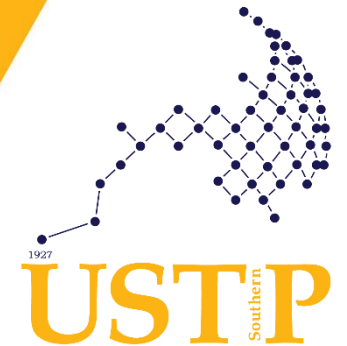


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QUANTITATIVE METHODS

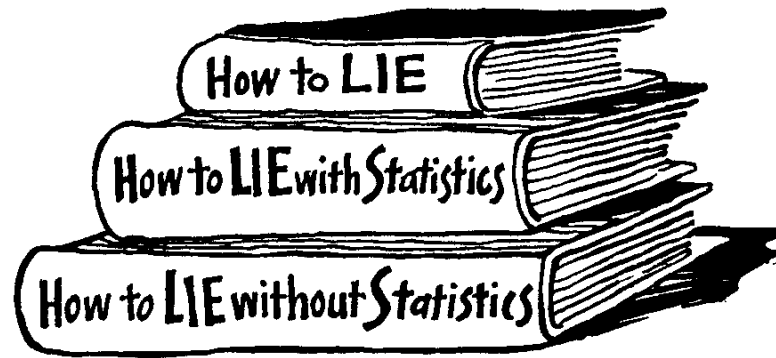


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Alubijid | Cagayan de Oro | Claveria | Jasaan | Oroquieta | Panaon

Facts

- ***“There are three types of lies—lies, damn lies, and statistics.”***
- ***“Figures don’t lie, but liars figure.”***
- ***“Statistics can be used to support anything ---especially statisticians” Franklin P. Jones***



Objectives:

- ❖ Explain how statistics can be used and misused.

Uses and Misuses of Statistics

Uses of Statistics

- Describe data
- Compare two or more data sets
- Determine if a relationship exists between variables
- Test hypothesis (educated guess)
- Make estimates about population characteristics
- Predict past or future behavior of data
- Use of statistics can be impressive to employers.

Uses and Misuses of Statistics

Almost all fields of human endeavor benefit from the application of statistical method; however, the misuses of statistics are just as abundant, if not more so!

Uses and Misuses of Statistics

There are two main sources of misuse of statistics:

- ❖ Evil intent on part of a dishonest researcher
- ❖ Unintentional errors (stupidity) on part of a researcher who does not know any better

Uses and Misuses of Statistics

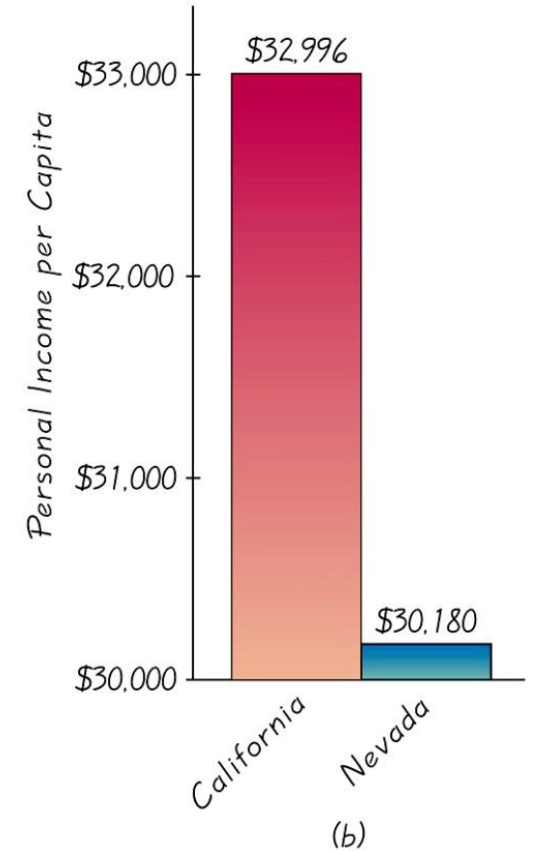
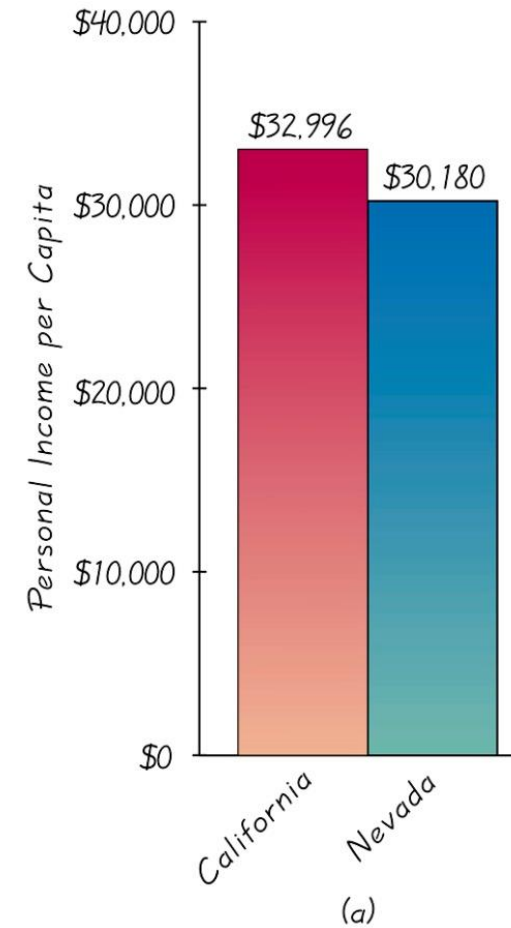
Misuses of Statistics

