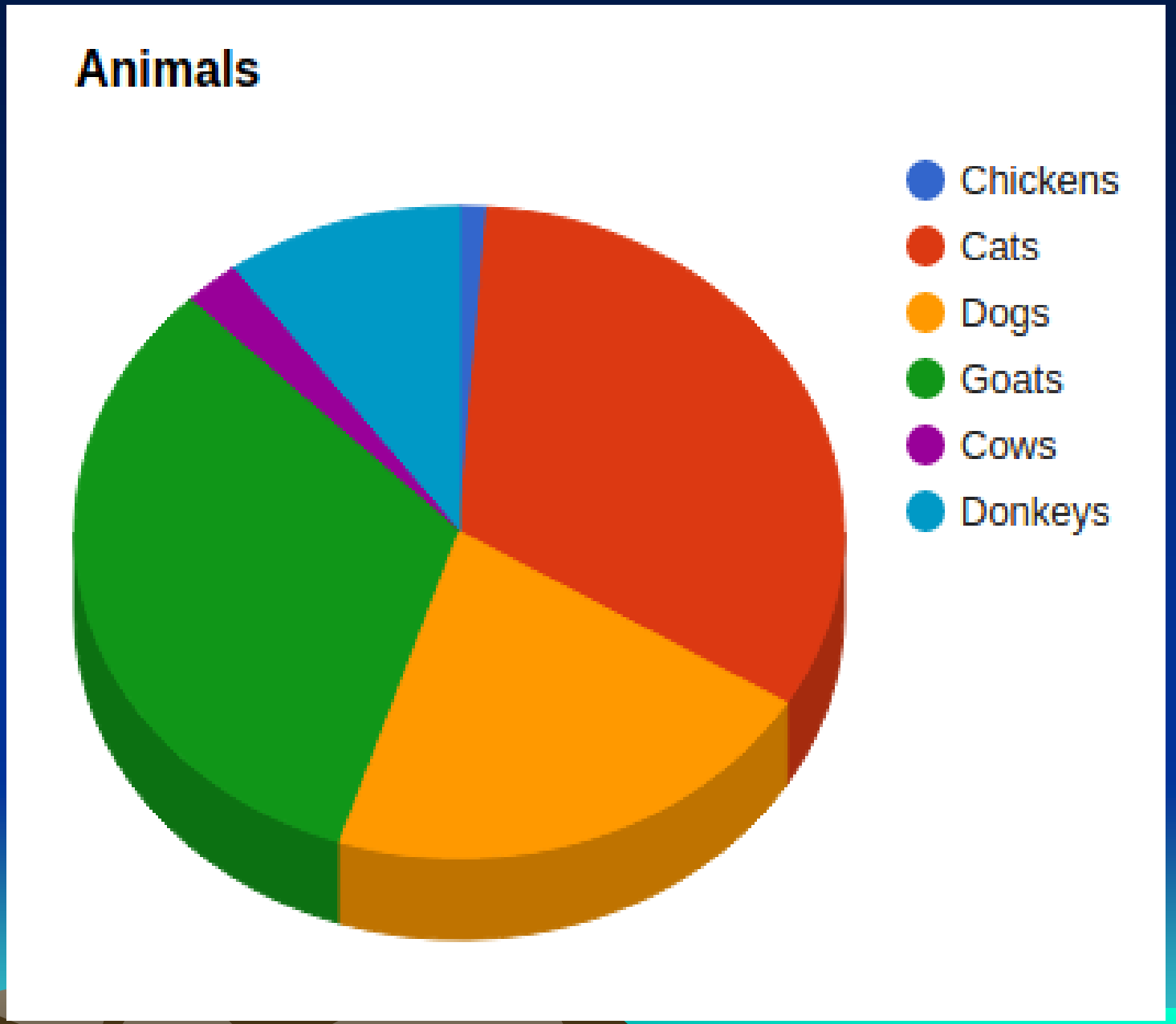
- Remember that there are 360 degree in a circle so each group in the pie chart will be a proportion of 360 degree.
- In the actual presentation of data, we convert the degrees into proportions for generalizability purposes. Where 360° is equivalent to 100%.

- Like a bar graph, pie charts are used to present *categorical data*.
- Pie Charts are used to:

✓ Compare part to whole relationship.

✓ Compare part to part relationship.

✓ Use when exact quantities are less important than the relative size of parts.



Histographs and Lineargraphs

- A graphic representation of the frequency distribution of a continuous variable. For example: age, income, time, distance etc.
- A Histogram (vary colour) can be used to:

