Creating Student Centered Activities in the Lab and Classroom: BOPPPS and the Creation of STAT 1150

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Outline

A Little Bit About Me

- T.A.'d throughout undergrad
- Began teaching after my MSc
- Full time instructor in 2016
- Teaching and Learning Certificate (TLC) Program

A Little Bit About 1150

- Set to be an alterative stream for stats major and science/mathematically inclined students
- Make use of computer software and be more data driven
- Take topics from 1000 and 2000
- Go deeper into ideas and “background” material
- First offering Fall 2017

Personal Goals

- Apply what I learned about lesson planning to the class and the lab.
- Incorporate interesting case studies
- Push boundaries of what T.A.'s could teach
- See how deeply we could teach "ideas" without math

Goal for Today

- Introduce one possible tool for organizing activities
- Small individual pieces that could apply on a smaller scale
- Share how much further we can go in “ideas” based on data.

What is BOPPPS?

BOPPPS is a framework for designing a lesson plan with six different components: Bridge In, Objective, Pre-Assessment, Participatory Learning Activities, Post-Assessment, Summary.

What is BOPPPS to me?

- A helpful guideline to reflect on what I want to teach/how I'll know they've learned what I taught them.
- A guideline and not a prescription.
- A reminder that I'm telling a story with a beginning/middle/end.
- One of many different organizational tools.

Bridge-In

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- Case study
- Anecdote from my personal life
- Comic
- Fun Fact
- Quick Demonstration

Objectives

Two-three learning outcomes that you would like the students to be able to do by the end of the lecture.

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- Measurable
- Shared with students
- Fit into the larger course outcomes

Pre-Assessment

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- Small group discussion based on prompt question
- Practice question
- Making a prediction or inference based on the story in the bridge-in.
- Give a practical explanation for what we saw in the bridge-in.

Learning Activities

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- Simulation activity
- Group problem solving
- Teach a concept and have a demonstration
- "Homework check" pre-lab activities together
- Brainstorming applications
- Guessing outcomes

Post-Assessment

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- Ask students to predict what would happen in a different context
- Work in small groups to solve a related problem
- Ask lead-in question to next lab/lecture that needs ideas from current lab to answer

*Best way to assess learning is to get them to apply the ideas.

Summary

Restate in a few sentences the main ideas from the lecture.

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- Tie into the learning objectives
- Reframe what we did to the key points
- Set a clear ending to the activity

Lab Example

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This lab is run after being taught about sampling distributions and confidence intervals but prior to hypothesis testing.

Bridge-in

We tell the story of Marine and set up the experiment:

- In each trial Marine is presented with 5 people
- Four are cancer free, one has collerectal cancer
- Marine needs to go next to patient with collerectal cancer

Objectives

By the end of this lab students should be able to:

- Calculate a confidence interval for $\hat{p}$
- Assess whether a claim about a parameter is likely to be true based on a confidence interval for a statistic
- Predict likely values of a parameter based on a statistic

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1. If Marine was randomly guessing, what should the proportion of correct guesses be?
2. Marine actually got 30/33 attempts correct. Make a confidence interval for the true proportion of times she can correctly identify a cancer patient.
3. Using the confidence interval, do you think it's likely the dog was randomly guessing. Why or why not?

Verify their confidence interval.

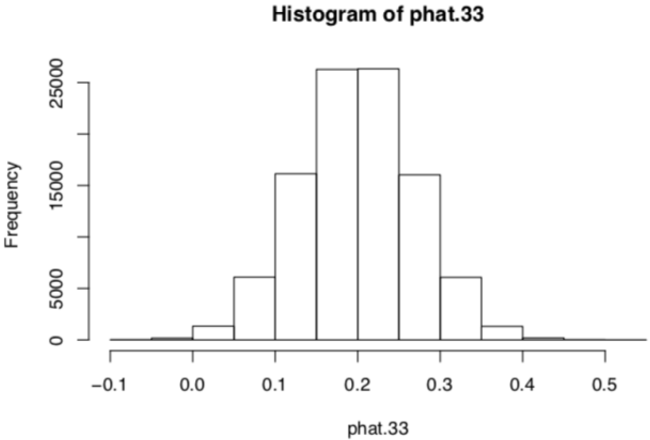
$$\hat{p} \pm Z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