- ❑ Voluntary-response sample (or self-selected sample)
 - One in which the subjects themselves decide whether to be included--- creates built-in bias
 - ✓ Telephone call-in polls (radio)
 - ✓ Mail-in polls
 - ✓ Internet polls
- ❑ Small Samples
 - ✓ Too few subjects used
- ❑ Convenience
 - ✓ Not representative since subjects can be easily accessed

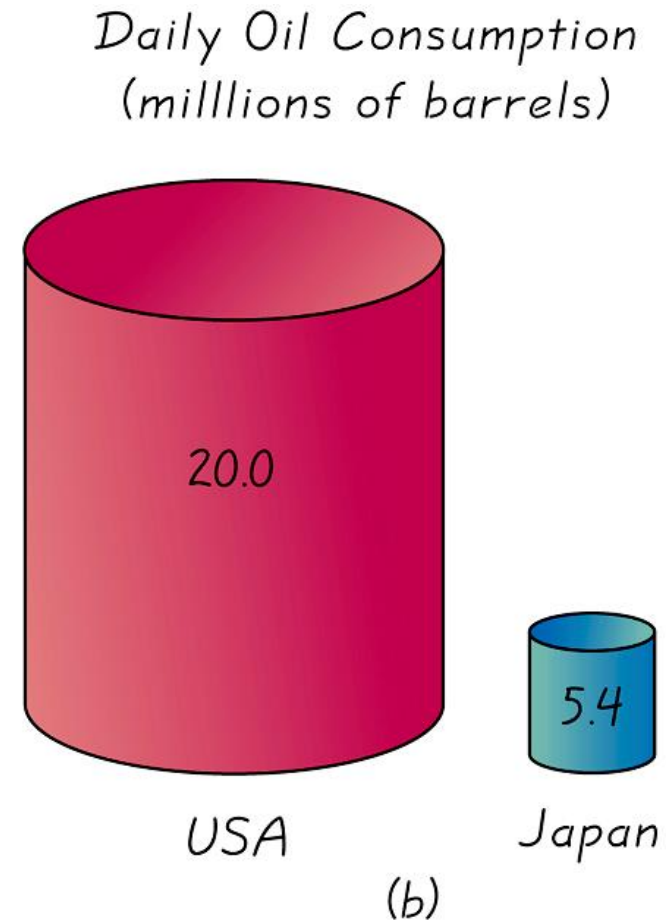
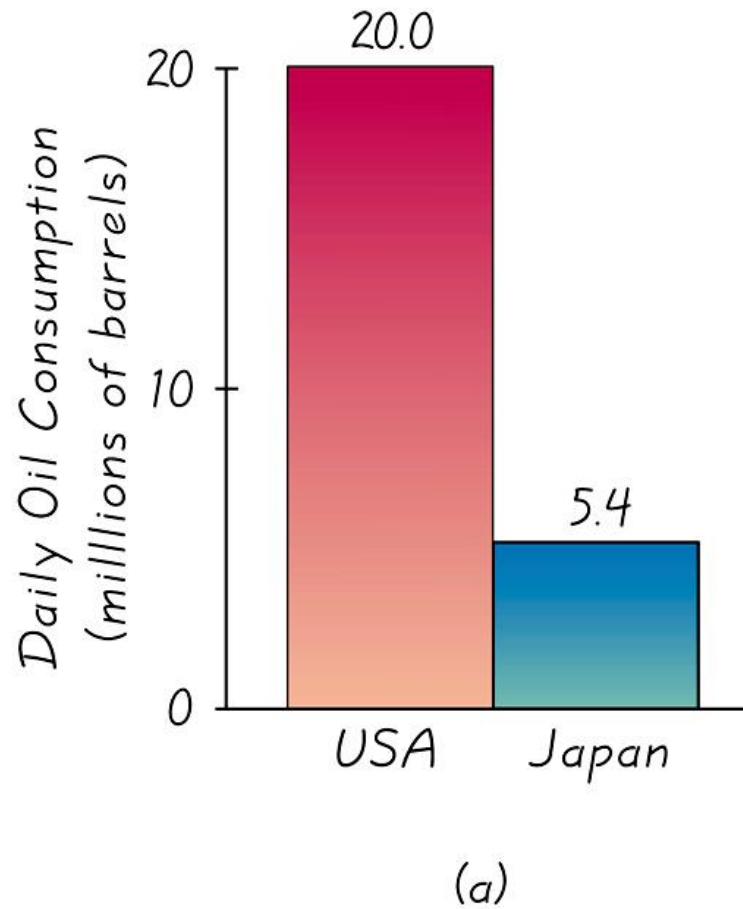
Misuses of Statistics

Graphs

- ❑ Can be drawn inappropriately leading to false conclusions
 - ✓ Watch the “scales”
 - ✓ Omission of labels or units on the axes
 - ✓ Exaggeration of one-dimensional increase by using a two-dimensional graph



Misuses of Statistics



Misuses of Statistics

Survey Questions

- ✓ Loaded Questions---unintentional wording to elicit a desired response
- ✓ Order of Questions
- ✓ Nonresponse (Refusal)—subject refuses to answer questions
- ✓ Self-Interest ---Sponsor of the survey could enjoy monetary gains from the results

Misuses of Statistics

- ❑ Missing Data (Partial Pictures)
 - ✓ Detached Statistics ---no comparison is made
 - ✓ Percentages
- ❑ Precise Numbers
 - ✓ People believe this implies accuracy
- ❑ Implied Connections
 - ✓ Correlation and Causality –when we find a statistical association between two variables, we cannot conclude that one of the variables is the cause of (or directly affects) the other variable

