

PS 211: Introduction to Experimental Design

Fall 2025 · Section C1

Discussion 5: Lectures 6-7 Review & Finalizing Poster Hypotheses

Outline for Today

- Attendance – please sign the sheet at the front
- Lectures 6 and 7 review
- Worksheet
- Finalize poster hypotheses

Lecture 6: The Normal Curve & Z Scores

- Normal distributions: bell-shaped, symmetric, unimodal
- Outliers/deviations from normal → can flag anomalies (e.g., fraud detection)
- Standardization: convert raw scores → **z scores** (SDs from mean)
- Z distribution: mean = 0, SD = 1
- Compare across scales: z tells us relative standing
- Percentiles: proportion of scores below a given z

Lecture 7: Central Limit Theorem & Standard Error

- **Central Limit Theorem (CLT):** distribution of sample means \approx normal if n is large
- Even if raw scores aren't normal, sample means will be
- Distribution of means = less variable than raw scores
- **Standard Error (SE):** SD of sample means
 - Formula: $SE = s / \sqrt{n}$
 - Larger samples \rightarrow smaller SE \rightarrow more precise estimates

Worksheet for Today

1. Z Scores: A test has $M = 70$, $SD = 10$. You got an 85.

- What is the z score?
- Is it above/below average?

2. CLT & SE: We have two samples from same population: $n = 9$ vs. $n = 100$.

- Which has smaller SE? Why?

3. Normal Curve

- If $z = 1$, what % of scores are below it?
- If $z = -1$, what % are above it?

4. Hypothesis Testing

- Suppose $\mu = 50$, $\sigma = 8$.
- Sample ($n = 16$): $M = 46$.
 - Compute SE.
 - Compute z.

5. Wrap-up

- Share one real-life case where you'd want to compare two groups (IV levels).
- How could you phrase it as H_0 vs. H_1 ?

Last week: broad topics -> testable hypotheses

- Hypothesis = specific, directional prediction that connects your IV & DV
- Must be **measurable**, **clear**, and **feasible**
- Stuck? Think of hypotheses as "If..., then..." statements. *If (change in IV), then (change in DV)*
- Always specify the IV levels you're comparing
 - For >2 levels, describe the expected pattern (e.g., "Performance decreases as noise increases")
- E.g., "If students drink coffee before class, then their reaction times will be faster on a simple task compared to students who don't."
- E.g., "If people listen to upbeat music, then they will complete puzzles more quickly than when listening to calm music."
- E.g., "Students who study in quiet settings will recall more words than those who study with music."
- During class, check in with me so we can workshop your group's hypothesis

This week: Refine topic and compile references

- Use Google Scholar or BU Library databases to search your topic
- Start with **review articles** → they summarize many studies at once
- Look for peer-reviewed journal articles, not blogs or random websites
- Skim the abstract & conclusion first: does it clearly connect to your hypothesis?
- Collect at least **3–5 solid references** this week to support your poster
- Keep track of them in a shared doc (include citation info!) and show me
 - You may use any citation style as long as it is consistent
 - That said, I am most familiar with APA
- Tip: “cited by” on Google Scholar helps you find more recent follow-ups

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.

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

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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 **fostered 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!""]
  
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Hypotheses

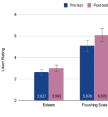
Virtual affirmations will have a beneficial impact on college students' self-esteem and well-being. Affirmations given via text message will have a greater positive impact on self-esteem and well-being than affirmations given via mobile application.

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** ($t(23) = -3.760, p < 0.005$).

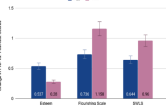
When comparing score changes for each condition, there were no significant changes in: **Esteem** ($t(22) = 1.511, p > 0.05$), **Flourishing** ($t(22) = 0.723, p > 0.05$), and **SWLS** ($t(22) = 0.674, p > 0.05$).

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]

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!