Analyzing and Redesigning Tasks to Promote Statistical Inference

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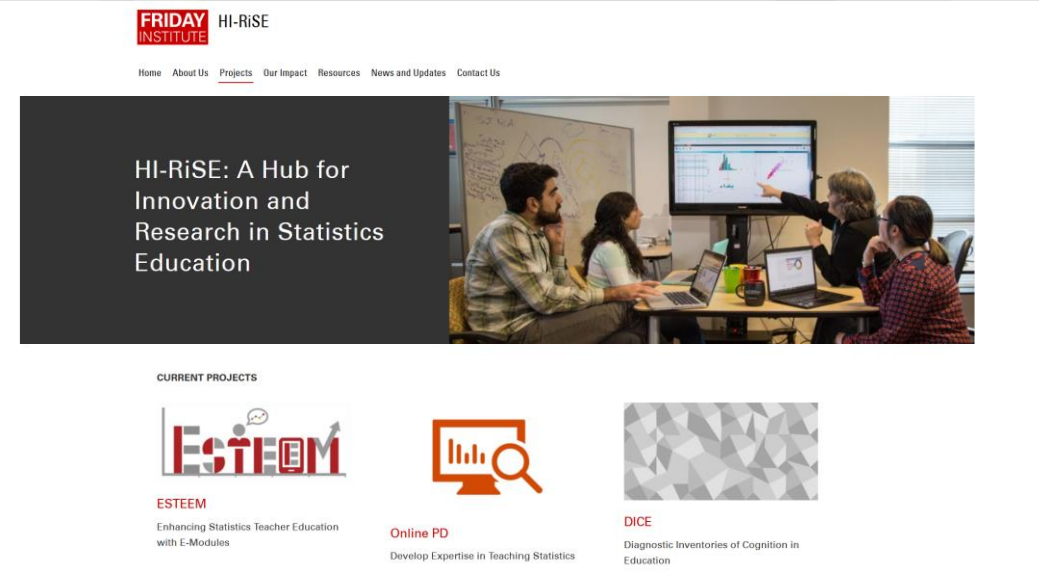
https://tinyurl.com/AMATYC-2019-Stat-Session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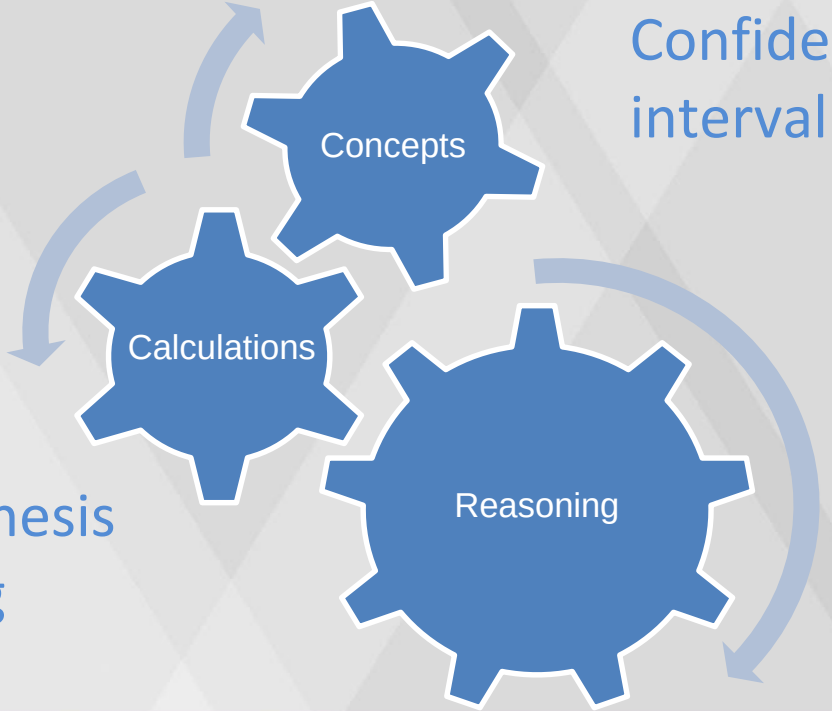
Goal of This Session