Computers and Calculators

- **Microsoft Excel**
- **Minitab**
- **SAS**
- **SPSS**

Outline

Introduction

- What is a quantitative method?
- Quantitative and qualitative data
- Levels of measurement
- Types of quantitative research
- Types of random sampling

Outline

- Descriptive and Inferential Statistics
- Population and sample
- Parameter and statistic

Qualitative vs Quantitative

Qualitative	Quantitative
The aim of qualitative analysis is a complete detailed description.	In quantitative research we classify features, count them, and construct statistical models in an attempt to explain what is observed.
The design emerges as the study unfolds	All aspects of the study are carefully designed before data is collected.
Researcher is the data gathering instrument.	Researcher uses tools (questionnaires or equipment) to collect data.
Data is in the form of words (interviews), pictures (videos), or objects (artifacts).	Data is in the form of numbers and statistics.
Qualitative data is more rich, time consuming, and less able to be generalized.	Quantitative data is more efficient, able to test hypotheses, but may miss contextual data.

Data

Statistical data are usually obtained by counting or measuring items. Most data can be put into the following categories:

- **Qualitative** - data are measurements that each fall into one of several categories. (hair color, ethnic groups and other attributes of the population)
- **quantitative** - data are observations that are measured on a numerical scale (distance traveled to college, number of children in a family, etc.)

Statistical Data

- The collection of data that are relevant to the problem being studied is commonly the most difficult, expensive, and time-consuming part of the entire research project.
- Statistical data are usually obtained by counting or measuring items.
 - **Primary data** are collected specifically for the analysis desired
 - **Secondary data** have already been compiled and are available for statistical analysis
- A **variable** is an item of interest that can take on many different numerical values.
- A **constant** has a fixed numerical value.

Qualitative vs Quantitative Data

Qualitative Data

Overview:

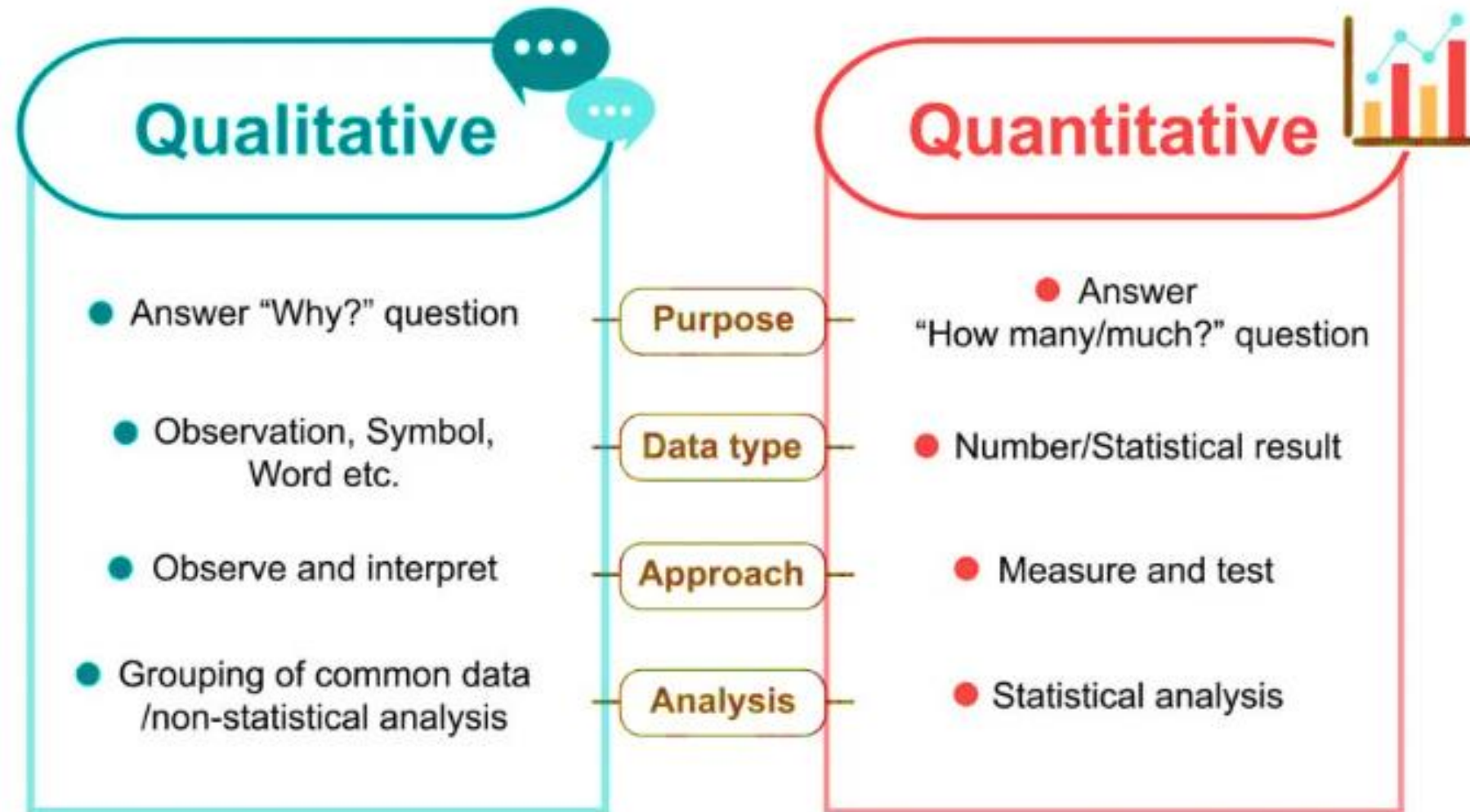
- Deals with descriptions.
- Data can be observed but not measured.
- Colors, textures, smells, tastes, appearance, beauty, etc.
- Qualitative → Quality

Quantitative Data

Overview:

- Deals with numbers.
- Data which can be measured.
- Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc.
- Quantitative → Quantity

Qualitative vs Quantitative Data



Qualitative data

Qualitative data are generally described by words or letters. They are not as widely used as quantitative data because many numerical techniques do not apply to the qualitative data. For example, it does not make sense to find an average hair color or blood type.