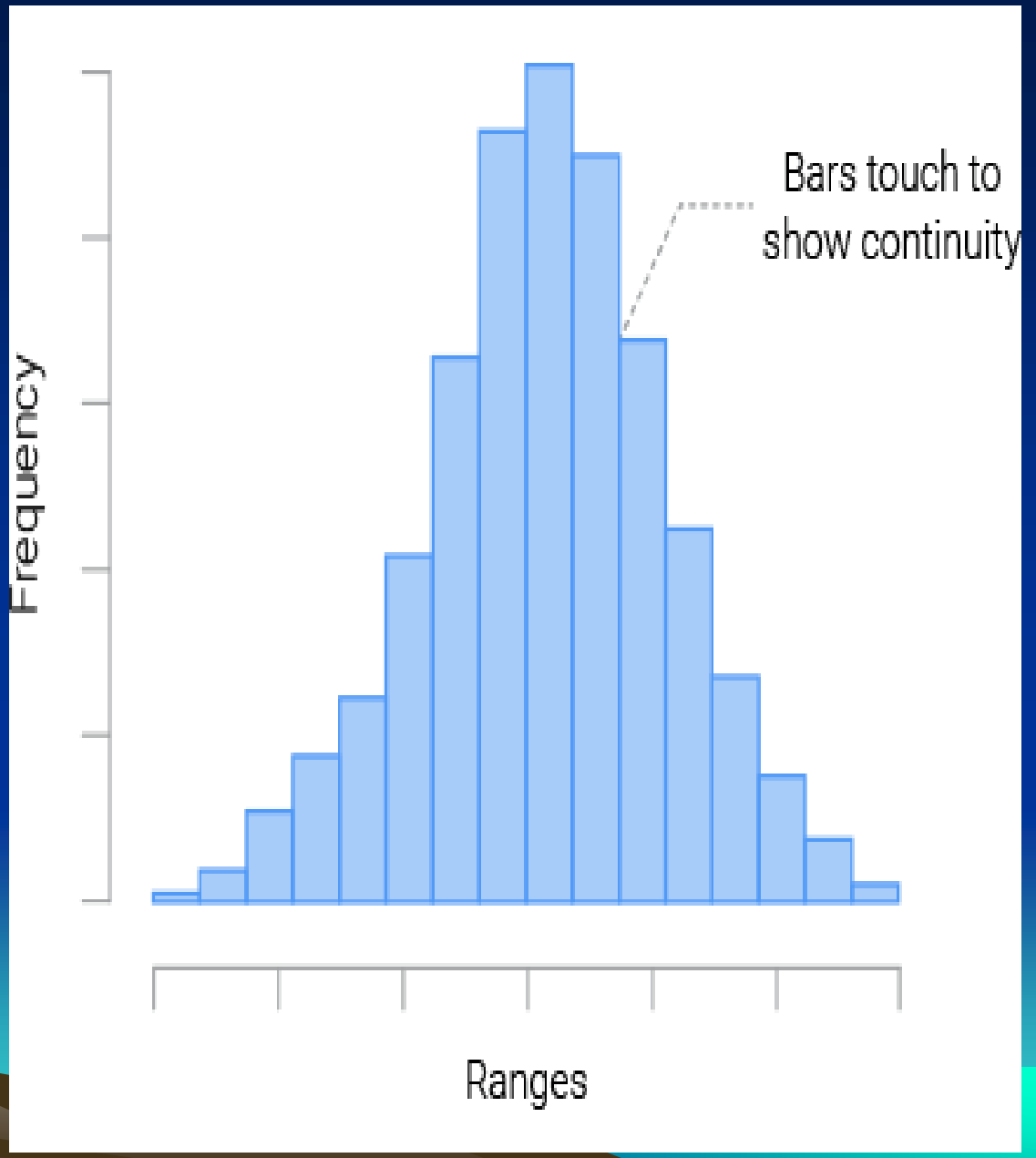
✓ Display large amounts of data values in a relatively simple chart form.

✓ Tell relative frequency of occurrence.

✓ Easily see the distribution of the data.

✓ See if there is variation in the data.

✓ Make future predictions based on the data.



