

PS 211: Introduction to Experimental Design

Fall 2025 · Section C1

Discussion 2: Summaries of Lectures 1–3

Outline for Today

- Attendance
- Recap of Lectures 1–3
- Worksheet and icebreakers
- Discussion poster project

Lecture 1: Course Overview

- Introductions (Kate & Juneau)
- Logistics: lectures, discussions, Slack
- No textbook → we use R & RStudio
- Course goals: describe variables, samples, hypothesis testing, R analysis, interpretation, communication, limits of statistics
- Grading: exams (70%), homework (10%), data write-up (10%), discussion (10%)

Lecture 1: Science & Statistics

- **Data** = values that convey information
 - E.g., numbers, words, observations
 - Used for calculation, reasoning, discussion, decision-making
- **"Statistics"** can mean data, summaries of data, or methods for analysis
- Statistics are used constantly in daily life: medicine, finance, policy, news, science
- Goals of science: describe phenomena, predict relationships, and explain these relationships
- Scientific method: observe, review literature, hypothesis, design, collect/analyze data, conclude & communicate
- Publication process: peer review, revision, publication

Lecture 2: Variables & Research

- **Continuous:** any value, can have fractions (height, weight)
- **Discrete:** specific values only (number of pets)
- **Nominal:** categories (names only)
- **Ordinal:** rankings, ordered but no fractions
- **Interval:** equal intervals, no true zero (temperature °F)
- **Ratio:** equal intervals, true zero (reaction time = 0)

Lecture 2: Research Methods

- Non-experimental: naturalistic, case study, surveys
- Experimental: manipulation of IV(s), measure effect on DV(s)
- IV = manipulated variable, levels = values it takes
- DV = outcome variable
- Variables must be defined (easy: age; harder: happiness?)
 - Abstract, hard-to-define variables can be carefully defined **operationally**
 - Operational definitions specify the observations or procedures used to measure/manipulate a variable
- Variables can have levels
 - Discrete example = type of pet could be dog, cat, hamster
 - Continuous example = reaction time could range from 0 to infinity

Lecture 2: Correlation vs Experiment

- **Correlational studies:** variables observed as they naturally occur, cannot show causality
- **Confound** = variable that varies with IV and affects DV, making it hard to isolate the causal effect of IV on DV
- **Experiments:** random assignment helps reduce confounds and allows causal inference
- **Reliability:** consistency of a measure
- **Validity:** accuracy of a measure
- **Between-Subjects** participants experience only one level of the IV
- **Within-Subjects** participants experience all levels of the IV

Lecture 3: Descriptive vs Inferential

- **Descriptive stats:** summarize and organize data
- **Inferential stats:** use sample data to make inferences about a population
- Raw data = original numbers, hard to interpret alone
- Frequency distributions help visualize data: tables, grouped tables, histograms
- There are many correct ways to present data
 - But our goal is to choose the **most useful** ways!

Lecture 3: Visualizing Data

- **Frequency table:** list values + counts
- **Grouped frequency table:** intervals (bins) for ranges
- **Histogram:** graph of grouped frequency table; bars touch, continuous variables only
- **Distribution** = how values are spread or clustered
- **Normal distribution:** symmetric, bell-shaped
- **Skew:**
 - Positive skew → tail right, floor effect
 - Negative skew → tail left, ceiling effect
- Bar graphs = categorical data

Worksheet for Today

1. Introduction: In groups of 3-4, share your **name** and one example of a **variable** you've noticed in daily life (e.g., coffee cups per day, hours of sleep). Say whether it's **discrete** or **continuous**.
2. Come up with two examples of **ordinal variables** that could show up in a BU student survey.
 - a. For one of them, explain why it is ordinal and not interval.
3. Methods: As a group, come up with an **operational definition** for a tricky variable (e.g., "happiness," "stress," "study effort").
4. Studies: BU finds that students who sleep more have higher GPAs.
 - a. Is this correlational or experimental?
 - b. What would a confound be?
 - c. How could you redesign this as a true experiment?
5. Visualization: Sketch a **positively skewed** and a **negatively skewed** histogram of exam scores.
 - a. How does the shape differ between the two?
 - b. In what situation might you prefer a **bar graph** instead of a histogram?
6. Wrap-up: What is the most useful concept from lecture so far? The easiest? The most challenging?

