

Ownership/Stewardship and Confidence Intervals

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Team Facilitator

- **SJSU**

- Math 161A is one semester upper division statistic course that students from diverse majors are required to take
- 80 students were enrolled in Fall 2025 across the two sections

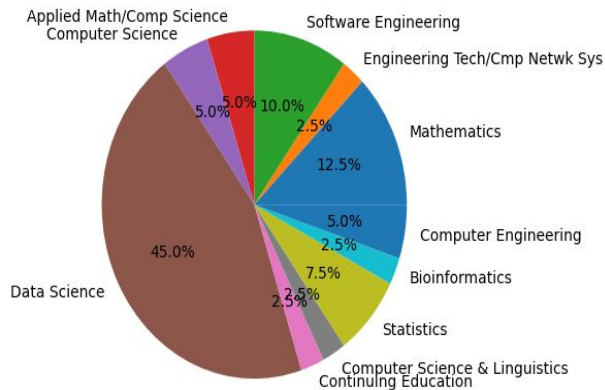
- **CPP**

- STA 1200 is the one semester course that introduces the foundation of the statistics course.
- There are 33 students (mainly freshman) enrolled in this class during Fall 2025.

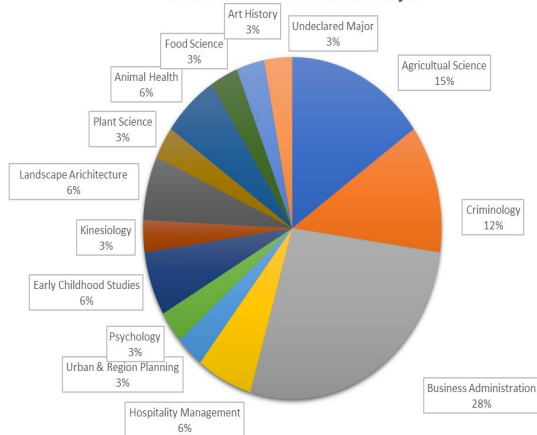
- **SSU**

- Math 165AB is a year-long introductory statistics course meant for incoming first-year students whose mathematical reasoning is not college-ready.
- 22 students are enrolled in the Spring 2026 MATH 165AB class.

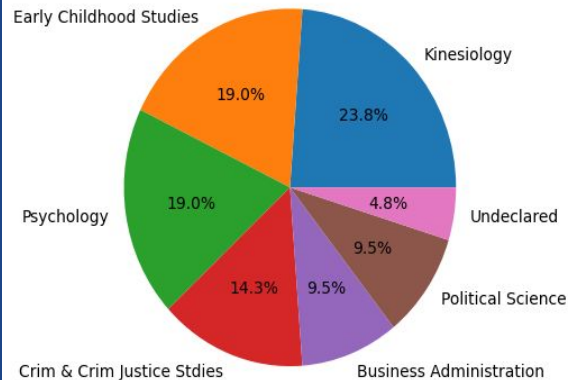
Distribution of Math 161A major



Distribution of STA 1200 Major



Distribution of MATH 165AB Majors



Content Goal and RM Dimension

- Content Goals Considered:
 - Sampling Distributions
 - Randomization Distributions
 - **Confidence Intervals**
 - RM Dimensions Considered
 - Creation
 - Inventing new (to them) forms of science; authors of STEM
 - **Ownership / Stewardship**
 - Desire to play or express oneself; questions of importance to self/community; self determination
- STEM as something one does for oneself/community, not just for others (e.g., school); questions and answers are useful for own purposes*

Lesson Development

Original Plan

- Gather data at start of class to form “population” of data
- Use RNG to generate samples of size 30
- Calculate statistics, create class dot plot, use it to estimate SE
- Compute CIs
- See what proportion of CIs contained the parameter

Problems!

None of this plan truly addressed Creation or Ownership/Stewardship. Our TIPS consultant gave us some helpful pointers for how to revise our plan to better address the RM goal.

Revision:

Emphasized getting students into groups to identify topics that were meaningful to them.

Also provided advanced notice about the activity to avoid panic or anxiety.

Focal Student Interview Questions

Rehumanizing Questions

1. How would you describe statistics to a friend?
2. What has the process of learning statistics been like for you?
3. How do you or people you know - your friends or family - usually use statistical reasoning in their lives?
4. What would help you to feel more connected to what we are learning in class?