LEVELS OF MEASUREMENT

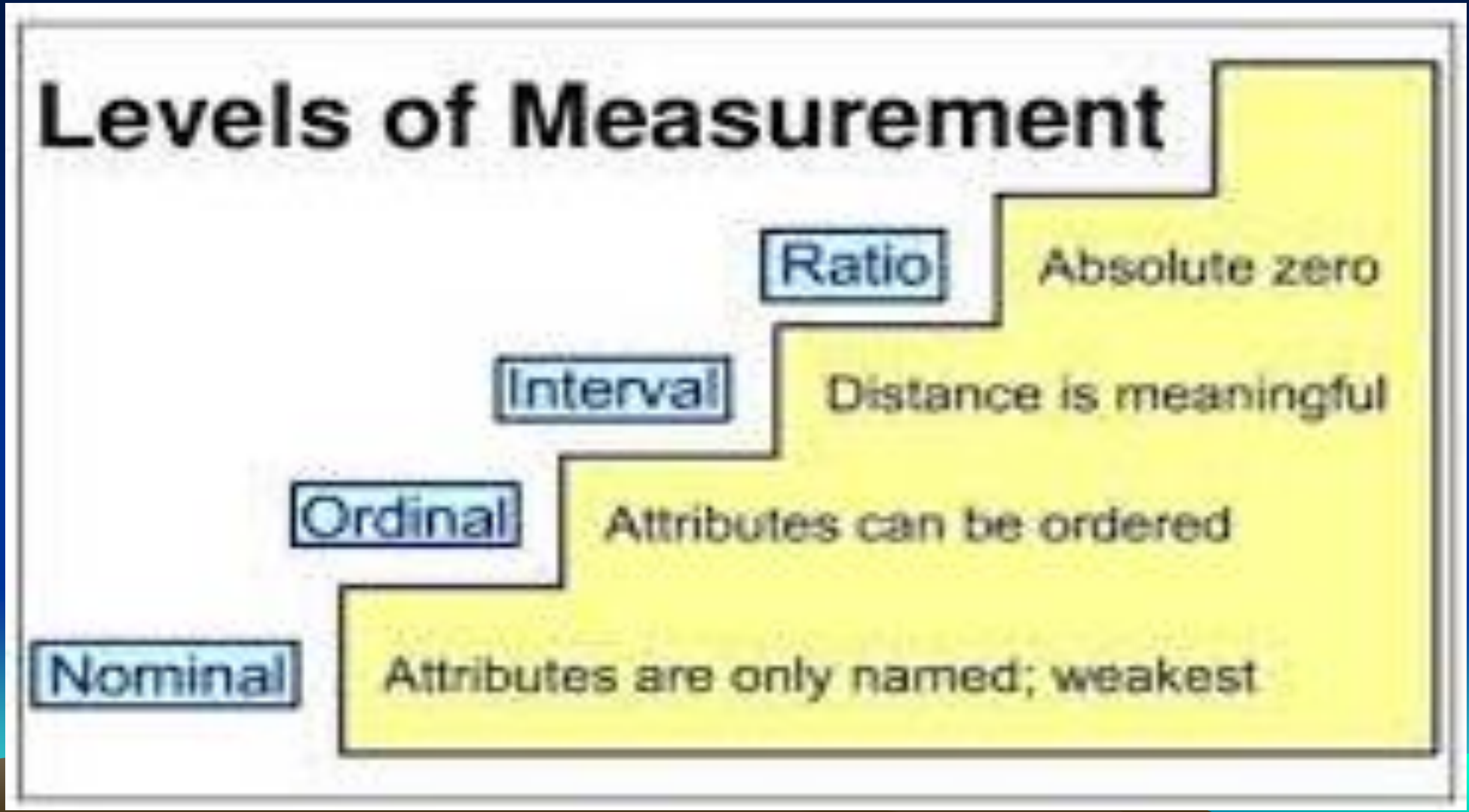
Definition

Level of measurement (*or scale of measurement*) is a classification that describes the nature of information within the values assigned to variables.

Classification

There are four levels/scales of measurement:

1. Nominal
2. Ordinal
3. Interval
4. Ratio.


Levels of Measurement
Ratio
Absolute zero
Interval
Distance is meaningful
Ordinal
Attributes can be ordered
Nominal
Attributes are only named; weakest

Nominal Level

- This is the simplest, and the lowest type of measurement.
- When measuring using a nominal scale, one simply names or categorizes responses.
- For example, gender, handedness, male, female, favourite colour, tall, short and religion.
- The essential point about nominal scales is that they do not imply any ordering among the responses. For example, when classifying people according to their favourite colour, there is no sense in which green is placed "ahead of" blue. Responses are merely categorized.

Ordinal Level

- The measure responses are placed in the order of preference or occurrence with regard to some defined criteria.
- For example, a researcher wishing to measure consumers' satisfaction with their governance system might ask despondence to specify their feelings on governance as either "***very dissatisfied***," "***somewhat dissatisfied***," "***somewhat satisfied***," or "***very satisfied***."
- The items in this scale are ordered, ranging from least to most satisfied. This is what distinguishes ordinal from nominal scales.
- Ordinal scales allow comparisons of the degree to which two subjects possess the dependent variable. For example, our satisfaction ordering makes it meaningful to assert that one person is more satisfied than another with their governance system.
- Such an assertion reflects the first person's use of a verbal label that comes later in the list than the label chosen by the second person.

Interval Level

- Interval scales are numerical scales in which intervals have the same interpretation throughout.
- For example, consider the Fahrenheit scale of temperature.
- The difference between 30 degrees and 40 degrees represents the same temperature difference as the difference between 80 degrees and 90 degrees.
- This is because each 10-degree interval has the same physical meaning (in terms of the kinetic energy of molecules).

Ratio Level

- The ratio scale of measurement is the highest and most informative scale.
- It is an interval scale with the additional property that its zero position indicates the absence of the quantity being measured.
- It combines the nominal, ordinal and interval scales as one.
- That is, as a nominal scale, *it provides a name or category for each object* (the numbers serve as labels); as an ordinal scale, *the objects are ordered* (in terms of the ordering of the numbers); and as an interval scale, *the same difference at two places on the scale has the same meaning*.
- In addition, *the same ratio at two places on the scale also carries the same meaning*.

BIOETHICS

Definition

It is the interdisciplinary study of ethical, legal, and social issues arising in research (the life sciences and health care).

- It is concerned with ethical issues emerging from advances in biology, medicine and technologies.
- It proposes the discussion about moral discernment in society and it is often related to medical policy and practice, but also to broader questions as environment and well-being.

Bioethics: History and Development

Assignment:

- ✓ Individually and in your respective study groups, search and discuss history and development of bioethics.
- ✓ Write short notes on the same.

Purpose of Bioethics

- To assist the health care and research community in examining moral issues involved in the understanding of life, harm, injury and death, and resolving ethical dilemmas in medicine and research.

Importance of Bioethics in Research

- It affects different parts of the society such as healthcare, research and the society in general.
- Brought about awareness to health workers of the medical practice as well as enriching the ability of health workers to further understand the patient as a person.
- Enabled health workers to follow an ethical code when working with patients which was once a problem.
- The healthcare of countries has been significantly improved due to clarity of connections to problems in health care.

Principles of Bioethics

- There are a number of ethical principles that should be taken into account when performing research.

