

Week 9

Measurement

Overview of Research Process

1. Problem formulation
2. Methodology
 - Study population and sampling
 - Operationalization and measurement
 - Research design
 - Data collection
 - Data analysis plan
3. Implementation- Data collection
4. Data analysis
5. Dissemination

Today's class

- Operationalization of Variables
- Ways to Measure/Categories
- Levels of Measurement
- Use of Reliable and Valid Measure
- Sources of Measurement Error
- Avoid Measurement Errors
- Designing Questions
- Using an Existing Measurement

Operational Definitions of Variables

- In quantitative research we must first translate variables into operational definitions (observable terms) before a study is implemented
- Operational definitions differ from nominal definitions. For example, consider the concept *level of social adjustment*:
 - *Nominal definition*: “How well people perform their major roles in life”
 - *Operational definition*: “Score on a scale that measures social adjustment”

Ways to Measure

1. To measure a variable

– Quantitative Research

- Standardized Measurement (Scale)
- Behavioral Observation
- Individualized Rating Scales
- Available Record

– Qualitative Research

- Qualitative Interviewing- Unstructured, informal interview, semi-structured interviews, standardized interviews
- Behavioral Observation
- Available Record

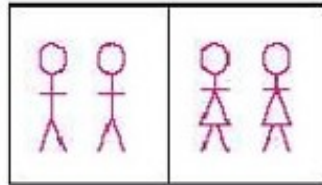
2. Transform variable into data

Types of Data (Levels of Measurement)

SCALE

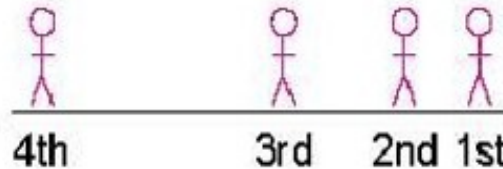
EXAMPLE

Nominal:



Gender

Ordinal:



Happiness

A semantic differential scale question

Interval:

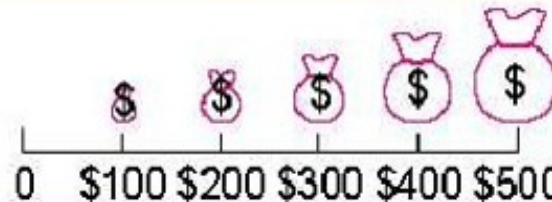


Temperature
(in Fahrenheit)

IQ score

Ordered, Equal differences

Ratio:



Money

Zero

Statistics

Learning

Chart

Types of Data:

Nominal

Ordinal

Interval/Ratio



Nominal Level Measurement

- Describes a variable in terms of the number of cases in each category of that variable.
- Examples
 - gender
 - ethnicity
 - religious affiliation

Ordinal Level Measurement

- Describes a variable whose categories can be rank-ordered according to how much of that variable they are.
 - We know only whether one case has more or less of something than another case, but we don't know precisely *how much* more.
- Examples
 - Likert scale and a semantic differential scale
 - Happiness
 - level of client satisfaction
 - brief rating scale:

Amount of anxiety you feel:

1	2	3	4	5
Little or none	Some	Moderate amount	Strong	Intense

Interval Level Measurement

- **Interval:** differences between different levels have the same meanings.
 - Example: IQ. The difference between an IQ score of 95 and 100 is the same in magnitude as the difference between 100 and 105.
 - “The **Likert scale** is widely used in social work research and is commonly constructed with four to seven points. It is usually treated as an **interval scale**, but strictly speaking it is an **ordinal scale**, where arithmetic operations cannot be conducted.” (Wu & Keung, 2017)
 - Likert scale, Semantic Differential scale.

Ratio Level Measurement

- **Ratio:** have the same attribute as interval measures, but in addition have a true zero point.
 - Example: # of arrests- possible to have no arrests, one arrest... Because there is a true zero point, we know that the persons with 4 arrests has been arrested exactly twice as many time as person with 2 arrests.
 - Zero of IQ test differ across the types of test: Stanford-Binet Intelligence Scale, Universal Nonverbal Intelligence, Differential Ability Scales. (Not true 0)

Illustration of levels of Measurement



LEVELS OF MEASUREMENT

01

NOMINAL

Named variables

ORDINAL

Named + ordered variables

02

03

INTERVAL

Named + ordered + proportionate interval between variables

RATIO

Named + ordered + proportionate interval between variables
+ Can accommodate absolute zero

04

How Do We Measure

1. Verbal report
2. Observation
3. Archival records
4. Individualized Rating Scale
4. Standardized Measurement
 - Using existing scales and indexes via self-report
 - Popular way to operationally define variables
 - Consider the quality of existing scales and indexes (Reliability- Alphas run from 0 to 1)
5. Using multiple measures- Triangulation

More than one indicator?

Measuring life satisfaction

- Single item (one question)

e.g., How many days are you satisfied during the last 30 days?

- Indexes: Composite/cumulative measures

e.g., Choose yes or no

When I think about myself, I feel downhearted and blue.