Qualitative data can be separated into two subgroups:

- **Dichotomic** (if it takes the form of a word with two options (gender - male or female))
- **Polynomic** (if it takes the form of a word with more than two options (education - primary school, secondary school and university)).

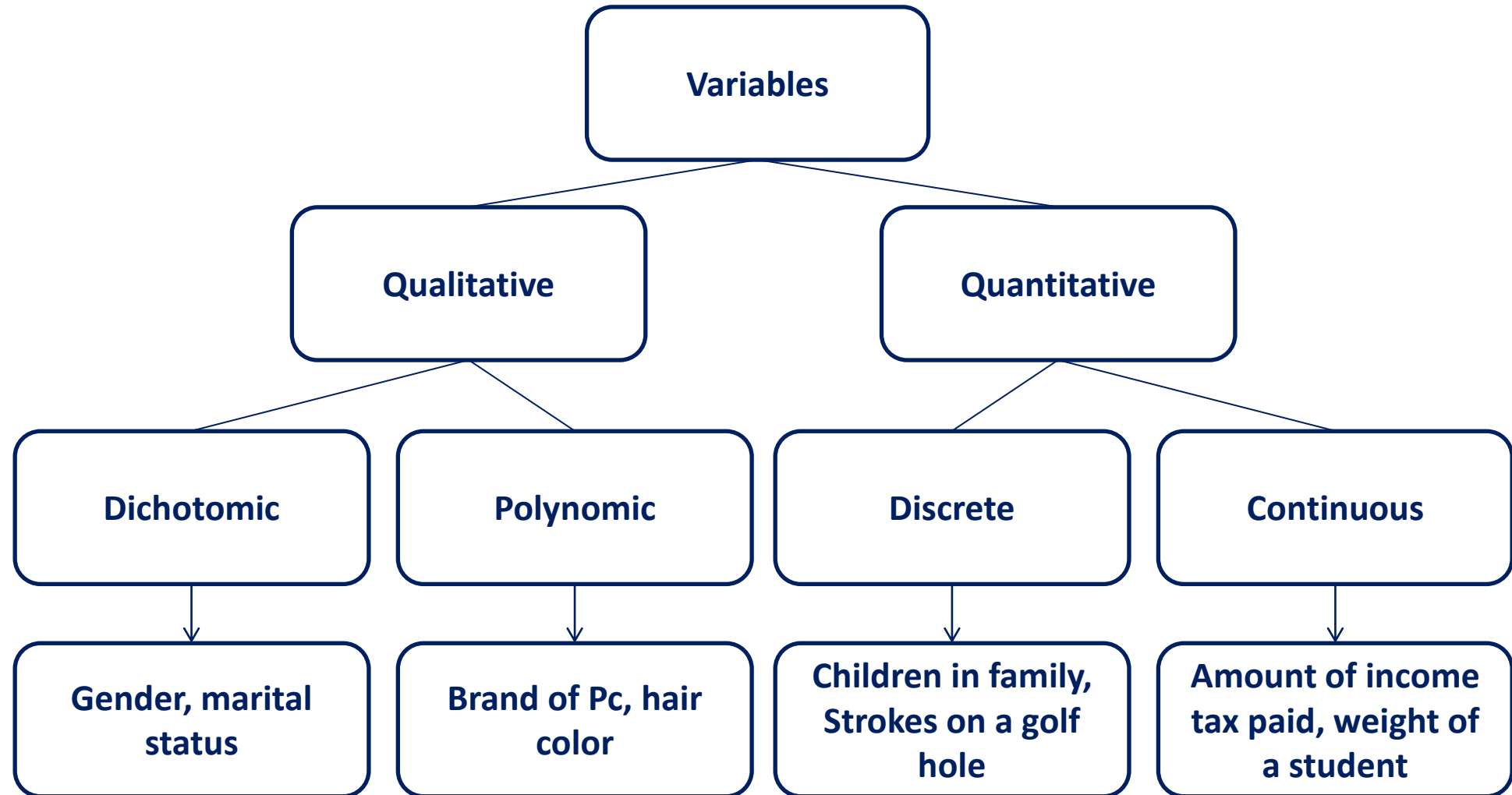
Quantitative Data

Quantitative data are always numbers and are the **result of counting or measuring** attributes of a population.

Quantitative data can be separated into two subgroups:

- **Discrete** (if it is the result of *counting* (the number of students of a given ethnic group in a class, the number of books on a shelf, ...))
- **Continuous** (if it is the result of *measuring* (distance traveled, weight of luggage, ...))

Types of Variables



Numerical Scale of Measurement

- **Nominal** – consist of categories in each of which the number of respective observations is recorded. The categories are in no logical order and have no particular relationship. The categories are said to be ***mutually exclusive*** since an individual, object, or measurement can be included in only one of them.
- **Ordinal** – contain more information. Consists of distinct categories in which order is implied. Values in one category are larger or smaller than values in other categories (e.g. rating-excelent, good, fair, poor)
- **Interval** – is a set of numerical measurements in which the distance between numbers is of a known, sonstant size.
- **Ratio** – consists of numerical measurements where the distance between numbers is of a known, constant size, in addition, there is a nonarbitrary zero point.