The Major Ethical Issues:

- The two most important (key) ethical principles, stress the need to:
  - ✓ Do good (known as beneficence), and
  - ✓ Do no harm (known as non-maleficence) in research.

Basic Bioethical Principles

These are:

1. Autonomy: a person's ability to act on his or her own values and interests, or state of being self-governing.
2. Beneficence: an act of charity, mercy, and kindness with a strong connotation of doing good to others including moral obligation.
3. Non-maleficence: holds that there is an obligation not to inflict harm on others.
4. Justice: fair treatment. Everyone deserves justice.
5. Informed consent, confidentiality, privacy, accountability, loyalty, honesty, trustworthiness, truthfulness, respect, autonomy etc.

The Five Ethical Principles in Research:

- In practice, these ethical principles mean that as a researcher, you need to:

1. Obtain informed consent from potential research participants
2. Minimize the risk of harm to participants
3. Protect participants' anonymity and confidentiality
4. Avoid using deceptive practices
5. Give participants the right to withdraw from the research.

Special and Vulnerable Groups

These are persons or groups of people that are likely to be abused in the course of conduct of research.

For example, the:

- ✓ ***Children***
- ✓ ***Prisoners***
- ✓ ***Mentally ill***
- ✓ ***Pregnant women***
- ✓ ***Low socio-economic status***
- ✓ ***Uneducated***
- ✓ ***Disabled persons***

Regulating Conduct of Research

- The conduct of research is highly regulated the world over.
- This is based on the existing local, international, regional and global:
  1. Policies
  2. Regulations, and
  3. Laws

Requirements for Conducting Research in Kenya

- The researcher makes an application to be permitted to conduct research to the Ministry of Education Science and Technology.
- An Applicant who has been permitted to conduct research in Kenya must deposits four bound copies of his/her research findings, including notes and methodology, with the ministry on completion of the study.

Research Authorization and Approval in Kenya

- Research clearance and authorization process was instituted in Kenya in 1966 and that all research work in the country can be conducted only on issuance of a *Research Permit* from the National Council for Science and Technology (NCST).
- NCST is a Semi Autonomous Government Agency established on 1st July 1977, by the Science and Technology Act (Cap 250) of the Laws of Kenya, and is mandated to coordinate, promote and advise on national matters of Science, Technology and Innovation in the country.
- However, the Pharmacy and Poisons Board (PPB) is the regulatory authority responsible for clinical trial approvals, oversight, and inspections for such research in Kenya.

- The PPB’s of Kenya performs research scope assessment of a clinical trial application during a public health emergency, for example, the treatment and management of nCovid-19.
- PPB will conduct an expedited review and liaise with relevant stakeholders to facilitate a holistic review of an application and make decision for authorization and approval of the clinical trial.

Responsible Conduct of Research

- In general terms, responsible conduct in research is simply good citizenship applied to professional life.
- Researchers who report their work honestly, accurately, efficiently, and objectively are on the right road when it comes to responsible of research.

In Summary, observe:

a) Honesty: conveying information truthfully and honouring commitments
b) Accuracy: reporting findings precisely and taking care to avoid errors,
c) Efficiency: using resources wisely and avoiding wastage, and
d) Objectivity: letting the facts speak for themselves and avoiding bias.

PROPOSAL WRITING

1. Components of a proposal

The components of the research proposal are:

1. Title/Topic
2. Abstract
3. Background
4. Statement of the problem
5. Objectives
6. Research questions
7. Hypothesis
8. Justification
9. Purpose of the Study
10. Significance of the Study
11. Literature Review
12. Conceptual framework
13. Methodology
14. Conclusion
15. Reference
16. Appendices – Budget, Work plan, Map etc.

•

2. Qualities of a Good Research Proposal

1. Covers the Basics

– Did you follow the guidelines exactly?
  Is your budget within the resources offered by the funder?

– Is your proposal well-organized and easy to follow?
  Is your writing free of jargon and unnecessary acronyms?Is your writing free of spelling and grammar mistakes?

– Is the information presented in the proposal factually correct?

2. Describes the Relevance

– How does your project goal align with the funder's goal?

– How does your project fit within the scope of the funder's call?

– Why you are requesting funds?

3. Emphasizes the Significance

– What is the problem or need you want to address?

– What is the value gained by solving that problem or need?

– How will your project help to solve that problem or need?

– How will your project contribute to your field?

4. Explains the Approach

– What is your approach to addressing the problem or need?

– How do all of the key elements of your approach work?

– What do you need to carry out your approach?

– What is the quality of your approach?

– What is the feasibility of carrying out your approach?

– How will you measure outcomes and success?

5. Highlights the Expertise

– How are you qualified to complete the project?

– Who will contribute to your project?

– What literature or preliminary work supports your project?

