Reading & Critiquing Applications of Statistics in an Introductory Course

Jessie Oehrlein
Fitchburg State University
August 4, 2023

Applied Statistics

- Algebra-based introductory statistics course for students in social sciences and health sciences and some students in natural sciences

- Sections capped at 25 students
- Two 75 minute periods per week + 50 minute corequisite section

- Students with a 2.7 high school GPA do not need a placement test
- Corequisite included for all students

Course Learning Goals

- Critically evaluate uses of statistics and statistical arguments.

- Interpret statistical analyses to make and share decisions.

- Perform some key statistical analyses to answer research questions.

- Engage in consistent collaborative and individual exploration of new ideas, practice, and reflection.

Course Learning Goals

- **Critically evaluate uses of statistics and statistical arguments.**

- **Interpret statistical analyses to make and share decisions.**

- Perform some key statistical analyses to answer research questions.

- Engage in consistent collaborative and individual exploration of new ideas, practice, and reflection.

Reading Discussion or Critique Assignments

- Based around a collection of data visualizations or an article
- Students read the article outside of class
- Discussion or critique builds up to evaluation of the analysis and argument
- Students turn in some kind of individual assignment

Driving is a risky business

Lapses in concentration while driving can be fatal, so if a person experiences a seizure – whether behind the wheel or not – UK authorities require that person to take time off driving until the risk of another seizure falls below a set threshold. But how much time off is required? **Laura Bonnett** explains how statistics helped find an answer

Study estimates increased death rate in Puerto Rico in months after Hurricane Maria

Official death count of 64 likely a substantial underestimate

Date: May 31, 2018

Source: Harvard T.H. Chan School of Public Health

Summary: The mortality rate in Puerto Rico rose by 62 percent [95 percent 11percent to 114 percent] after Hurricane Maria, according to a n
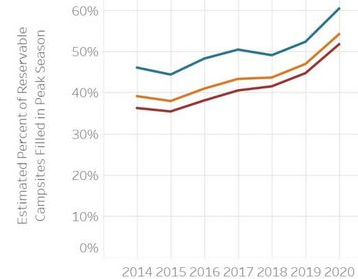

How satisfied are you with your experiences at FSU? (% Very Satisfied, Satisfied)

Students 2018 — 81
Students 2020 — 79
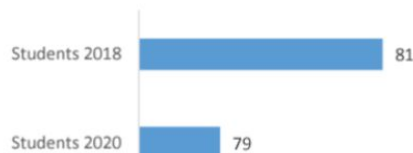
Estimated Increases in Public Lands Camping

39% increase in estimated peak season reservable campsite occupancy... but **a 12% larger increase** on weekdays than on weekends

Two modes

Before Spring 2023: In-class Jigsaw

- 5 times per semester
- Students chose from several options, read before class
- In-class: discussed with 2-4 others who read the same article
- Mixed groups and/or full class: discussed across articles
- After class: individual reflection

Spring 2023- : Out-of-class Critique

Two modes

Before Spring 2023: In-class Jigsaw

- 5 times per semester
- Students chose from several options, read before class
- In-class: discussed with 2-4 others who read the same article
- Mixed groups and/or full class: discussed across articles
- After class: individual reflection

Spring 2023- : Out-of-class Critique

- 7-8 assignments per semester
- Scaffolded questions to guide reading & evaluation
- In-class: data visualization critique to build skills
- Described by students as most helpful in working towards learning goals
- Graded as Satisfactory/Revise, but needed clearer expectations

Example 1: Malinda Lo on LGBTQ+ YA Novel Awards

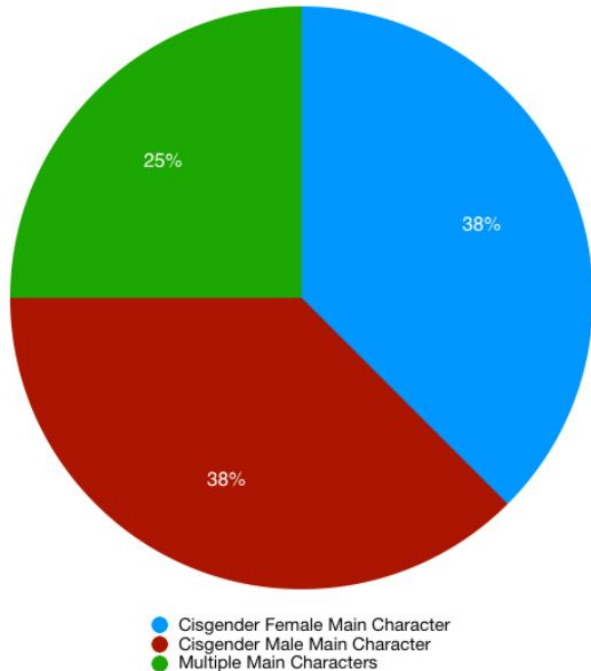### Lambda Book Awards, 2010-19: Gender Representation in Winning YA Novels

- ● Cisgender Female Main Character
- ● Cisgender Male Main Character
- ● Multiple Main Characters