Content Questions Touched on:

- Trade-off between large sample size and sources of potential bias
- Importance of both measures of center and spread to describe data
- Connections between population distribution and sampling distribution

Focal Students

- We chose these students based upon their participation during the class period. Some were actively engaged during class while others were attentive but shy during the class session.
- All of them expressed a genuine interest in learning through asking questions outside of class, even if they were quiet during the class period.
- We had a total of four focal students:
 - Student 1, CPP - majoring in Urban & Regional Planning (Like to participate)
 - Student 2, CPP - majoring in Plant Science (Very Engaged in the lesson)
 - Student 3, SSU - majoring in Biology (Shy but wanted to participate)
 - Student 4, SJSU - majoring in Bioinformatics-Returning to School after many years-Very Engaged-Stay connected after the class

Focal Student Interviews - Common Threads

- Most had a close connection with someone who uses statistics professionally:
 - Parents are professors in related fields
 - Brother in law works in economics
 - Parents work in a warehouse that uses data for operational decisions
- Students said that some of statistics was intuitive for them, but not all, and so they understood the importance of taking a formal class.
- Most saw the application of statistics to what they wanted to do for an eventual career.
- Biggest content struggle (from interview questions): the trade-off between sampling bias and sample size.

Day 1 of the SSU Lesson Study Implementation

- The lesson plan was broken up into three separate days of instruction.

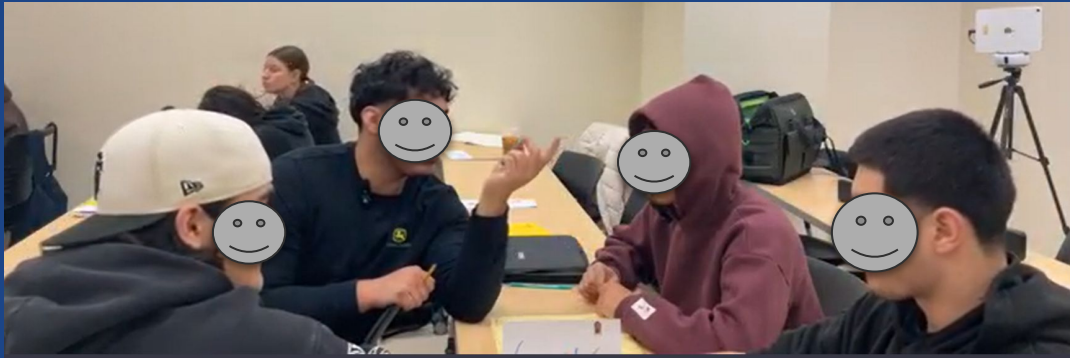


The overall purpose of the group project is to come up with a research question that interests you and your group, to phrase the research question in terms of a parameter, and to gather data to answer your research question with a 95% bootstrap confidence interval.

Let's get into groups of size no more than four.

Day 1 of the SSU Lesson Study Implementation

As a group, think about which of the following questions are phrased in terms of a parameter and can be answered with a confidence interval. If a question is not phrased in terms of a parameter, rephrase it in terms of a parameter.



3. Which type of smartphone is most popular among students at our college?

the sonoma state students
3. what proportion of sonoma state students
from 2023/26 have an iphone
as course units

Day 1 of the SSU Lesson Study Implementation

Choose a topic that is of interest to you and your group, and pose a question that can be investigated using a confidence interval.

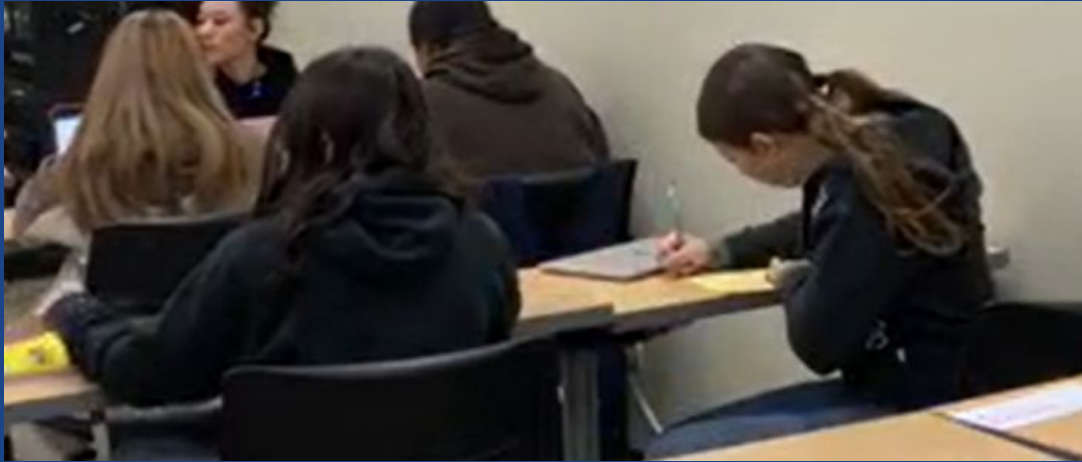
Gather your own data directly or gather existing data from an online source. Create a spreadsheet of your data. Collect at least 30 observations and save your data set as a CSV file.