An Outline for Proposal Writing

Title/Topic of the Study

Preliminary items

i. Abstract

- *a) Background*
- *b) Existing gap*
- *c) The aim of study*
- *d) Objectives of study*
- *e) Study design*
- *f) Sampling design*
- *g) Sample size*
- *h) Tools for data collection*
- *i) Data analysis and presentation*
- *j) Conclusion*
- *k) Recommendations*

ii. Declaration

iii. Dedication

iv. Acknowledgement

v. Table of contents

vi. List of abbreviations

vii. Operational terms

viii. List of tables

ix. List of appendices

Chapter I: Introduction

1.1 Background

1.2 Statement of the problem

1.3 Research objectives

1.4 Hypothesis

1.5 Justification

1.6 Scope of the study

1.7 Significance of the study

1.8 Purpose of the Study

1.9 Limitation of the study

Chapter II: Literature Review

2.1 Introduction

2.2 Theoretical framework

2.3 Empirical review (according to specific objectives)

2.4 Conceptual framework

Chapter Three: Methodology

3.1 Introduction

3.2 Setting

3.3 Study design

3.4 Study population

3.5 Inclusion & Exclusion Criteria

3.6 Sampling design

3.7 Sample size determination

3.8 Development and validation of tools

3.9 Recruitment and training of interviewers

3.10 Data collection

3.12.Data analysis and presentation

3.13**. Ethical considerations**

i. Ethical approval
ii. Informed consent
iii. Risks and discomfort
iv. Benefits from the study
v. Confidentiality and data management
vi. Voluntary participation

References

(Write alphabetically, A - Z)

Appendices

i. Map of study area

ii. Questionnaire

iii. Study budget

iv. Informed consent form

v. Schedule of the study

vi. (Any other relevant item)

BIOSTATISTICS

Definition

- Statistical processes and methods applied to the collection, analysis, and interpretation of biological data and especially data relating to human biology, health, and medicine. ***OR***,
- The branch of statistics that deals with data relating to living organisms, in this case, human beings.

1. Introduction to data analysis

- Data Analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. ***OR***,
- The various analytic procedures "provide a way of drawing inductive inferences from data and distinguishing the signal (the phenomenon of interest) from the noise (statistical fluctuations) present in the data".

Methods of Data Analysis

1. **Qualitative Analysis**

- This approach mainly answers questions such as '*why*,' '*what*' or '*how*.'
- Each of these questions is addressed via quantitative techniques such as questionnaires, attitude scaling, standard outcomes, and more.
- Such analysis is usually in the form of texts and narratives, which might also include audio and video representations.

2. **Quantitative Analysis**

- Generally, this analysis is measured in terms of numbers.
- The data here present themselves in terms of measurement scales and extend themselves for more statistical manipulation.

3. Text analysis

- Text analysis is a technique to analyze texts to extract machine-readable facts.
- It aims to create structured data out of free and unstructured content.
- The process consists of slicing and dicing heaps of unstructured, heterogeneous files into easy-to-read, manage and interpret data pieces.
- It is also known as text mining, text analytics, and information extraction.

4. Statistical analysis

- Statistics involves data collection, interpretation, and validation. Statistical analysis is the technique of performing several statistical operations to quantify the data and apply statistical analysis.
- Quantitative data involves descriptive data like surveys and observational data.
- It is also called a descriptive analysis.
- It includes various tools to perform statistical data analysis such as SAS (Statistical Analysis System), SPSS (Statistical Package for the Social Sciences), Stat soft, and more.

5. Diagnostic analysis

- The diagnostic analysis is a step further to statistical analysis to provide a more in-depth analysis to answer the questions.
- It is also referred to as root cause analysis as it includes processes like data discovery, mining, and drill down and drill through.
- The diagnostic analysis is a step further to statistical analysis to provide a more in-depth analysis to answer the questions.
- It is also referred to as root cause analysis as it includes processes like data discovery, mining, and drill down and drill through.

The functions of diagnostic analytics

a) **Identify anomalies:** After performing statistical analysis, analysts are required to identify areas requiring further study as such data raise questions that cannot be answered by looking at the data.

b) **Drill into the Analytics (discovery):** Identification of the data sources helps analysts explain the anomalies. This step often requires analysts to look for patterns outside the existing data sets. It requires pulling in data from external sources, thus identifying correlations and determining if they are causal in nature.

c) **Determine Causal Relationships:** Hidden relationships are uncovered by looking at events that might have resulted in the identified anomalies. Probability theory, regression analysis, filtering, and time-series data analytics can all be useful for uncovering hidden stories in the data.

6. Predictive analysis

- Predictive analysis uses historical data and feds it into the machine learning model to find critical patterns and trends.
- The model is applied to the current data to predict what would happen next.
- Many organizations prefer it because of its various advantages like volume and type of data, faster and cheaper computers, easy-to-use software, tighter economic conditions, and a need for competitive differentiation.

The following are the common uses of predictive analysis:

a) **Fraud Detection:** Multiple analytics methods improves pattern detection and prevents criminal behavior.

b) **Optimizing Marketing Campaigns:** Predictive models help businesses attract, retain, and grow their most profitable customers. It also helps in determining customer responses or purchases, promoting cross-sell opportunities.

c) **Improving Operations:** The use of predictive models also involves forecasting inventory and managing resources. For example, airlines use predictive models to set ticket prices.

d) **Reducing Risk:** The credit score used to assess a buyer's likelihood of default for purchases is generated by a predictive model that incorporates all data relevant to a person's creditworthiness. Other risk-related uses include insurance claims and collections.

7. Prescriptive Analysis

- Prescriptive analytics suggests various courses of action and outlines the potential implications that could be reached after predictive analysis.
- Prescriptive analysis generating automated decisions or recommendations requires specific and unique algorithmic and clear direction from those utilizing the analytical techniques.

Data Analysis Process

1. Data Requirement Specification - define your scope:

- ✓ Define short and straightforward questions, the answers to which you finally need to make a decision.
- ✓ Define measurement parameters
- ✓ Define which parameter you take into account and which one you are willing to negotiate.
- ✓ Define your unit of measurement. Ex – Time, Currency, Salary, and more.

