More on Data Collection & Group Comparison

Today's Agenda
- Review
- Exercise on t-tests
- Find Article #2
- New information
  - More on group comparisons
  - More on data collection
- Analyze Article #2

Schedule Reminder
No class next week for Spring Break!
**Research Process**

- Examine association between 2+ variables
- Develop hypothesis or question
- State specific, testable prediction
- Collect data

**Variables**

- Basis for research
- Individual elements of hypotheses/predictions
- Must vary

A variable has levels

- Is a category
- Is a member of category
- Can change
- Cannot change

**Variable Definitions**

- Concept → Operation
- Valid
  - Face
  - Predictive
  - Concurrent
  - Convergent
  - Discriminant
- Reliable
  - Internal
  - Test-retest
  - Inter-rater
- Scale
  - Ratio
  - Interval
  - Ordinal
  - Nominal
**Variables & Causality**

- Types of variables
  - Subject
  - Situation
  - Response
- Created vs. pre-existing variables
  - Subject always pre-existing
  - Situation & response *may be*
    - Pre-existing
    - Created

**Goals of Research**

- Description → **Descriptive Statistics**
- Prediction → **Inferential Statistics**
- Causation

**Describing a Group**

- Norms (Central Tendencies)
  - Mean
  - Median
  - Mode
- Individual Differences (Variability)
  - Range
  - Standard Deviation
# Kinds of Inferences

- Linear Relations
- Correlations
- Group Comparisons
- Experiments

## Comparison Between 2 Groups

- Based on
  - Difference between group norms (means)
  - Differences within groups (standard deviation)
  - Odds that sample represents population (degrees of freedom)
  - Produces probability of Type 1 Error

## Example

- Is the number of fights in classrooms with 20 children significantly greater than the number of fights in classrooms with 10 children?

  - Steps
    - Sample classrooms in each group
    - Count the fights in each room
    - Compare groups to see if norm for 20 children classes is “typical” of 10 children classes
**Frequency of Fighting in 20 Student Classes**

Number of Fights

- 4
- 5
- 6
- 7
- 8
- 9
- 10

**Frequency of Fighting in 10 Student Classes**

Number of Fights

- 2
- 3
- 4
- 5
- 6
- 7
- 8

**Properties of a Normal Distribution**

<table>
<thead>
<tr>
<th>Area</th>
<th>±2.2</th>
<th>±13.6</th>
<th>±34.1</th>
<th>±34.1</th>
<th>±13.6</th>
<th>±2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Deviation</td>
<td>-3S</td>
<td>-2S</td>
<td>-1S</td>
<td>Mean</td>
<td>1S</td>
<td>2S</td>
</tr>
</tbody>
</table>
Comparing Groups

T-statistic

- Numerical representation of difference between groups
- $t(18) = 3.75, p < .05$

<table>
<thead>
<tr>
<th>Research Decision</th>
<th>Reality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null is True</td>
<td>Hypothesis is True</td>
</tr>
<tr>
<td>Accept Null</td>
<td>☺</td>
</tr>
<tr>
<td>Accept Hypothesis</td>
<td>Type I Error</td>
</tr>
</tbody>
</table>

Degrees of Freedom
Probability of Type 1 Error
Difference between means divided by standard deviation
Degrees of freedom

- Related to sample size
- Possible variability in sample
- How much freedom is there to get a different score?

Exercise

Moving on to Article 2
Research Project Context

- Article Review 1
- Article Review 2
  - Self-selected article
  - Same theme as article 1
  - Individual or 1 partner
  - Develop presentation (due 4/5)
- Article Review 3
  - 2 (4) additional articles
  - Individual or group up to 4
  - Workday 4/12
  - Due 4/19

Article Review 2 Activities

- Now
  - Identify partner (if desired)
  - Select article
  - Print article
- Later
  - Review article (use worksheet)
  - Identify key points
  - Develop presentation

More on Group Comparisons
### Scales of Measurement

- Ratio/Interval
- Ordinal
- Nominal

<table>
<thead>
<tr>
<th>Scale Type</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio/Interval</td>
<td>Mean, Median, Mode</td>
</tr>
<tr>
<td>Ordinal</td>
<td>Median, Mode</td>
</tr>
<tr>
<td>Nominal</td>
<td>Mode</td>
</tr>
</tbody>
</table>

### Scales of Measurement in Between Group Comparisons

- **Grouping Variable**
  - Called independent or predictor
  - Used as nominal measure
- **Outcome Variable**
  - Called dependent or criterion
  - Must
    - Be interval/ratio or Likert
    - Accommodate math

### Defining Groups

- Created groups
  - Independent variables
  - Defined by experimenter
  - Create experimental design
  - Group creation strategies:
    - Random assignment
    - Matched pairs
- Existing groups
  - Predictor variables
  - Defined by
    - Subject variables
    - Pre-existing situation variables
  - Create quasi-experimental design
**Developmental Designs**

- Quasi-experimental
  - Examine change associated with age
  - Attempt to differentiate development and experience
- 3 different designs
  - Cross-sectional
  - Longitudinal
  - Sequential

---

**Cross-Sectional**

1. Cohort Effects

---

**Longitudinal**

<table>
<thead>
<tr>
<th>Repeated Measures</th>
<th>Cross-Sectional</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Types of Comparisons

- Two different groups of people
  - Scores are independent of each other
  - One measurement does not influence the other
    - Independent group design
- One group of people before and after (pretest vs. post-test)
  - Scores are related to each other
  - One measurement does influence the next
    - Repeated measures design

Relations among Design Elements

- Existing vs. created grouping variables
- Predictor vs. independent variables
  - Independent groups created by
    - Random assignment
    - Matched-pairs
- Quasi-experimental vs. experimental
- Independent vs. Repeated measures
  - 2+ different groups vs.
    - one group measured 2+ times
  - Longitudinal design = repeated