- Learning to work with real datasets
- Getting engaged with tasks which will create the connections from Unit 1 (Descriptive Statistics) to Unit 4 (Statistical inference)
  - *Even with the probability unit*
- Data visuals is at the center along with calculations for making an inference
- Learning to use a different technology, an accessible, dynamic statistical software

Statistical Inference is…

- Pfannkuch(2006) “the drawing of conclusions from data that is based mainly on looking at, comparing, and reasoning from distributions of data” (p.149)
- Pratt and Ainley (2008) Learners’ informal ideas about statistical inference or on people’s intuitive ways of reasoning about statistical inference in diverse contexts rather than on mastery of formal procedures or methods.
- Zieffler, Garfield, delMas, & Reading (2008) The way in which students use their informal statistical knowledge to make arguments to support inferences about unknown populations based on observed samples.

Components of Statistical Inference



Confidence interval

Hypothesis testing

Harradine, Batanero, and Rossman, 2011, p.236

Informal Statistical Inference
vs
Statistical Inference

The topic was the focus of the Fifth International Forum on Statistical Reasoning, Thinking and Literacy, held at the University of Warwick, UK, in August 2007.

The International Collaboration for Research on
STATISTICAL REASONING, THINKING AND LITERACY
SRTL

Key Constructs of Statistical Inference is…

- Langrall, Makar,Nilsson and Shaughnessy(2017)

the concepts of **variability and distribution** have become **a unifying theme across probability** and statistics—one can develop a teaching– learning trajectory starting from distributions of data, moving to the generation of empirical sampling distributions, and finally from **sampling distributions** to **theoretical probability distributions.**

Key Constructs of Statistical Inference is…

- Biehler and Pratt (2012)

The reports by Abrahamson, Garfield et al. and Pfannkuch et al. offer insights into how perception, **modelling,** simulation and imagery might provide valuable epistemic resources for the **construction of probabilistic concepts.** Pfannkuch et al. argue that the conceptual pathway towards confidence intervals needs to begin at an early age, referring in fact to age 14.

Key Constructs of Statistical Inference is…

- Thompson, Liu and Saldanha (2007)

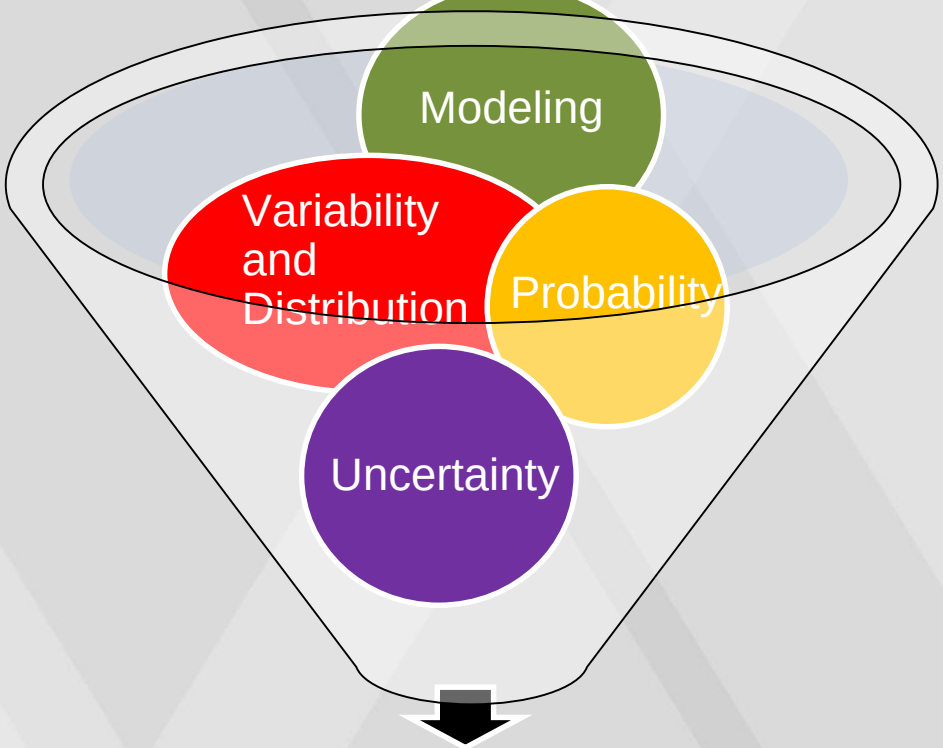
The implication of this result is that instructions on probability and on statistical inference must be designed with the principal purpose that it helps one **understand probability statistically** and to **understand statistics probabilistically.**