Chart by Malinda Lo | www.malindalo.com | 2019

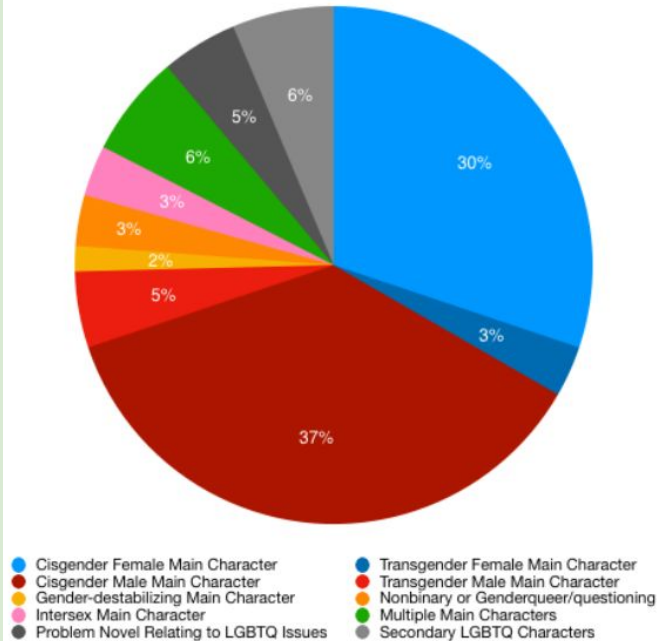### Lambda Book Awards for Children's/Young Adult Books, 2010-19: Gender Representation in YA Novels

- ● Cisgender Female Main Character
- ● Cisgender Male Main Character
- ● Gender-destabilizing Main Character
- ● Intersex Main Character
- ● Problem Novel Relating to LGBTQ Issues
- ● Transgender Female Main Character
- ● Transgender Male Main Character
- ● Nonbinary or Genderqueer/questioning
- ● Multiple Main Characters
- ● Secondary LGBTQ Characters

Chart by Malinda Lo | www.malindalo.com | 2019

What argument is Lo making?

Based on this evidence, do you agree? Why/why not?

How else might you represent this dataset and why?
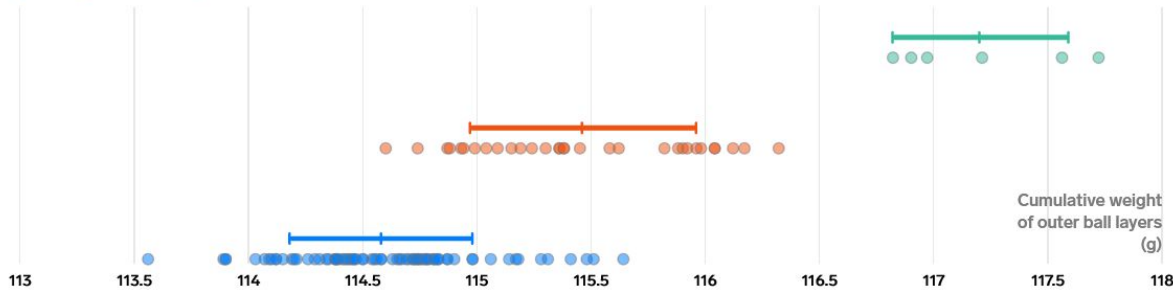
What else do you want to know?

Example 2: Three Baseballs?

MLB used balls in three different weight groupings last season

The league claims that only the new, "dead" balls were used in 2022. But we found older "juiced" balls as well as middle-weight "Goldilocks" balls. Dead, juiced, and Goldilocks balls all bear batch codes indicating they were manufactured during distinct, non-overlapping production weeks.

● Dead ● Goldilocks ● Juiced

Cumulative weight of outer ball layers (g)

113   113.5   114   114.5   115   115.5   116   116.5   117   117.5   118

Note: The lines above each set of dots indicates the mean weight and one standard deviation on either side.

Chart: Annie Fu/Insider • Source: Dr. Meredith Wills

INSIDER

How were the balls classified?

Estimate sample summary stats to calculate confidence intervals.

Do you think these are different kinds of balls?

Explain why this might not contradict another group's claim that baseball weights were normally distributed & compliant with MLB regulations.

What makes a good source?

- **Enough statistical information/focus but not too academic** – *Significance* or *The Pudding* articles
- **Analysis or conclusions that students can replicate or critique** – Online collections of misleading graphs or questionable data tables
- **Short and on relatable topics** – Carry the Two podcast episodes, previous winners of CAUSE's Undergraduate Class Project Competition (USCLAP)

But it's hard to get all of these aspects together! Read/listen widely, keep track of possibilities I come across, get recommendations from others.

Moving forward

- Keeping critique format for the regular evaluation deep-dives
- Clearer about what Satisfactory means for these assignments
  - Could be different for different sources
  - Making sure I'm not asking "guess what I'm thinking" questions
- Separate **short** weekly-ish readings for alternate explanations of key concepts, exposure to applications

Always looking for source recommendations!

Moving forward

- Keeping critique format for the regular evaluation deep-dives
- Clearer about what Satisfactory means for these assignments
  - Could be different for different sources
  - Making sure I'm not asking "guess what I'm thinking" questions
- Separate **short** weekly-ish readings for alternate explanations of key concepts, exposure to applications

Always looking for source recommendations!

joehrlei@fitchburgstate.edu   Twitter: @numberdance