Examples of Measurement Scale

NOMINAL-LEVEL DATA

- Zip code
- Gender (male, female)
- Eye color (blue, brown, green, hazel)
- Political affiliation
- Religious affiliation
- Major field (mathematics, computers, etc.)
- Nationality

Examples of Measurement Scale

ORDINAL-LEVEL DATA

- Grade (A, B, C, D, F)
- Judging (first place, second place, etc.)
- Rating scale (poor, good, excellent)
- Ranking of tennis players

Examples of Measurement Scale

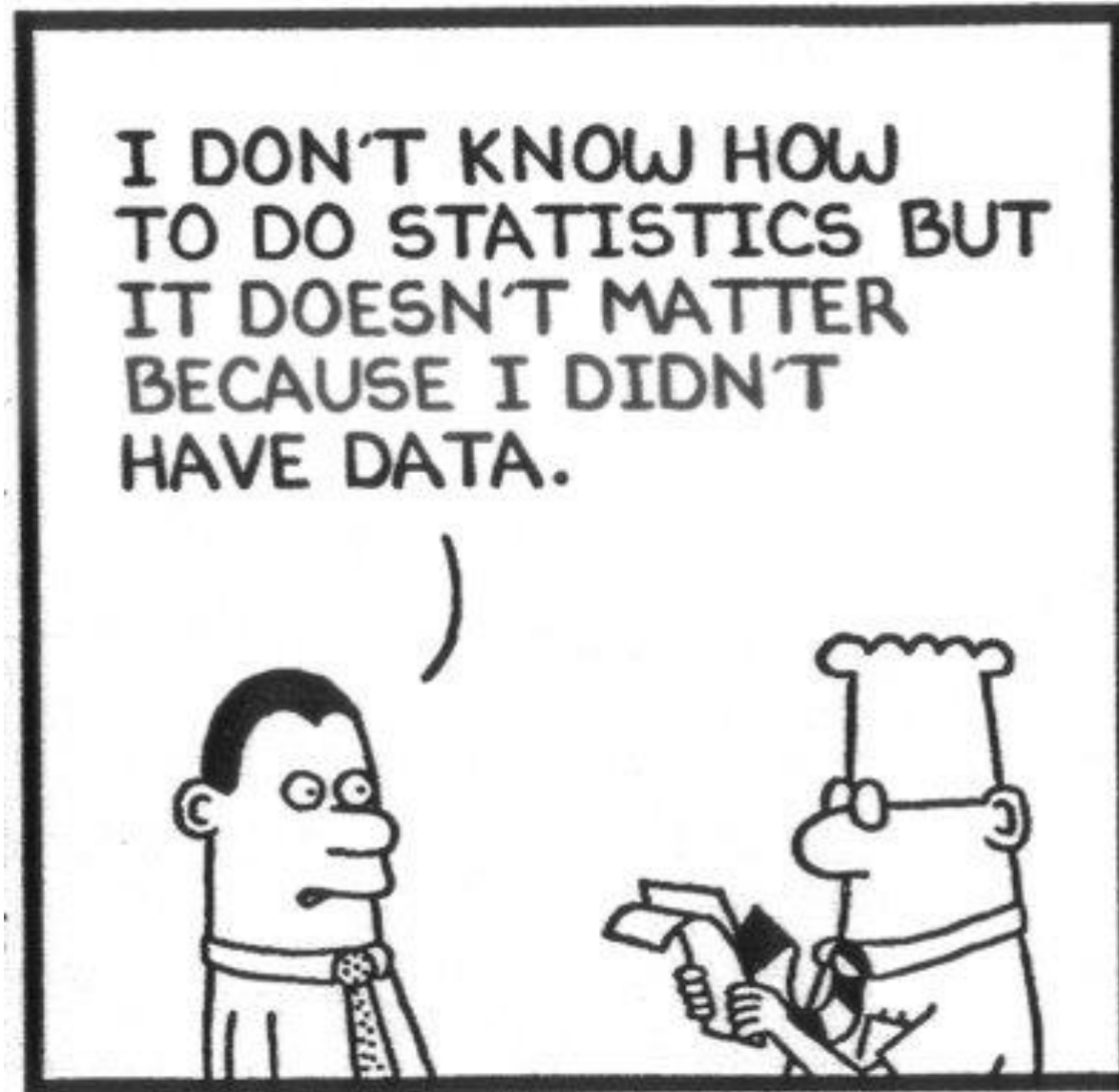
INTERVAL-LEVEL DATA

- SAT score
- IQ Temperature

Examples of Measurement Scale

RATIO-LEVEL DATA

- Height
- Weight
- Time
- Salary
- Age





Example 1: Oil Painting

Qualitative data

- *red/green color, gold frame
- *smells old and musty
- *texture shows brush strokes of oil paint
- *peaceful scene of the country
- *masterful brush strokes

Example 1: Oil Painting

Quantitative Data

- *picture is 10" by 14"
- with frame 14" by 18"
- * weighs 8.5 pounds
- surface area of painting is 140 sq. in.
- *cost \$300



Example 2: Latte

Qualitative data:

- *robust aroma
- *frothy appearance
- *strong taste
- *glass cup

Example 2: Latte

Quantitative data:

- *12 ounces of latte
- *serving temperature 150° F.
- *serving cup 7 inches in height
- *cost \$4.95