Finally GAISE (2016)

- GAISE College Report ASA Revision Committee (2016),

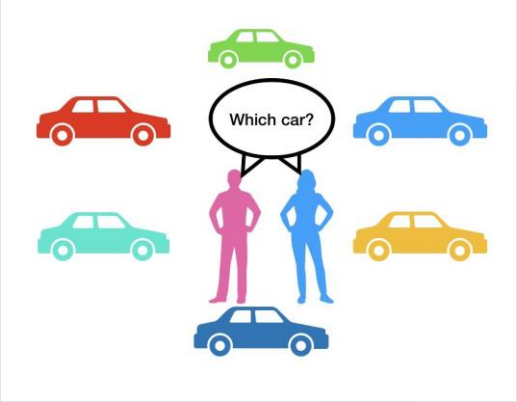
Give students **experience with multivariable thinking**. We live in a complex world in which the answer to a question often depends on many factors. Students will encounter such situations within their own fields of study and everyday lives. We must prepare our students to **answer challenging questions** that require them to investigate and **explore relationships among many variables**.

Key Constructs



Tasks in Statistics

Task
Which car to buy?



- Context: Vehicle
  - Start with a ….video
- Data: Vehicle data
  - 1,270 data entry
  - Many different attributes, categorical/numerical
- Tools: Open source, dynamic, data visual
  - Common Online Data Analysis Platform (CODAP) https://codap.concord.org
- Task : Handout

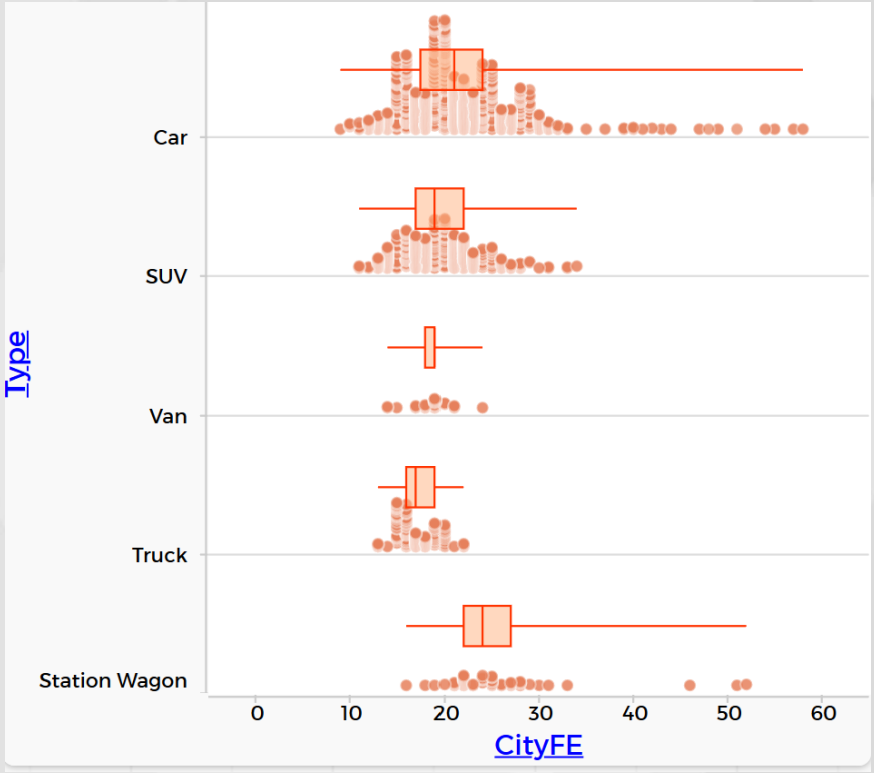
*This task is taken from

Let’s play together

- All the materials are located in the link
- https://tinyurl.com/AMATYC-2019-Stat-Session
- There is a Google Folder
- Download the csv file
- Download the Word. Doc- Tasks is written here
- Then go to https://codap.concord.org
- An d follow the prompts from the word doc