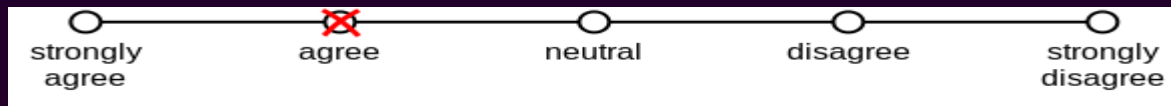
I often get tired for no reason

- Scales: composite measure that is composed of several items

e.g., Likert scale 0-7

In most ways my life is close to my ideal

The conditions of my life are excellent



Example

- Variable- Life satisfaction
- Operationalization- Scores on the Satisfaction With Life Scale (SWLS), which is a short 5 item instrument to measure global cognitive judgments of satisfaction with one's life ranging 5-35.
- How to Measure- Use of the Satisfaction with Life Scale
- Level of Measurement: Ordinal

The Satisfaction with Life Scale

DIRECTIONS: Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

- 1 = Strongly Disagree
2 = Disagree
3 = Slightly Disagree
4 = Neither Agree or Disagree
5 = Slightly Agree
6 = Agree
7 = Strongly Agree

- ___ 1. In most ways my life is close to ideal.
___ 2. The conditions of my life are excellent.
___ 3. I am satisfied with life.
___ 4. So far I have gotten the important things I want in life.
___ 5. If I could live my life over, I would change almost nothing.

Using Reliable and Valid Measure

Measurement Reliability and Validity

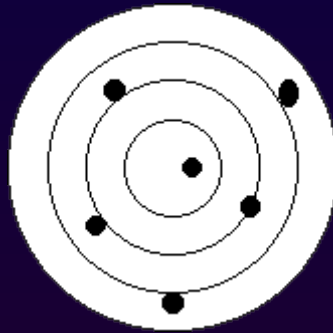
- Reliability- how closely a measurement procedure gets us to the actual quantity we are trying to measure (Consistency or stability)
- Validity- the degree to which a measure covers the range of meanings included within the concept (Accuracy)

Relationship between Reliability and Validity

- Reliability does not ensure validity, but Valid measure is generally reliable



Reliable but
not valid



Neither reliable
nor valid



Valid and
reliable

Example

- You measure the temperature of a liquid sample several times under identical conditions. The thermometer displays the same temperature every time, so the results are (). However, the results of other thermometers are 2 degrees lower than the original one. So, the thermometer is ()
- A doctor uses a symptom questionnaire to diagnose a patient with a long-term medical condition. Several different doctors use the same questionnaire with the same patient but give different diagnoses. This indicates that the questionnaire has low () as a measure of the condition.

Example

- A psychologist developed a new measure for intelligence. The results of the measure show consistency (= Similar results), when testing with the general population for more than 10 times. However, the measure only includes items for memory (e.g., ability to remember a short list of common objects and later, repeat it back). On the other hand, other existing measures include questions related to numerical reasoning, logical reasoning, and verbal intelligence as well since these are also important component of intelligence This indicates that the measurement is ().

Sensitivity to Diversity in Measurement

- Refine measurement, if necessary
- Use culturally sensitive measures
 - Use key informants
 - Translation-back translation
 - Pilot testing

Sources of Measurement Error

- Measurement Error: Data do not accurately reflect the concept we attempt to measure
 - Systematic error: when the information we collect consistently reflects a false picture; related to validity (e.g., Social desirability bias; Cultural bias)
 - Random error: no consistent patterns; errors by chance; related to reliability (e.g., Cumbersome, complex, boring measurement procedures; Measure uses professional jargon which respondents are not familiar with)

Errors in Alternative Forms of Measurement

- Written Self-reports
 - Words vs. deeds
 - Item wording
- Direct Behavioral Observation
 - Social desirability bias
 - Observers might be biased
- Interviews
 - Social desirability bias
 - Different interviewers
- Examining Available Records
 - Practitioners might exaggerate their records
 - Improper documenting

Avoiding Measurement Error

- Use unbiased wording in questionnaires and survey
- Use understandable terms
- Obtain collegial feedback
- Pilot testing
- Triangulation
- Thorough training interviewer/observer

Designing Questions Guidelines

1. Closed VS. open-ended questions

- Exhaustive and mutually exclusive

2. Wording of questions

- Simple, short, direct and clear
- Never use slang terminology

3. Avoid double-barreled questions

- “Should the state abandon its community-based services and spend the money on improving institutional care?”

Designing Questions

4. Culturally sensitive wording choice

5. Respondents Must be Willing to Answer

6. Questions Should be Relevant

Study results are not useful if questions are not relevant to respondents

7. Short Items are Best

8. Avoid Words like No or not- easy misinterpretation

Designing Questions

9. Structure and Design of Questionnaires

- Be easy on the eyes and easy to complete
- Directions: clear & Precise
- Order: Begin with easy, interesting items, opinion first, factual later; Put sensitive questions at the end

Critically Appraising Quantitative Instruments: Questionnaires

- Spread out and uncluttered
- Format for Respondents
 - Use genuine boxes ☐ ☐
- Contingency Questions are followed by a Filter Question
 - Respondents will only answer questions that are relevant to them

Have you ever smoked marijuana?

☐ **Yes**

☐ **No**

Filter question

Contingency question

If yes, about how many times have you smoked marijuana?

☐ **Once**

☐ **2 to 5 times**

☐ **6 to 10 times**

☐ **11 to 20 times**

☐ **more than 20 times**

Using an Existing Measurement

- Go to AU Library
- Go to Resources
- Click A-Z List of Databases
- Scroll down to PsychTests and click it
- Log in
- Type the name of your variable
- Select a measurement
- Check questions, validity and reliability