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.
- **Next 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/>

The Effect of Positive Affirmations on Self-Esteem and Well-Being in College Students

Lynnelle Arquiza
Dominican University of California



Introduction

- Spontaneous other- and self-affirmation have been associated with **greater levels of resilience, hopefulness, and more health benefits** (Emanuel et al., 2018).
- Past research has shown that self-esteem can be **fortified through positive regard from others** (Rogers, 1951 as cited by Maxwell & Backrow, 2010).
- Well-being theorists believe that it is important to examine if people can **intentionally enhance their resiliency** by using happiness-enhancing strategies such as **affirmations** (Lynnelle & Della Porta, 2010 as cited by Howell, 2017).
- Delivering virtual messages through a mobile phone is a **widely accessible method in facilitating behavior changes** through the support and immediate feedback (Shariff et al., 2015).

Method

This study had a sample of 38 students from a small liberal arts university in the Bay Area. 23 of which completed the study (21 females and 2 males aged 18-22 years old; mostly of Asian descent).

Participants were asked to complete an online survey consisting of the three measures listed below.

- Rosenberg Self-Esteem Scale** (Rosenberg, 1965) measuring positive and negative feelings about the self using a 4-point Likert scale.
- Flourishing Scale** (Diener & Biswas-Diener, 2000) measuring self-perceived success in key areas of life using a 7-point Likert scale.
- Satisfaction with Life Scale** (Diener, Emmons, Larsen, & Griffin, 1981) measuring cognitive judgments of the self-perceived life satisfaction aspect of subjective well-being using a 7-point Likert scale.

For two weeks, participants in both conditions received affirmations twice daily between the hours of 10am and 10pm. Then asked to take a post-test survey.

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graph TD
    A[Pre-test Survey] --> B{Daily Affirmations}
    B --> C[Post-test Survey]
    B --> D["Ex. "I believe in myself, push through my fears, and do whatever it takes to conquer your goals!""]
  
```

Hypotheses

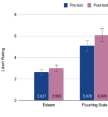
Virtual affirmations will have a beneficial impact on college students' self-esteem and well-being. Affirmations given via text message will have a greater positive impact on self-esteem and well-being than affirmations given via mobile application.

Results

When comparing pre- and post-test scores, there were significant increases in: **Esteem** ($t(23) = -4.447, p < 0.001$), **Flourishing** ($t(23) = -3.274, p < 0.005$), and **SWLs** ($t(23) = -3.760, p < 0.005$).

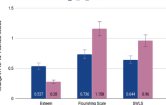
When comparing score changes for each condition, there were no significant changes in: **Esteem** ($t(22) = 1.511, p > 0.05$), **Flourishing** ($t(22) = 0.723, p > 0.05$), and **SWLS** ($t(22) = 0.674, p > 0.05$).

Average Pre-test and Post-Test Scores



Measure	Pre-test	Post-test
Esteem	~4.5	~5.5
Flourishing	~5.5	~6.5
SWLS	~5.5	~6.5

Differences in App vs. Text



Measure	App	Text
Esteem	~0.5	~0.5
Flourishing	~0.5	~0.5
SWLS	~0.5	~0.5

Conclusions

Key findings



- Significant differences were found between pre-test and post-test scores for self-esteem, flourishing, and satisfaction with life.
- No significant differences were found between changes in scores of the text and mobile app conditions.
- One variable had greater change in one condition, while the other two had greater change in the other condition

Future directions

- Replicate this study with a different population
- Follow up after 4-6 weeks to see if these benefits last beyond the intervention

Implications

- Virtual positive affirmations have a statistically significant beneficial impact on reported self-esteem and well-being
- There are simple things people can do to better the lives of others


[illegible]

Outline for future weeks

- 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!