Quantitative Methodology Toolkit

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Section Outcomes

• Articulate the concepts of data level, reliability, and validity
• Articulate the strengths and weaknesses of quantitative assessment methodologies
• Apply the basics of quantitative sampling

Assessment Topic

• Consider an assessment question you want to know the answer to.

Paradigm, Methodology, Method

• What is the difference?
• Paradigm: worldview or perspective
  • qualitative vs. quantitative
• Methodology: theory of how inquiry should proceed
  • experimental, causal comparative, survey
• Method: tool or technique for collecting data
  • experiment, survey, checklist

(Schwandt, 1997)
What is It?

- In small groups, list the characteristics of quantitative assessment.

Some Quantitative Tenets

- Facts and data have an objective reality.
- Variables can be identified and measured.
- Events are viewed from an objective, outsider’s perspective.
- Life is static.

(Burns, 2000, pp. 391-392.)

Levels of Data

- Nominal/Categorical
- Ordinal
- Interval
- Ratio

Levels of Data

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Qualitative

Quantitative
Levels of Data

Nominal/Categorical

• Applies to data which are classified only by name
• Sometimes called “qualitative” data

Examples
• First year, sophomore, junior, senior
• On-campus vs. off-campus

Ordinal

• Not only things that differ from each other by belonging in different groups, but are different in amount or degree
• Differences between ranks may not be equal

Example
• Strongly disagree, disagree, agree, strongly agree

Interval

• Distances between the categories or intervals of measurement are defined in fixed and equal terms

Example
• Temperature (Celsius, Farenheit)
• GPA

Ratio

• Has all the properties of interval data, but it DOES have a true zero point, at which it is assumed that there is a complete absence of the element being measured
• These numbers have all of the properties of actual numbers and may be added, divided, or multiplied

Examples
• Number of credits
• Income
• Age
Levels of Data

- Nominal/Categorical - no ordering
- Ordinal - ordering exists, but not distance
- Interval - distance exists, but not ratios
- Ratio - ratios exist

(www.stat.wmich.edu/s216/book/node4.html)

Reliability

- What is it?
- Why is it important?

Validity

- What is it?
- Why is it important?
Validity

- Three types
  - Internal
  - Instrument
  - External

Internal Validity

- “Observed differences on dependent variable are due to independent variable” (Fraenkel and Wallen, 2003 p. 179)
  - History
  - Maturation
  - Testing/pre-testing procedures
  - Instrumentation/instrument decay
  - Selection/subject characteristics

Internal Validity

- Mortality
- Data collector characteristics
- Data collector bias
- Attitude of subjects
- Regression to the mean

Internal Validity

- Thinking about your assessment topic, which threats to internal validity should you be concerned about for your assessment and why?
  - History
  - Maturation
  - Testing/pre-testing procedures
  - Instrumentation/instrument decay
  - Selection/subject characteristics
  - Mortality
  - Data collector characteristics
  - Data collector bias
  - Attitude of subjects
  - Regression to the mean
Instrument Validity

- 3 types of instrument validity
  - Content
  - Criterion
  - Construct

- Content validity: The degree to which an instrument or test examines the total content of the element or area being measured

- Criterion validity: The degree to which the results of a test or other data gathering instrument is in agreement with the findings of other criterion measures

- Construct validity: The degree to which given explanatory concepts or constructs may account for the performance of subjects
  - Is the construct you want to measure actually being measured?
External Validity
- The extent to which the results from the sample can be generalized to the population under study

Reliability and Validity
- Can a data collection methodology be valid, but not reliable?
- Can a data collection methodology be reliable, but not valid?

Quantitative Methodologies
- Experiment
- Causal-comparison
- Correlation
- Survey/Interview

Experiment
- Experiments: seek to control threats to validity through the use of random assignment or other methods (i.e., assessment design, statistical control)
Experiment

**Examples**

- Determine if roommate matching increases satisfaction with living environment
- Determine if participation in study groups increases course grades compared to non-participation

**Strengths**

- Convenient to supervise
- May be less expensive to carry out than large-scale descriptive studies
- Can postulate causation because researcher can control variables
- Easy to replicate because there are detailed steps for performance

**Weaknesses**

- May be very costly if it requires special environments, trained observers, or testing procedures
- Lab experience may not simulate reality effectively
- Usually have small number of subjects, so findings may be misleading
- Might be regarded as harmful from an ethical perspective because people have to do something or you have to alter their life

**Causal Comparison**

- “Investigators attempt to determine the cause or consequence of differences that already exist between or among groups of individuals”

(Fraenkel and Wallen, 2003, p. 368)
Causal Comparison

**Examples**

- Effects of group membership (student org member)
- Causes of group membership (major)
- Consequences of intervention (how engaged are students in a leadership development course)

**Strengths**

- A focus on determining causation
- Can identify relationships
- Allows the study of variables that cannot be manipulated

**Weaknesses**

- Lack of control over threats to validity
- Cannot control all variables
- Causation cannot be fully determined

**Correlation**

- Relational – used to determine a relationship between variables
**Correlation**

**Examples**
- Determine association between high-risk alcohol use and gender
- Determine association between participating in a leadership development course and academic success
- Determine association between extroversion and being an effective resident assistant

**Correlation**

**Strengths**
- Can be used to explain
- Can be used to predict
- Correlation coefficients are relatively easy to understand

**Correlation**

**Weaknesses**
- Correlation is NOT causation
- Correlations can be “muddied” by influence of other variables
- More advanced correlational techniques (e.g., regression, discriminant analysis, and path analysis) can be difficult to perform and interpret

**Survey/Interview**

- Information is collected from a group of people to describe characteristics of that group (Fraenkel and Wallen, 2003, p. 396)
- Samples of a population are often used
- Types
  - Cross-sectional
  - Longitudinal
Examples

- Describe the beliefs of our students regarding why they came to college
- Describe how many hours our students volunteered last semester
- Describe how many drinks, on average, our students consume in a typical week

Strengths

- Relatively easy to implement
- Variety of data collection methods available

Weaknesses

- Question development is more difficult than it may seem
- Questions may not be as precise of a measurement as one would want
- Many assumptions made regarding participants’ responses

Assessment Topic

Thinking about your assessment topic, is quantitative methodology most appropriate and if so, which methodology(s) would be the best for your assessment and why?

- Experiment
- Causal-comparison
- Correlation
- Survey/Interview
References