2. Data Collection

- ✓Gather your data based on your measurement parameters.
- ✓Collect data from databases, websites, and many other sources. This data may not be structured or uniform, which takes us to the next step.

3. Data Processing

- ✓Organize your data and make sure to add side notes, if any.
- ✓Cross-check data with reliable sources.
- ✓Convert the data as per the scale of measurement you have defined earlier.
- ✓Exclude irrelevant data.

4. Data Analysis

- ✓Once you have collected your data, perform sorting, plotting, and identifying correlations.
- ✓As you manipulate and organize your data, you may need to traverse your steps again from the beginning. You may need to modify your question, redefine parameters, and reorganize your data.
- ✓Make use of the different tools available for data analysis.

5. Infer and Interpret Results

- ✓Review if the result answers your initial questions
- ✓Review if you have considered all parameters for making the decision
- ✓Review if there is any hindering factor for implementing the decision.
- ✓Choose data visualization techniques to communicate the message better.
- ✓These visualization techniques may be charts, graphs, color coding, and more.

6. Data tabulation and display

- Tabular presentation of data refers to representation of a large amount of data in an engaging, easy to read, and coordinated manner using tables.
- The data is arranged in rows and columns of a table, and is one of the most popularly used forms of presentation of data as data tables are simple to prepare and read.
- The most significant benefit of tabulation is that it coordinates data for additional statistical treatment and decision making.
- **Types of Analysis used in tabulation:**

1. Qualitative
2. Quantitative
3. Temporal
4. Spatial

1. **Qualitative classification:** When the classification is done according to traits such as physical status, nationality, social status, etc., it is known as qualitative classification.

2. **Quantitative classification:** In this, the data is classified on the basis of features that are quantitative in nature. In other words, these features can be estimated quantitatively, ratio, percentage etc.

3. **Temporal classification:** In this classification, time becomes the categorizing variable and data are classified according to time. Time, maybe in years, months, weeks, days, hours, etc.,

4. **Spatial classification:** When the categorization is done on the basis of location (place), it is known as spatial classification. The place may be a country, state, district, block, village/town, etc.

Objectives of Tabulation

The following are the objectives of tabulation:

1. To simplify the complex data
2. To bring out essential features of the data
3. To facilitate comparison
4. To facilitate statistical analysis
5. Saving of space

Limitations of a Table

1. Lacks description
   - The table represents only figures and not attributes.
   - It ignores the qualitative aspects of the facts.
2. Incapable of presenting individual items
   - It does not present individual items.
   - It presents aggregate data.
3. Needs special knowledge
   - The understanding of the table requires special knowledge.
   - It cannot be easily used by a layman.

The Main Parts of a Table

1. Table number: Table number is the very first item mentioned on the top of each table for easy identification and further reference.
2. Title: Title of the table is the second item that is shown just above the table. It narrates the contents of the table, hence it has to be very clear, brief, and carefully worded. Title of the table is the second item that is shown just above the table. It narrates the contents of the table, hence it has to be very clear, brief, and carefully worded.
3. Head note: It is the third item just above the table and shown after the title. It gives information about units of data like, ‘amount in rupees or $’, “quantity in tonnes’, etc. It is generally given in brackets.

4. Captions or Column headings: At the top of each column in a table, a column designation/head is given to explain the figures of the column. This column heading is known as ‘caption’.
5. Stubs or Row headings: The title of the horizontal rows is known as ‘stubs’.
6. Body of the table: It contains the numeric information and reveals the whole story of investigated facts. Columns are read vertically from top to bottom and rows are read horizontally from left to right.
7. Source note: It is a brief statement or phrase indicating the source of data presented in the table.
8. Footnote: It explains the specific feature of the table which is not self-explanatory and has not been explained earlier. For example, points of exception if any.

Types of Tabulation

1. **Simple tabulation:** This gives information regarding one or more independent questions.
2. **Complex tabulation:** This gives information regarding two mutually dependent questions.

Simple tabulation:

1. One way table: For example, question is, how many millions of the persons are in the Divisions; the One-Way Table will give the answer.

ONE WAY TABLE	
DIVISION	POPULATION (Millions)
Karachi	10.875968
Hyderabad	14.186954
Sukkur	12.994401

2. Two way table

- These types of table give information regarding two mutually dependent questions.
- If we want to know that in the population number, who are in the majority, male, or female.
- The Two-Way Tables will answer the question by giving the column for female and male.

TWO WAY TABLE				
DIVISION		POPULATION (Millions)		
		Male	Female	Total
Karachi Hyderabad Sukkur				

3. **Three-Way Table**

- Three-Way Table gives information regarding three mutually dependent and inter-related questions.
- For example, from one-way table, we get information about population, and from two-way table, we get information about the number of male and female available in various divisions.
- Now we can extend the same table to a three way table, by putting a question, “How many male and female are literate?”
- Thus the collected statistical data will show the following, three mutually dependent and inter-related questions:

1. Population in various division.
2. Their sex-wise distribution.
3. Their position of literacy.

Example of three way table

	THREE-WAY TABLE									
DIVISION	POPULATION (Millions)									
	Male				Female			Total		
		Literate	Illiterate	Total	Literate	Illiterate	Total	Literate	Illiterate	Total
Karachi Hyderabad Sukkur										

This table gives information concerning the literacy of both male and female in various divisions of Sindh.

