PS 211: Introduction to Experimental Design

Fall 2025 · Section C1

Discussion 3: Lectures 4–5 and Poster Brainstorming

Outline for Today

- Attendance – please sign the sheet at the front

- Important packages for knitting R Markdown to PDF

- Recap of Lectures 4–5

- Worksheet and icebreakers

- Brainstorming research ideas

- Discussion poster project

Important packages for knitting R Markdown to PDF

- I will give you time to do this later during our worksheet

- Copy and paste these two lines into the Console (the bottom left window), and then press enter:

```
install.packages(c("rmarkdown", "tinytex"))
```

```
tinytex::install_tinytex()
```

After running these two lines, you should now be able to Knit your Homework 1 Rmd file to PDF.

Lecture 4: Central Tendency

- Central tendency = "center" of dataset

- **Mean**: arithmetic average; sensitive to outliers

- **Median**: middle score; 50th percentile; robust to outliers

- **Mode**: most common score; can be unimodal, bimodal, multimodal

- In normal distribution → mean = median = mode

- In skewed distributions → mean, median, mode differ

- Outliers distort mean; median less affected

Lecture 4: Variability

- Variability = spread of scores

- **Range**: highest – lowest

- **Interquartile Range (IQR)**: Q3 – Q1, middle 50%

- **Variance**: average squared deviation from mean

- **Standard deviation (SD)**: square root of variance

- Boxplots: show median, quartiles, IQR, outliers

Lecture 5: Sampling

- Populations: entire group of interest

- Samples: subset used to estimate population

- **Random sample**: equal chance of selection; representative but hard

- **Convenience sample**: easier, common in psychology; less representative

- **Random assignment**: within experiments, ensures comparability of groups

Lecture 5: Probability

- Probability = likelihood of outcome (0 to 1)

- Trial = repetition (e.g., dice roll); outcome = result; success = outcome of interest

- Independent trials: outcomes don't affect each other (coin flips)

- Experimental probability: based on repeated trials

- Theoretical probability: based on known outcomes

- Common errors: gambler's fallacy, overestimating rare events, confirmation bias

Lecture 5: Hypothesis Testing

- Descriptive stats: summarize samples

- Inferential stats: generalize to populations

- Hypothesis testing uses probability to judge if sample result is likely under null hypothesis

Worksheet for Today

1. Central Tendency & Variability: Your group has these exam scores — 70, 80, 90, 100.

   - What are the **mean** and **median**? If we add an outlier of 0, how do the mean and median change?

   - Which class shows higher **variance**: (Class A: 79, 80, 81) or (Class B: 60, 80, 100) ?

2. Sampling & Assignment: A researcher wants to study BU students' sleep habits.

   - Is recruiting from Psych 101 **random** or **convenience** sampling?

   - Suppose you flip a coin to assign students to two tasks. How would you use the coin to assign them?

   - What does random assignment accomplish? How is it different from random sampling?

3. RStudio checklist: Copy and paste these two lines into the Console (the bottom left window), and then press enter:

   ```
   install.packages(c("rmarkdown", "tinytex"))
   ```

   ```
   tinytex::install_tinytex()
   ```

   After running these two lines, you should now be able to Knit your Homework 1 Rmd file to PDF. Try this now!

4. Wrap-up: Which concept from Lectures 4–5 feels most important for the exam?

   - Imagine your sleep schedule as a histogram. What does it look like now vs. ideally? Who in your group is the most "normal" and who's the outlier?

How to Brainstorm Research Ideas

- Start with **broad psych topics** that interest you (e.g., sleep, stress, social media, learning).

- Ask: *What variables could we measure or manipulate?*

    - IV = what we change (e.g., study environment, type of task)

    - DV = what we measure (e.g., accuracy, reaction time, mood)

- Look for **connections to everyday life** or current issues.

- Keep it **simple and testable** within the scope of this class.

    - Although we will not be conducting experiments ourselves, our hypothetical study should still be attainable, understandable, and clearly tied to measurable variables.

- Be creative — but ground your ideas in **experimental design concepts** we've learned so far, so you can connect them directly to your poster.

Discussion poster project

- In small groups, you will come up with a research hypothesis, conduct a literature review, and write hypothetical methods, results, and discussion sections to be presented on a poster at the end of the semester.

- **This week**, we will form groups of 3-4 and brainstorm research ideas

- Attend discussion! → much easier to coordinate

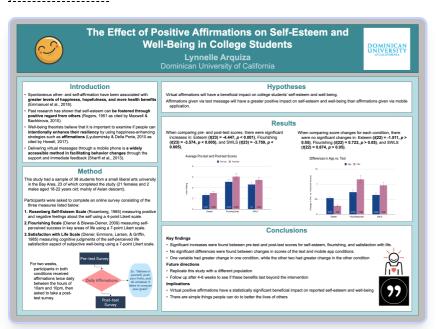 - Goal is no work outside of discussion section

Checklist – what should my poster have?

- Introduction
  - Current literature
  - Research question
  - Hypothesis
- Methods
  - Participants
  - Independent variable
  - Dependent variable
  - Analysis

- Results
  - Descriptive statistics
  - Inferential statistics
- Figures (1-2)
- Conclusion
- Limitations
- References (choose a citation style)

Design your figures and posters to be easily understood!

Good: https://scholar.dominican.edu/ug-student-posters/101/

Not so good: https://colinpurrington.com/2012/02/example-of-bad-scientific-poster/

Discussion poster project outline

- Discussion 3: Form groups and brainstorm research ideas

- Discussion 4: Research poster topics and form hypotheses

- Discussion 5: Refine topic and compile references

- Discussion 6-7: Introduction section

- Discussion 8-9: Methods section

- Discussion 10-11: Analysis plan and limitations section

- Discussion 12: Finalize poster

- Discussion 13: Group poster presentations!