

## Measurement

*Juliet: "Tis but thy name that is my enemy... What's in a name? That which we call a rose by any other name would smell as sweet..."*

From: Shakespeare's *Romeo and Juliet*

- I. Check in about Written Assignment #1
- II. Conceptualization and Operationalization

A. **Conceptual definition:** A conceptual definition is a specific theoretical meaning of a term, but usually NOT one used for describing measurement. (It's what you would find in a dictionary.)

"Self-esteem is the personal judgment of self-worth."

**\*\*\* These types of definitions are found in the literature review**

B. **Operational definition:** An operational definition is the explicit specification of a variable in such a way that its measurement is possible.

"Self-esteem is the self-rated score of personal worth measured by the Rosenberg Self-Esteem inventory."

**\*\*\* These types of definitions are found in the methods section**

**\*\*\*Note: For some variables, the conceptual definition is self-explanatory, such as "gender"**

**\*\*Student report: Give two examples of how variables can be operationalized.**

C. **Operationalization** is the process of developing operational definitions of the variables that are contained within the concepts of a quantitative research study.

Some variables have self-explanatory conceptual definitions, such as "gender."

### More Examples:

"*Ethnicity*" is the self-reported ethnic group of birth, origin or self-identification (*conceptual definition*) where participants can be classified as European American, African American, Asian American/Pacific Islander, Latino, Native American, or Other (*operational definition*)

*Happiness*: The state of feeling happy (*conceptual*) measured by a total score on

"Y. I. M. Delighted Scale" (*operational*)

➔ **Tip:** When you review the literature, feel free to use conceptual and operational definitions already developed by other researchers. You don't have to "reinvent the wheel" here.

### III. Types of measurement—Categorical and Continuous Variables

**Why important:** A Variable can be categorized according to its *level or type of measurement*. This has relevance now as you consider the best types of ways to operationalize concepts for your projects. It will have even more relevance next semester when we cover analysis strategies.

#### A. **Categorical Variables:** nominal and ordinal—think *categories*

1. **Nominal variable:** A variable with discrete, named categories (attributes) without order or value. For example, "Gender" or "Ethnicity"
2. **Ordinal variable:** A variable with discrete named categories (attributes) with a ranking or order. An ordinal level of measurement is one that classifies variables by rank-ordering them from "high" to "low" or from "most" to "least" or first to last. For example "On a scale of 1 to 5..."

#### B. **Continuous Variables:** interval and ratio—think *continuum*

1. **Interval variable** - A variable measured on a continuous scale with equal intervals between values (e.g., temperature in Celsius or Fahrenheit). (The word "values" is used interchangeably with "attributes.") An interval level of measurement is one that has "an arbitrarily chosen zero point that classifies its values on an equally spaced continuum."
2. **Ratio variable** - A variable measured on a continuous scale with equal intervals between values *and* with a true zero point (e.g., age and height). A ratio level of measurement is one that has "a nonarbitrary, fixed zero point and classifies the values of a variable on an equally spaced continuum."

	<b>Categorical Variables</b>		<b>Continuous Variables</b>	
	<b>Nominal Scale</b>	<b>Ordinal Scale</b>	<b>Interval scale</b>	<b>Ratio Scale</b>
Ordered		<b>X</b>	<b>X</b>	<b>X</b>
Equal intervals			<b>X</b>	<b>X</b>
Based on a true zero point				<b>X</b>

What level of measurement is each of these variables?

1. Degrees of Fahrenheit scale.

2. Degrees of the Kelvin Scale (*hint*: “absolute 0” is the coldest it can get, theoretically)
3. On a scale of 1= very unsatisfied to 5 = highly satisfied
4. Number of people who attend a training
5. Gender
6. All Likert scales
7. Total annual income
8. Income categories:
  - \$0 to \$24,999
  - \$25,000 to \$49,999
  - \$50,000 to \$74,999
  - \$75,000 or above
9. Percentage of training attendees who are African American
10. San Jose State’s 2007 football win/loss ratio
11. “I like anchovies: Yes or No”
12. How much do I like anchovies:
  - A lot
  - Somewhat
  - No opinion
  - Not so much
  - Don’t let them anywhere near me
13. Client randomly assigned to experimental treatment (vs. control group), “Yes” or “No”

\*\*When collecting data on income, which of these is the preferred type of data to collect?  
Why?

- a) Exact income (e.g. “annual income”), OR
- b) Categories 0 to \$19,999; 20,000 to 40,999; 50,000 to 59,000; 60,000 or above, OR
- c) “Do you make \$50,000 or less, or do you make above \$50,000?”

#### IV. Measurement Error

- A. The mission of the researcher is to measure, minimize, or explain measurement error whenever possible.