Example 3: Freshman Class

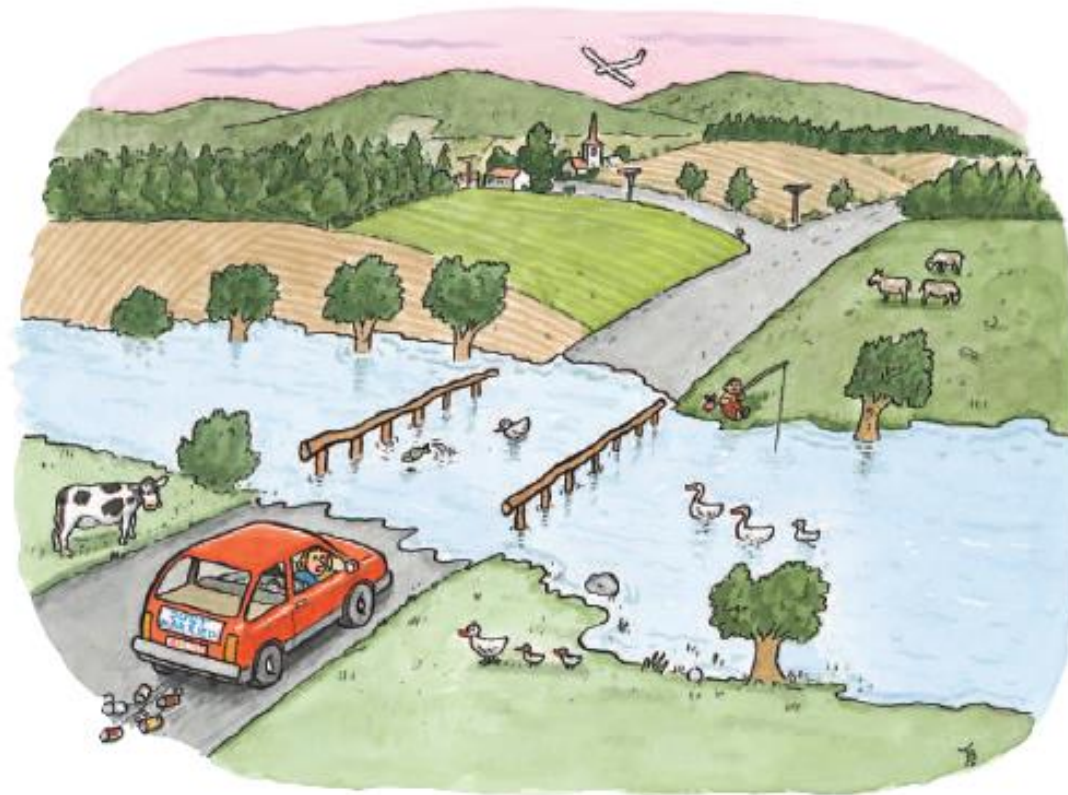
Example 3: Freshman Class

Qualitative data:

- *friendly demeanors
- *civic minded
- *environmentalists
- *positive school spirit

Quantitative data:

- *672 students
- *394 girls, 278 boys
- *68% on honor roll
- *150 students accelerated in mathematics



Make one qualitative observation about the picture above.
Explain why this is a qualitative observation.

Make one quantitative observation about the picture above.
Explain why this is a quantitative observation.



Make one qualitative observation about the picture above.
Explain why this is a qualitative observation.

Make one quantitative observation about the picture above.
Explain why this is a quantitative observation.

What is Quantitative Research?

- Formal, objective, rigorous, systematic process for generating information
- Describes new situations, events, or concepts
- Examines relationships among variables
- Determines the effectiveness of treatments

Types of Quantitative Research

Descriptive

Correlational

Quasi-experimental

Experimental

How Would You Describe Correlational Research?

- Looks at the relationship between two or more variables
- Determines the strength and type of relationship
- Explains what is seen
- No cause and effect

How about Quasi-experimental Research?

- Examines cause-and-effect relationships
- Less control by researcher than true experimental designs
- Samples are not randomly selected.
- All variables in the study cannot be controlled by the researcher.

What are the Main Characteristics of Experimental Research?

- Controlled manipulation of at least one independent variable
- Uses experimental and control groups
- Random assignment of the sample to the experimental and control groups

What is the Aim of Experimental Research?

- Looks at cause-and-effect relationships
- Highly controlled, objective, systematic studies
- Involves the measurement of independent and dependent variables

Check Your Understanding: Question

The nurse manager collects data about hours worked, age, sex, and geographic area of the nursing staff over a 10-year period. What type of research would this be considered?