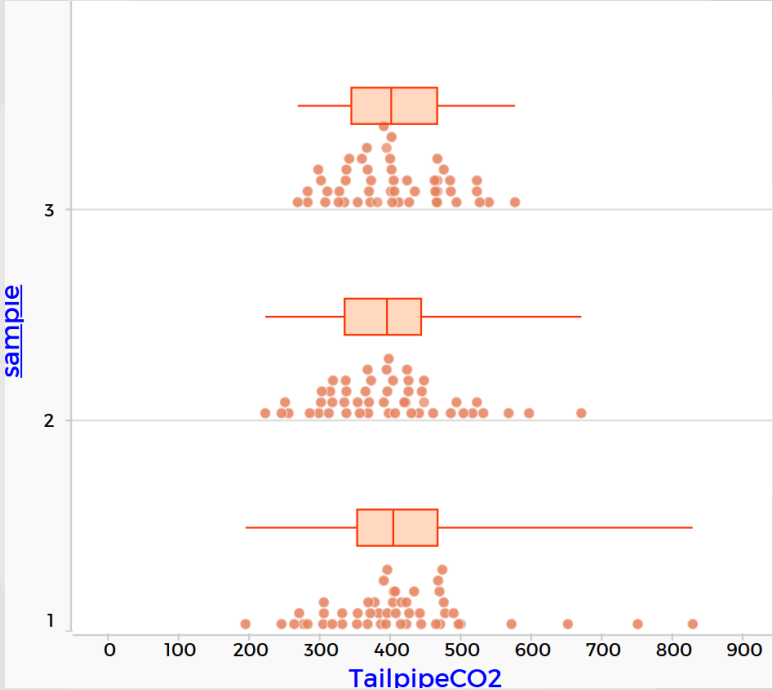
What do you think?

Compare groups



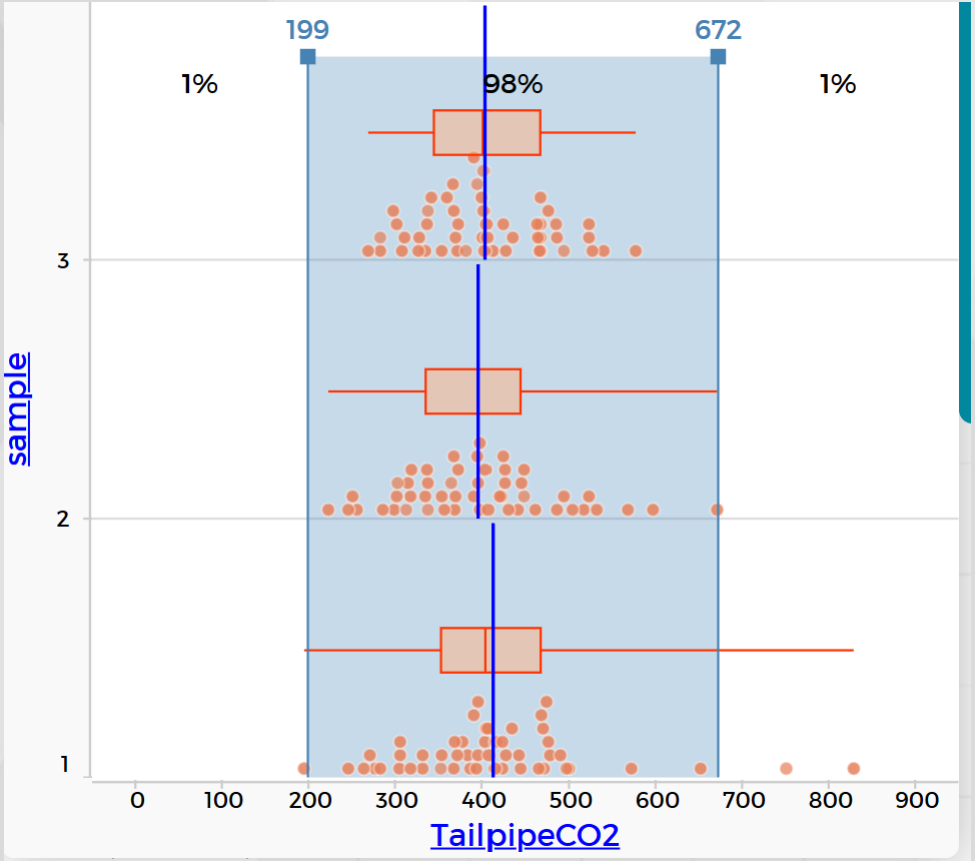
- What is CityFE?
- Are SUV's more economic? How would you support your finding?
- What can we tell about CityFE and type of vehicles?
- Which vehicle type has a wider range?
- How is the variability in CityFE between vehicle types?
- What other data attributes would like to compare?