- what proportion of ssu students are registered to vote?

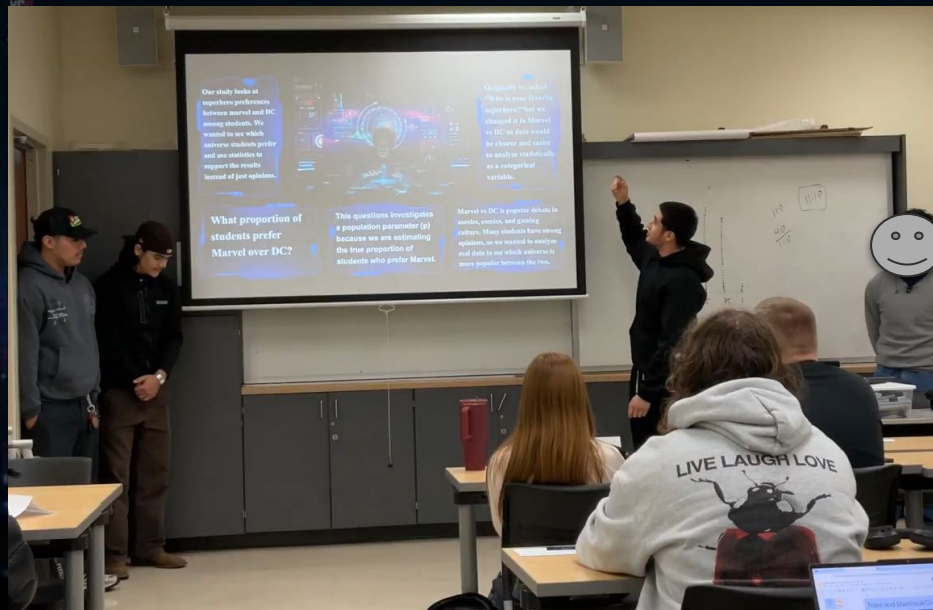
Day 2 of the SSU Lesson Study Implementation

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Upload your data to Statkey. Use Statkey to generate a bootstrap distribution. Use your bootstrap distribution to estimate the standard error of the sampling distribution of your statistic of interest. Construct and interpret your 95% confidence interval.

Our study looks at superhero preferences between marvel and DC among students. We wanted to see which universe students prefer and use statistics to support the results instead of just opinions.



Originally we asked “Who is your favorite superhero?”but we changed it to Marvel vs DC so data would be clearer and easier to analyze statistically as a categorical variable.

What proportion of students prefer Marvel over DC?

This questions investigates a population parameter (p) because we are estimating the true proportion of students who prefer Marvel.

Marvel vs DC is popular debate in movies, comics, and gaming culture. Many students have strong opinions, so we wanted to analyze real data to see which universe is more popular between the two.

Lesson Study Implementation: Cal Poly Pomona

- In this Lesson Study, we spend two days (25 minutes each day) to make students into groups of 4 to 5 student.
- In this study, we formed six different groups.
- Each group was asked to brainstorm and write the proposal for finding the confidence interval of the field that they are interested in.
- After these 2 days discussion, they will have one week to submit the write up as a team with the topics, source of data, and their finding of confidence interval in pdf format.

Examples of Student Work - Cal Poly Pomona (Team 2)

Page 1: Title: Suicide Rates in the Vet Med Field

Topic

- Suicide rates in the vet med field
- Examine how common suicide is among veterinarians
- Research Question: What is the true proportion of veterinarian deaths due to suicide?
- Why Important: Showcase the level of stress, burnout, compassion fatigue, etc. Highlight serious mental-health issues in people that are important in public health, animal health, and food safety.