- A. Descriptive
- B. Correlational
- C. Quasi-experimental
- D. Experimental

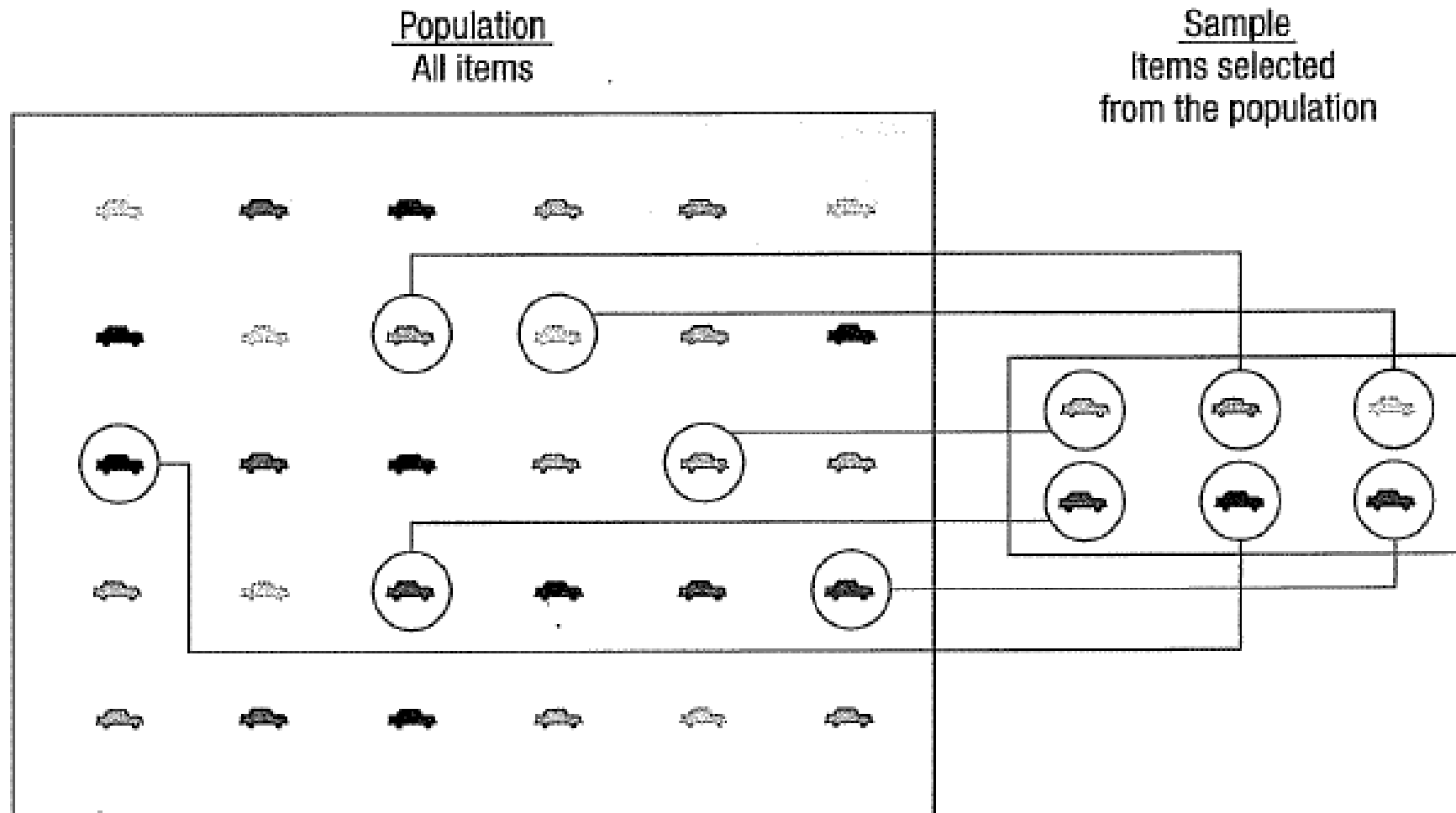
Check Your Understanding: Answer

ANSWER: A

- The quantitative research methods are classified into four categories: (1) descriptive, which defines the magnitude of a concept and its characteristics; (2) correlational, which determines associations between or among variables; (3) quasi-experimental, which tests an intervention and lacks control in at least one of three areas; and (4) experimental, which tests an intervention and includes both a control group and random assignment. This research study is designed to define the magnitude of an idea and its characteristics.

Types of Statistics

- **Descriptive statistics** – Methods of organizing, summarizing, and presenting data in an informative way
- **Inferential statistics** – The methods used to determine something about a population on the basis of a sample
 - Population – The entire set of individuals or objects of interest or the measurements obtained from all individuals or objects of interest
 - Sample – A portion, or part, of the population of interest



Inferential Statistics

- Estimation
 - e.g., Estimate the population mean weight using the sample mean weight
- Hypothesis testing
 - e.g., Test the claim that the population mean weight is 70 kg



Inference is the process of drawing conclusions or making decisions about a **population** based on **sample** results

Sampling

a sample should have the same characteristics as the population it is representing.

Sampling can be:

- **with replacement:** a member of the population may be chosen more than once (picking the candy from the bowl)
- **without replacement:** a member of the population may be chosen only once (lottery ticket)

Sampling Methods

Sampling methods can be:

- **random** (each member of the population has an equal chance of being selected)
- **nonrandom**

The actual process of sampling causes **sampling errors**. For example, the sample may not be large enough or representative of the population. Factors not related to the sampling process cause non-sampling errors. A defective counting device can cause a Non-sampling error.

Random Sampling Methods

- **simple random sample** (each sample of the same size has an equal chance of being selected)
- **stratified sample** (divide the population into groups called strata and then take a sample from each stratum)
- **cluster sample** (divide the population into strata and then randomly select some of the strata. All the members from these strata are in the cluster sample.)
- **systematic sample** (randomly select a starting point and take every n -th piece of data from a listing of the population)

Techniques in Collecting Quantitative Data and Instruments Used

1. Observation

Using your sense organs, you gather facts or information about people, things, places, events,



and so on, by watching and listening to them; then, record the results of the functioning of your eyes and ears. Expressing these sensory experiences to quantitative data, you record them with the use of numbers.

Techniques in Collecting Quantitative Data and Instruments Used

1. Observation

- Seeing, touching, and hearing the sources of data personally, you engage yourself in ***direct observation***.
- It is an ***indirect observation***, if you see and hear them, not through your own eyes and ears, but by means of technological and electronic gadgets like audiotapes, video records, and other recording devices used to capture earlier events, images, or sounds.