From the table we can explain the sex which has more education in relation to division, and also, we can say whether literacy is low in rural areas than in urban areas.

Higher Order Tables

- Higher order tables are those which provide information about a large number of inter related questions.
- Higher order tables may be of four-way, five-way, six-way etc. Such kind of tables are called manifold tables.

3. Measurement scales

– Each scale of measurement is considered to fulfill one or more of the below mentioned properties of measurement.

a) **Magnitude:** Values on the scale of measurement have a systematized correlation with one another. In other words, some values are bigger and some are smaller.

b) **Equal Intervals:** Units of Scale by the side of the scale are equivalent to each other. This implies, for instance, that the difference between 1 and 2 would be equivalent to the difference between 10 and 11.

c) **Identity:** Each value on the scale of measurement holds a peculiar description.

d) **A Minimum Value of Zero:** The measurement scale has a true 0 point, further down which no values exist.

- There are 4 scales of measurement, namely:
  1. Nominal,
  2. Ordinal,
  3. Interval, and,
  4. Ratio
- All variables in any given study fall in one of these scales.
- Understanding the mathematical properties and assigning proper scale to the variables is important because they determine which mathematical operations are allowed.
- That determines statistical operations we can use.

4. Pilot study

- Is a small-scale study used to test the methods and procedures to be used on a larger scale study.
- The goal of pilot work is not to test hypotheses about the effects of an intervention, but rather, to assess the feasibility/acceptability of an approach to be used in a larger scale study.
- Thus, in a pilot study you are not answering the question “Does this intervention work?”
- Instead you are gathering information to help you answer “Can I do this?”

5. Descriptive statistics

Definition:

Descriptive statistics are used to describe or summarize the characteristics of a sample or data set, such as a variable's mean, standard deviation, or frequency.

Calculating Descriptive Statistics

- Percentage is calculated by taking the frequency in the category divided by the total number of participants and multiplying by 100%.
- To calculate the percentage of males, take the frequency for males (80) divided by the total number in the sample (200).

Types of descriptive statistics

There are 3 main types of descriptive statistics:

1. The *distribution* concerns the frequency of each value.
2. The *central tendency* concerns the averages of the values.
3. The *variability* or *dispersion* concerns how spread out the values are.

Measures of Variability

Variability:

- Describes how far apart data points lie from each other and from the center of a distribution.
- Along with measures of central tendency, measures of variability give you descriptive statistics that summarize your data.
- Variability is also referred to as spread, scatter or dispersion. It is most commonly measured with the following:

1. Range: the difference between the highest and lowest values
2. Interquartile range: the range of the middle half of a distribution
3. Standard deviation: average distance from the mean
4. Variance: average of squared distances from the mean

The Range

- The range tells you the spread of your data from the lowest to the highest value in the distribution. It's the easiest measure of variability to calculate.
- To find the range, simply subtract the lowest value from the highest value in the data set.
- Because only 2 numbers are used, the range is influenced by outliers and doesn't give you any information about the distribution of values. It's best used in combination with other measures.

Interquartile Range

- The interquartile range gives you the spread of the middle of your distribution.
- For any distribution that's ordered from low to high, the interquartile range contains half of the values.
- While the first quartile (Q1) contains the first 25% of values, the fourth quartile (Q4) contains the last 25% of values.
- The interquartile range is the third quartile (Q3) minus the first quartile (Q1). This gives us the range of the middle half of a data set.
- Interquartile range exampleTo find the interquartile range of your 8 data points, you first find the values at Q1 and Q3.
- Multiply the number of values in the data set (8) by 0.25 for the 25th percentile (Q1) and by 0.75 for the 75th percentile (Q3).
    - Q1 position: 0.25 x 8 = 2
    - Q3 position: 0.75 x 8 = 6

- Q1 is the value in the 2nd position, which is **110**. Q3 is the value in the 6th position, which is **287**.
  - IQR = Q3 – Q1
  - IQR = 287 – 110 = **177**
- The interquartile range of your data is **177 minutes**.
- Just like the range, the interquartile range uses only 2 values in its calculation.
- But the IQR is less affected by outliers: the 2 values come from the middle half of the data set, so they are unlikely to be extreme scores.
- The IQR gives a consistent measure of variability for skewed as well as normal distributions.

Standard Deviation

- The standard deviation is the average amount of variability in the dataset.
- It tells you, on average, how far each score lies from the mean. The larger the standard deviation, the more variable the data set is.
- There are six steps for finding the standard deviation by hand:
  1. List each score and find their mean.
  2. Subtract the mean from each score to get the deviation from the mean.
  3. Square each of these deviations.
  4. Add up all of the squared deviations.
  5. Divide the sum of the squared deviations by $n - 1$ (for a sample) or N (for a population).
  6. Find the square root of the number you found to get the standard deviation.

Why Does Variability Matter?

- While the central tendency, or average, tells you where most of your points lie, variability summarizes how far apart they are.
- This is important because it tells you whether the points tend to be clustered around the center or more widely spread out.
- *Low variability is ideal because it means that you can better predict information about the population based on sample data.*
- *High variability means that the values are less consistent, so it's harder to make predictions.*
- Data sets can have the same central tendency but different levels of variability or vice versa. If you know only the central tendency or the variability, you can't say anything about the other aspect. Both of them together give you a complete picture of your data.