Examples of Student Work - Cal Poly Pomona (Team 2)

Page 2

Data

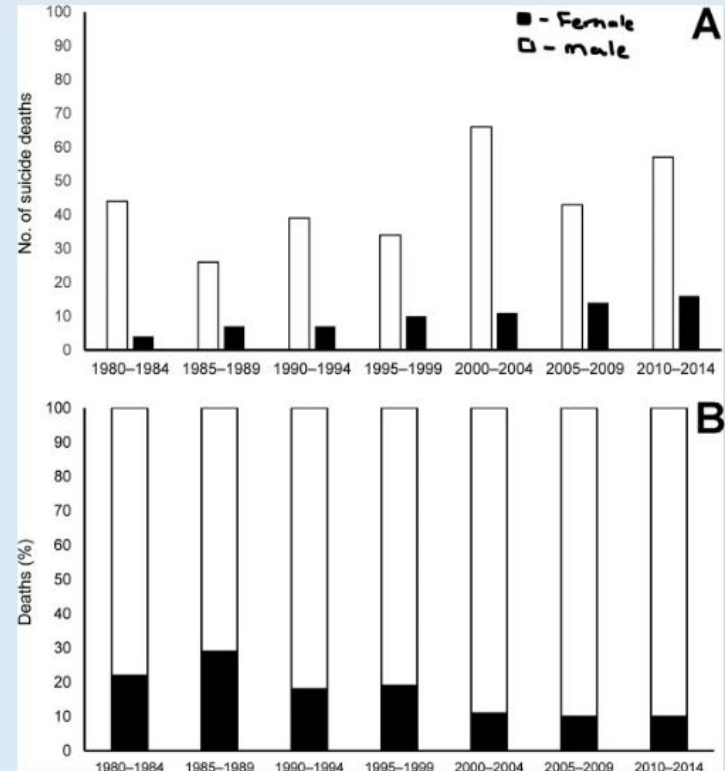
- Out of a sample from life insurance data provided by the American Veterinary Medical Association and data from the Central Bank of Death Records of the United States of America, 11,620 veterinarians that died from 1979 to 2015, 398 of them were from suicide.
- Out of the 398, 82% were male and only 18% were female and a majority of them were 65 or older.
- Proportionate Mortality Ratio of suicide of female as well as male veterinarians were higher than for the general population.



Examples of Student Work - Cal Poly Pomona (Team 2)

Page 3

**Data
Graph**

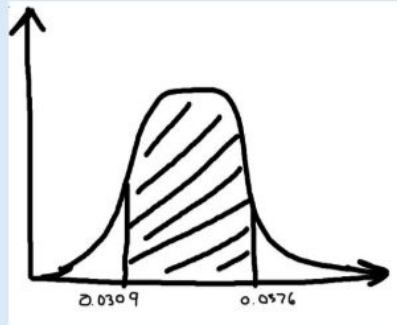


Examples of Student Work - Cal Poly Pomona (Team 2)

Page 4

Confidence Interval

- We calculated an interval of 95% for the proportion of veterinarian deaths caused by suicide
- Interpretation: We are 95% confident that the true proportion of veterinarian deaths due to suicide is between 3.09% and 3.76%



$$CI = \hat{p} \pm z \times \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$\hat{p} = \frac{388}{11,620} = 0.0343$$

$$n = 11,620$$

$$z = 1.96 \text{ (for 95\% confidence)}$$

$$CI = 0.0343 \pm 1.96 (0.00168)$$

$$CI = (0.0309, 0.0376)$$



Lesson Study Implementation: SJISU-Team 2-Deliverable

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COMBINING THE TWO PRODUCTS

[illegible]

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Supplementary Materials:

Reflections / Things Learned / Conclusions

- Classroom Spacing / Layout
- Group formation
- Interaction with groups during the brainstorming session to provide formative feedback
- Issues with recording: set-up and testing of equipment, reluctance of students to participate fully when being recorded
- Use of online source = used population-level data from the text
- Teamwork when project spans multiple days (absences, change of topics between days, original proponent of topic does not show up for work/presentation day)

Thank you!

Any Questions for Us?