Techniques in Collecting Quantitative Data and Instruments Used

2. Survey

- It is a data-gathering technique that makes you obtain facts or information about the subject or object of your research through the data-gathering instruments of *interview and questionnaire*.



Techniques in Collecting Quantitative Data and Instruments Used

Questionnaire

- ✓ Is a paper containing series of questions formulated for an individual and independent answering by several respondents for obtaining statistical information.
- ✓ Each question offers a number of probable answers from which the respondents, on the basis or their own judgment, will choose the best answer.
- ✓ Making up a questionnaire are factual and opinionated questions.

Techniques in Collecting Quantitative Data and Instruments Used

Questionnaire

- ✓ Questions to elicit factual answers are formulated in a multiple-choice type and those to ask about the respondents' views, attitudes, preferences, and other opinionated answers are provided with sufficient space where the respondents could write their sentential answers to opinionated questions.

Techniques in Collecting Quantitative Data and Instruments Used

Questionnaire

- ✓ Responses yielded by this instrument are given their numerical forms (numbers, fractions, percentages) and categories and are subjected to statistical analysis.
- ✓ Questionnaire is good for collecting data from a big number of respondents situated in different places because all you have to do is either to hand the paper to the respondents or to send it to them through postal or electronic mail.

Techniques in Collecting Quantitative Data and Instruments Used



Interview

- Survey as a data-gathering technique likewise uses interview as its data-gathering instrument.
- You ask a set of questions orally
- With the advent of modern technology, oral interviews happen through the use of modern electronic devices such as mobile phones, telephones, smart phones, and other wireless devices.

Order of Interview Questions

First set of questions – opening questions to establish friendly relationships, like questions about the place, the time, the physical appearance of the participant, or other non-verbal things not for audio recording

Second set of questions – generative questions to encourage open-ended questions like those that ask about the respondents' inferences, views, or opinions about the interview topic

Order of Interview Questions

Third set of questions – directive questions or close-ended questions to elicit specific answers like those that are answerable with yes or no, with one type of an object, or with definite period of time and the like.

Fourth set of questions – ending questions that give the respondents the chance to air their satisfaction, wants, likes, dislikes, reactions, or comments about the interview.

Guidelines in Formulating Interview Questions

1. Use clear and simple language.
2. Avoid using acronyms, abbreviations, jargons, and highfalutin terms.
3. Let one question elicit only one answer; no double-barrel question.
4. Express your point in exact, specific, bias-free, and gender-free language.

Guidelines in Formulating Interview Questions

5. Give way to how your respondents want themselves to be identified.
6. Establish continuity or free flow of the respondents' thoughts by using appropriate follow-up questions (e.g., Could you give an example of it? Would you mind narrating what happened next?).
7. Ask questions in a sequential manner; determine which should be your opening, middle, or closing questions.

Techniques in Collecting Quantitative Data and Instruments Used

3. Experiment

- It is a scientific method of collecting data whereby you give the subjects a sort of treatment or condition then evaluate the results to find out the manner by which the treatment affected the subjects and to discover the reasons behind the effects of such treatment on the subjects.



Techniques in Collecting Quantitative Data and Instruments Used

3. Experiment

- This quantitative data-gathering technique aims at manipulating or controlling conditions to show which condition or treatment has effects on the subjects and to determine how much condition or treatment operates or functions to yield a certain outcome.
- The process of collecting data involves selection of subjects or participants, pre-testing the subjects prior to the application of any treatment or condition, and giving the subjects post-test to determine the effects of the treatment on them.

Techniques in Collecting Quantitative Data and Instruments Used

3. Experiment

- Dealing with or treating their communicative abilities in two or more modes of communication is giving them *multiple treatments*.
- The basic elements of experiment which are subjects, *pre-test*, *treatment*, and *post-test* do not operate only for examining causal relationships but also for discovering, verifying, and illustrating theories, hypotheses, or facts. (Edmonds 2013; Morgan 2014; Picardie 2014)

Techniques in Collecting Quantitative Data and Instruments Used

4. Content Analysis

- It is another quantitative data-collection technique that makes you search through several oral or written forms of communication to find answers to your research questions.
- This data-collection method is not only for examining printed materials but also for analyzing information coming from non-book materials like photographs, films, video tapes, paintings, drawings, and the like.

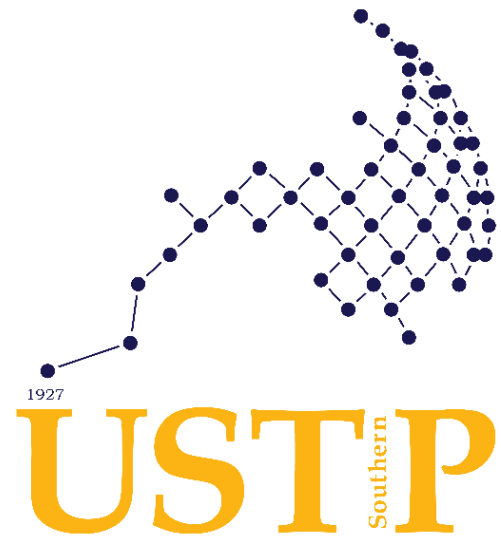
Techniques in Collecting Quantitative Data and Instruments Used

4. Content Analysis

- The focus of your study is on a single subject or on two entities to determine their comparative features.
- Any content analysis you want to do is preceded by your thorough understanding of your research questions because these are the questions to guide you in determining which aspect of the content of the communication should you focus on to find the answers to the main problem of your research.







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