\*\*Why do mean by “explain” measurement error? Why does it need explaining?

- B. What is “Measurement error”? Measurement error occurs when we obtain data that do not accurately portray the concept we are attempting to measure.

**\*\*Student report: What’s the difference between “systematic error” and “random error”? Give an example of each.**

C. Systematic vs. Random Error

3. **Systematic error:** Systematic (or constant) error in measurement due to factors that *consistently* or *systematically* affect the variable being measured. **Biased response is a common source of systematic error.**

- **Social desirability bias**—the tendency of people to say or do things that will make them or others associate with them look good
- **Acquiescence, or acquiescent response set**—people agree with or disagree with all statements regardless of the content
- **Cultural bias**—when a measure stemming from lack of cultural knowledge. The researcher and the respondent (from different cultural groups) have two different ideas about a concept, hence respondents from that culture will consistently respond in a way that does not measure the researcher’s intended meaning.

4. **Random error:** Error in measurement due to unknown or uncontrolled factors that affect the variable being measured and the process of measurement in an inconsistent fashion (i.e. there is no consistent pattern of error. **This is not the result of bias, but instead the result of unpredictable factors.**

- **Guessing** the correct answer when the respondent doesn’t understand the question (i.e. a question that uses vague or technical jargon)
- **Inter-rater differences**—two observers of the same behavior interpret the behavior differently
- **Situational or environmental factors** that affect response—e.g. respondents may respond to lethargy; children become inattentive, etc. There may be transient factors—the respondent had a bad day, or a cold...
- **Factors related to the measurement methods**—there are too many questions in the survey. Or, a survey originally written for adults is administered to children who do not fully understand some of the questions.

Is there a potential for *random* or *systematic* error here?

1. Asking a substance abuse treatment participant, upon intake, “How much alcohol do you consume each day?”
2. When administering the Child Anxiety Symptom Inventory to a young child, the child gets fidgety and is inattentive
3. In an interview about her satisfaction with the nursing home program, an elderly Latina reports “Very satisfied” to all questions

4. In asking adolescents about their views on standardized tests, one youth reports “I just check ‘C’ for each question and hope for the best.”
5. A question about depression is asked to a newly arrived Laotian client : “Have you felt down in the last six months?”
6. A survey to welfare recipients includes a question “How would you describe the amount of your capital?”
7. In a survey you see the question “Don’t you think that people who have a mental illness should take medications?”

## V. Small Group Exercise

**Groups of 3-4 students; each group assigned one scenario of explanatory research:**

**Scenario 1:** You are interested in what factors cause the symptoms of people diagnosed with mental illness to become worse. You have access to data about their perceived level of symptom distress, a recent measure of stress level, current level of family support, whether or not they are in treatment, and the number of social contact they have.

**Scenario 2:** You work for an agency that provides support groups for victims of domestic violence in local shelters. One of the objectives of the groups is to help clients feel more in control of their lives. You wonder whether or not the support groups are effective in doing that.

**Scenario 3:** Caseworkers are required to have regular contacts with children who have been removed from parental custody. An agency report shows that some children seem to have more contacts than others. You wonder what factors explain this. (**Note: for this scenario—also identify two independent variables that might be relevant**)

For each scenario:

- What is the problem being addressed?
- Identify the research statement. (“This research examines...,is focused on..., deals with..., addresses... \_\_\_\_\_.”)
- Identify the independent and dependent variables
- State a research question
- State one or more hypotheses

- For the dependent variable:
  - Define it conceptually
  - Define it operationally (“Measured by \_\_\_\_\_”)
  - What data collection method might be used to measure this (the choices are: 1. Face-to-face interviews, 2. Focus groups, 3. Written self-response surveys, or 4. Use of already-collected data)?
  - Name one random and one systematic source of potential measurement error

VI. Study questions for next week—need volunteer for #4...

- #1 What’s the difference between “validity” and “reliability”? Give an example of each.
- #2 In the article “The cultural adaptation of the Youth Quality of Life Instrument” the authors use the term “cultural equivalence.” Define it, and describe a few of the components.
- #3 In the same article, researchers recommended changes not only to the Spanish version of the instrument, but also the English version. Why?
- #4 Describe the difference between open-ended and closed-ended questions. Give examples of each.

Important Concepts

- Conceptual definition of a variable
- Operational definition of a variable
- Measurement error: systematic vs. random
- Measurement error
- Systematic error
- Random error
- Bias (in response): social desirability bias, acquiescent response set
- Cultural bias (in item/question/scale construction)
- Closed vs. open-ended questions
- Double-barreled questions
- Likert scale
- Measurement error (systematic vs. random)
- Categorical variable
- Continuous variable
- Nominal variable
- Ordinal variable
- Interval variable
- Ratio variable