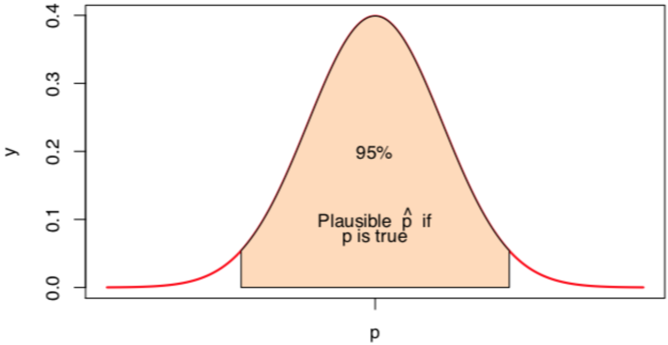
$$= \frac{30}{33} \pm 1.96\sqrt{\frac{(30/33)(1-30/33)}{33}}$$

$$= (0.8110, 1.0071)$$

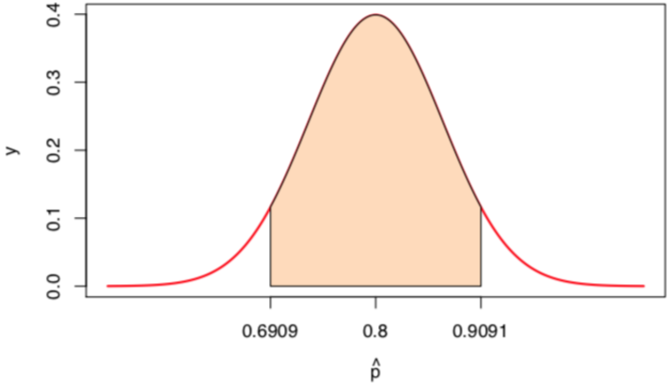
Learning Activities

Use confidence interval idea to try to capture plausible guesses at p. Simulate the sampling distribution for $\hat{p}$ with $p = 0.2$ and see where our observed $30/33 \approx 0.91$ falls.





$$P(Z < -1.96) + P(Z > 1.96) = 2 * p(Z > |1.96|) = 0.05$$


0.4
0.3
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y
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0.8
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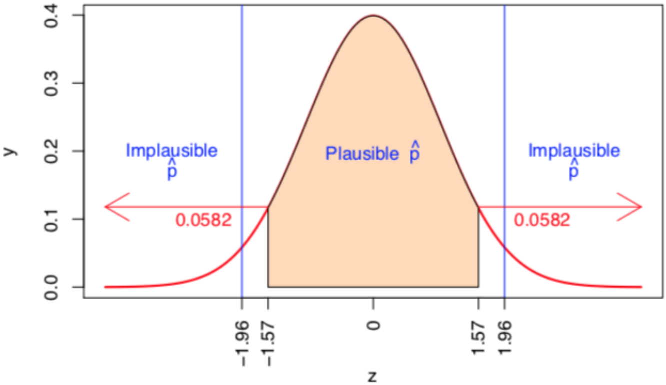
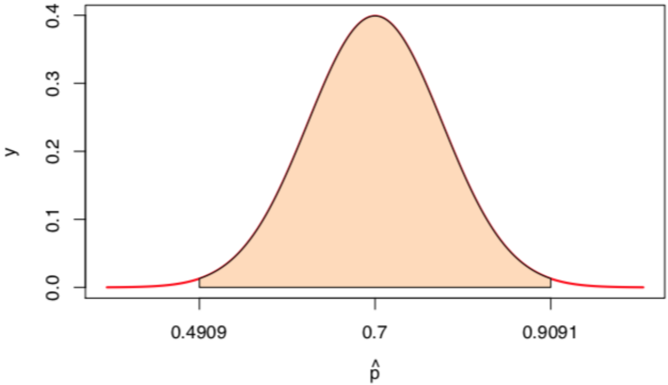
p̂



