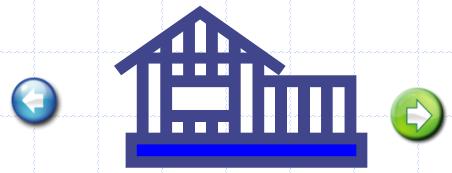
Instrumentation (Data Collection)



What are Data?

- **Data** refers to the information researchers obtain on the subjects of their research.
- Demographic information or scores from a test are examples of data collected.
- The researcher has to determine what kind of data they need to collect.
- The device the researcher uses to collect data is called an **instrument**.

Key Questions

- The instruments and procedures used in collecting data is called **instrumentation**.
- Questions arise regarding the procedures and conditions under which the instruments will be administered:
  - Where will the data be collected?
  - When will the data be collected?
  - How often are the data to be collected?
  - Who is to collect the data?
- The most highly regarded types of instruments can provide useless data if administered incorrectly,for example: if the instrument is administered by someone disliked by respondents, under noisy, inhospitable conditions, or when subjects are exhausted.

HOW TO DESIGN GOOD INSTRUMENTS

- The focus is on the researcher to ensure that the research questions are very precise and clear.
- The researcher must also ensure that the questions on the instrument are:

  - in simple language
  - clear
  - test or field test (give instrument(s) to resource persons or a group of people who has similar characteristics to those of intended target population, then compare answers/feedbacks to your original intention, and make amendment to the instrument accordingly).

Validity, Reliability, and Objectivity

- Validity is an important consideration in the choice of an instrument to be used in a research investigation.
  - It should measure what it is supposed to measure
  - Researchers want instruments that will allow them to make warranted conclusions about the characteristics of the subjects they study.

- Reliability is another important consideration, since researchers want consistent results from instrumentation.
  - Consistency gives researchers confidence that the results actually represent the achievement of the individuals involved

Usability

- An important consideration for any researcher in choosing or designing an instrument is how easy the instrument will actually be to use.
- Some of the questions asked which assess usability are:
  - How long will it take to administer?
  - Are the directions clear?
  - How easy is it to score?
  - Do equivalent forms exist?
  - Have any problems been reported by others who used it?
- Getting satisfactory answers can save a researcher a lot of time and energy.

Types of Subject-completed Instruments

- Questionnaires
- Self-checklists
- Attitude scales
- Personality inventories
- Achievement tests
- Performance tests
- Projective devices
- Psychometric devices

Item Formats

- Questions used in a subject-completed instrument can take many forms but are classified as either selection or supply items.
- Examples of selection items are:
  - True-false items
  - Matching items
  - Multiple choice items
  - Interpretive exercises
- Examples of supply items are:
  - Short answer items
  - Essay questions

Types of Scores

- Quantitative data is reported in the form of scores
- Scores are reported as either raw or derived scores
  - Raw score is the initial score obtained
    - Taken by itself, a raw score is difficult to interpret, since it has little meaning
  - Derived score are scores that have been taken from raw scores and standardized
    - They enable researchers to say how well the individual performed compared to others taking the same test
    - Examples include:
      - Age and Grade-level Equivalents
      - Percentile Ranks *(refers to the percentage of individuals scoring at or below a given raw score)*
  - Standard scores are mathematically derived scores having comparable meaning on different instruments

Examples of Raw Scores and Percentile Ranks

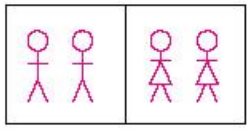
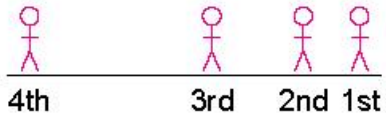
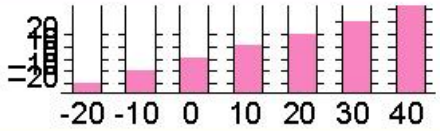
Raw Score	Cumulative Frequency	Percentile Frequency	Rank
95	1	25	100
93	1	24	96
88	2	23	92
85	3	21	84
79	1	18	72
75	4	17	68
70	6	13	52
65	2	7	28
62	1	5	20
58	1	4	16
54	2	3	12
50	1	1	4

N = 25

Measurement Scales

- There are four types of measurement scales
  - Nominal Scales
  - Ordinal Scales
  - Interval Scales
  - Ratio Scales

Four Types of Measurement Scales

SCALE		EXAMPLE
Nominal		Gender
Ordinal		Position in a race
Interval		Temperature (in Fahrenheit)
Ratio		Money

Four Types of Measurement Scales

Measurement Scale	Characteristics
Nominal	Groups and labels data only; reports frequencies or percentages.
Ordinal	Ranks data; uses numbers only to indicate ranking.
Interval	Assumes that equal differences between scores really mean equal differences in the variable used.
Ratio	All of the above, plus true zero point.

Validity and Reliability

Validity

- Validity has been defined as referring to the appropriateness, correctness, meaningfulness, and usefulness of the specific inferences researchers make based on the data they collect.
- It is the most important idea to consider when preparing or selecting an instrument.
- Validation is the process of collecting and analyzing evidence to support such inferences.

Errors of Measurement

- Because errors of measurement are always present to some degree, variation in test scores are common.
- This is due to:
  - Differences in motivation
  - Energy
  - Anxiety
  - Different testing situation

Test-Retest Method

- Involves administering the same test twice to the same group after a certain time interval has elapsed.
- A reliability coefficient is calculated to indicate the relationship between the two sets of scores.
- Reliability coefficients are affected by the lapse of time between the administrations of the test.
- An appropriate time interval should be selected.
- In Educational Research, scores collected over a two-month period is considered sufficient evidence of test-retest reliability.

Standard Error of Measurement

- An index that shows the extent to which a measurement would vary under changed circumstances.
- There are many possible standard errors for scores given.
- Also known as measurement error, a range of scores that show the amount of error which can be expected. (Appendix D)

Mortality

- It is common to lose subjects as a study progresses
- This is known as “mortality threat”.
- Loss of subjects limits generalizability and can introduce bias.
- Mortality is the most difficult threat to control for internal validity.
- An attempt to eliminate the problem would be to provide evidence that the subjects lost were similar to those who remained in the study.

Location

- The particular locations where data is collected may create different results or explanations known as ‘location threat’.
- The best way to control for this is to keep the location consistent for all subjects.
- If this is not possible, the researcher should ensure that different locations do not favor or jeopardize the hypothesis.

Instrumentation

- The way instruments are used may constitute a threat to the internal validity of a study.
- Some examples are as follows:
  - Instrument decay
  - Data Collector Characteristics
  - Data Collector Bias