3 Samples experiment for TailpipeCO2



- Discuss the reasons for the different values on the counts
- Place a movable line open a discussion about : What would we estimate for the true mean of "TailpipeCO2"?

98 % of ?


199
672
1%
98%
1%
3
2
1
sample
0
100
200
300
400
500
600
700
800
900
TailpipeCO2

References

Biehler, R., & Pratt, D. (2012). Research on the reasoning, teaching and learning of probability and uncertainty. *ZDM Mathematics Education, 44*, 819-823.

GAISE College Report ASA Revision Committee (2016), "Guidelines for Assessment and Instruction in Statistics Education College Report 2016," *Retrieved from http://www.amstat.org/education/gaise*

Harradine, A., Batanero, C., & Rossman, A. (2011). Students and teachers' knowledge of sampling and inference. In C. Batanero, G. Burrill, & C. Reading (Eds.), *Teaching statistics in school mathematics: Challenges for teaching and teacher education (A Joint ICMI/IASE Study)* (pp. 235–246). New York: Springer.

Langrall, C. W., Makar, K., Nilsson, P., & Shaughnessy, J. M. (2017). The teaching and learning of probability and statistics: An integrated perspective. In J. Cai (Ed.), *Compendium for research in mathematics education* (pp. 490–525). National Council of Teachers of Mathematics: Reston, VA.

Pfannkuch, M. (2006). Informal inferential reasoning. In A. Rossman & B. Chance (Eds.), *Proceedings of the Seventh International Conference on Teaching Statistics.* Voorburg, the Netherlands: IASE.

Pratt, D., & Ainley, J. (Eds.). (2008). Informal inferential reasoning [Special issue]. *Statistics Education Research Journal, 7* (2).

Thompson, P. W., Liu, Y., & Saldanha, L. A. (2007). Intricacies of statistical inference and teachers' understandings of them. *Thinking with Data*., 207–231.

Zieffler, A., Garfield, J., delMas, R., & Reading, C. (2008). A framework to support research on informal inferential reasoning. *Statistics Education Research Journal, 7*(2), 40–58.

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Teaching Statistics Through Data Investigations

The Teaching Statistics Through Data Investigation (TSDI) MOOC-Ed launched in Fall 2015 and has had over 3,500 educators participate thus far. Our world is rich with data sources, and technology makes data more accessible than ever before! To help ensure students are future ready to use data for making informed decisions, many countries around the world have increased the emphasis on statistics and data analysis in school curriculum–from elementary/primary grades through college. This course allows you to learn, along with colleagues from other schools, an investigation cycle to teach statistics and to help students explore data to make evidence-based claims.

Course Design Team Members: Dr. Hollylynne S. Lee, Dr. Dung Tran, Dr. Jennifer N. Lovett, Alex Dreier, Theresa Gibson, Dr. Glenn Kleiman