$$2 * P(Z > |1.57|) = 2 * 0.0582 = 0.1164 > 0.05$$


0.4
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y
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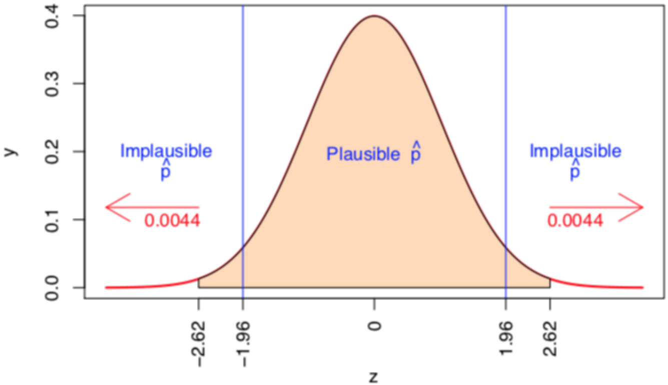
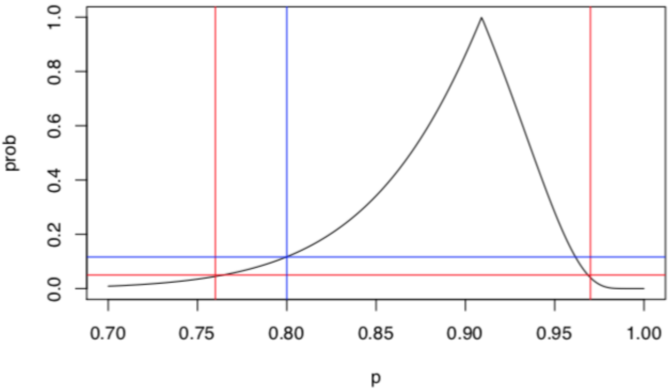
p̂



$$2 * P(Z > |2.62|) = 2 * 0.0044 = 0.0088$$

Track "plausibility measure" based on guessed p.



Values of p for which our $\hat{p}$ is "plausible" and within expected sampling variability: (0.76, 0.97).

Post-Assessment

Further guided questions/discussion as time permits:

- What value is our most likely value of p and why?
- Why didn't we conclude $p = 0.8$ if it was plausible?
- What should we also think about before concluding Marine can detect collerectal cancer?
- Does this say anything about other dogs?
- Why does the confidence interval not match up with our plausibility exercise?

“Hiding the Veggies”

Remember that students had not yet done hypothesis testing when taking this lab.

We never use the words null/alternate hypothesis, test statistic or p-value, yet they go through all of these steps in the lab.

The lab sets them up for success with an intuitive understanding of using sampling distribution to assess evidence for claims.

Mentorship

An essential piece of the 1150 labs is that they are run by graduate students and not the professors. This puts an expectation of real and meaningful teaching on the lab demonstrators.

Benefits

- Real hands on teaching experience and classroom management
- Prepares them for a future of teaching with data and computers
- Empowers them with a true sense of responsibility in the lab for teaching curriculum
- Helps take some content out of the classroom

Teaching Lab Meetings

- Meeting each week prior to a teaching lab
- Go over successes and failures of previous week
- Get suggestions from each other on ways to improve
- Set goal for next lab
- Review teaching strategies and content of next lab

Peer Learning

In taking responsibility for an important part of the lab, the lab T.A.s come together to work as a team to share ideas.

Senior T.A.'s work as mentors to newer T.A.'s and it creates discussions amongst graduate students about best teaching practices which is a conversation we should foster.

Final Thoughts

- Anecdotally, there has been positive feedback from the students who are very keen on the computing
- T.A.'s have expressed excitement at being part of a bigger project
- Labs and the ideas complement my lectures and help tell a coherent story
- The success encourages to push the teaching in my classroom further
- Goal to increase these labs in other courses or incorporate more of these style of labs occassionally in the classroom.

Thanks

Thank you!