6. Inferential statistics

- Taking data from samples and making generalizations about a population.
- This means taking a statistic from your sample data (for example the sample mean) and using it to say something about a population parameter (i.e. the population mean).

Major Uses of Inferential Statistics

1. Making estimates about populations, and
2. Testing hypotheses to draw conclusions about populations.

The Types of Inferential Statistics

1. One sample test of difference/One sample hypothesis test.
2. Confidence Interval.
3. Contingency Tables and Chi Square Statistic
4. T-test or Analysis of Variance (Anova)
5. Pearson Correlation
6. Bi-variate Regression
7. Multi-variate Regression

Assignment: *In your respective study group discuss and define these terms as used in statistics.*

Differences Between Descriptive and Inferential statistics

- Descriptive statistics summarize the characteristics of a data set.
- Inferential statistics allow you to test a hypothesis or assess whether your data is generalizable to the broader population.

Research Results (Findings)

Discussion of Study Findings

Conclusion

Recommendations

REPORT WRITING

Definition

- It is a written document containing key aspects of research project,

OR,

- It is a detailed presentation of research processes and findings, and it usually includes tables and graphs.

- Research report is a medium to communicate research work with relevant people.
- It is also a good source of preservation of research work for the future reference.
- It is written in a formal language.
- A research report is usually written in the third person.
- It is informative and based on first-hand verifiable information.

The aim of Research Report and Types of a Research Report

The aim of Research Report

– It is to write clearly and concisely about your research topic so that the reader can easily understand the purpose and results of your research.

Types of Reports

– The main types are:

1. Informational
2. Analytical
3. Persuasive

1. **Informational**

– Inform or instruct – present information.
– Reader sees the details of events, activities or conditions.
– No analysis of the situation, no conclusion, no recommendations.

2. **Analytical**

– Written to solve problems.
– Information is analyzed.
– Conclusions are drawn and recommendations are made.

3. **Persuasive**

– An extension of analytical reports - main focus is to sell an idea, a service, or product.
– Proposals are the most common type.

Other types are:

a) Journal articles

b) Technical research reports

c) Monographs or books

d) Graduate theses or dissertations.

e) Oral reports at professional meetings, seminars, symposia, and workshops.

Steps to Writing a Successful Research Report

- This is how to write a research paper report, the steps are:

1. Understand the assignment
2. Choose a research paper topic
3. Conduct preliminary research
4. Develop a thesis statement
5. Create a research paper outline
6. Write a first draft of the research paper
7. Write the introduction
8. Write a compelling body of text
9. Write the conclusion
10. The second draft
11. The revision process
12. Research paper checklist

Components of a Research Report

This comprise:

1. Title
2. Abstract
3. Preliminary items
4. Introduction
5. Review of Literature
6. Methods
7. Results
8. Discussion, Conclusions and recommendations
9. References.

These may be presented as follows:

– Title page,
– Abstract
– Preliminary items
– Chapter 1: Introduction
– Chapter 2: Literature Review
– Chapter 3: Methodology
– Chapter 4: Results
– Chapter 5: Discussion, Conclusions, and recommendations
– References

Characteristics of Research Report

A good research report has the following characteristics:

- Simplicity
- Clarity
- Brevity
- Positivity
- Punctuation
- Approach
- Readability
- Accuracy
- Logical sequence
- Proper form
- Presentation

1. Simplicity:

- The language shall be as simple as possible so that a report is easily understandable.
- Jargons and technical words should be avoided.
- Even in a technical report there shall be restricted use of technical terms if it has to be presented to laymen.

2. Clarity:

- The language shall be lucid and straight, clearly expressing what is intended to be expressed.
- For that the report has to be written in correct form and following correct steps.

3. Brevity:

– A report shall not be unnecessarily long so that the patience of the reader is not lost and there is no confusion of ideas.

– But, at the same time, a report must be complete.

– A report is not an essay, hence, concisely written.

4. Positivity:

– As far as possible positive statements should be made instead of negative ones.

– For example, it is better to say what should be done and not what should not be done.

6. Approach:

– There are two types of approaches:

a) Personal —When a report is written based on personal enquiry or observations, the approach shall be personal and the sentences shall be in the first person and in direct speech.

b) Impersonal—When a report is prepared as a source of information and when it is merely factual (e.g. a report on a meeting), the approach shall be impersonal and the sentences shall be in the third person and in indirect speech.

7. **Readability:**

– The keynote of a report is readability.

– The style of presentation and the diction (use of words) shall be such that the readers find it attractive and he is compelled to read the report from the beginning to the end.

– Then only a report serves its purpose.

– A report on the same subject matter can be written differently for different classes of readers.

8. Accuracy:

– A report shall be accurate when facts are stated in it. It shall not be biased with personal feelings of the writer.

9. Logical Sequence:

– The points in a report shall be arranged with a logical sequence, step by step and not in a haphazard manner.

– A planning is necessary before a report is prepared.

10. Proper Form:

– A report must be in the proper form.

– Sometimes there are statutory forms to follow.

11. Presentation:

- A report needs an attractive presentation.
- It depends on the quality of typing or printing as well as quality of paper used.
- Big companies make very attractive and colourful Annual Reports.

Appendices in the Research Report

These are items that are appended to the research report at the back of the report after the refences.

The End

Thank You for Listening.

Success...!