Various pedagogical approaches to classroom teaching

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Sta 771S - Teaching Statistics

Traditional lecture

What are advantages / disadvantages for lecturing for an entire class period?

Making your traditional lecture more effective

- Structure and organization: Clear learning goals and check points for each lesson

- Information delivery: Writing on the board, slides, a mix, more...

- Physical space: Walk around the classroom, use a mic for class size > 40 or so

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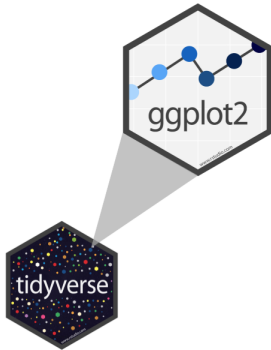- Physical space: Walk around the classroom, use a mic for class size > 40 or so

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ggplot2 $\in$ tidyverse

- **ggplot2** is tidyverse's data visualization package
- The gg in "ggplot2" stands for Grammar of Graphics
- It is inspired by the book **Grammar of Graphics** by Leland Wilkinson [†]
- A grammar of graphics is a tool that enables us to concisely describe the components of a graphic

[†] Source: BloggoType

3

Sample statistics vary from sample to sample

- We are often interested in *population parameters*.
- Since complete populations are difficult (or impossible) to collect data on, we use *sample statistics* as *point estimates* for the unknown population parameters of interest.
- Sample statistics vary from sample to sample.
- Quantifying how sample statistics vary provides a way to estimate the *margin of error* associated with our point estimate.
- But before we get to quantifying the variability among samples, let's try to understand how and why point estimates vary from sample to sample.

Suppose we randomly sample 1,000 adults from each state in the US. Would you expect the sample means of their ages to be the same, somewhat different, or very different?

2

Faceting options

✚ Smaller plots that display different subsets of the data

✚ Useful for exploring conditional relationships and large data

```
ggplot(data = starwars, mapping = aes(x = height, y = mass)) +
  facet_grid(. ~ gender) +
  geom_point() +
  labs(title = "Mass vs. height of Starwars characters",
       subtitle = "Faceted by gender",
       x = "Height (cm)", y = "Weight (kg)")
```


Mass vs. height of Starwars characters
Faceted by gender

5
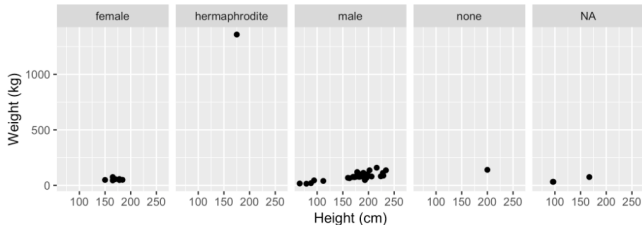
Hide the answers

- If using LaTeX / Beamer, this is easy:
  - For slides you show in class:

    `\newcommand{\soln}[1]{\textit{#1}}`

    I'm on the slides shown in class, but not on the posted slides.
  - For slides posted for students:

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- Possible to achieve similar formatting with R Markdown as well

- For Keynote, PowerPoint etc. you might need to manually add/remove text

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Clicker question

What is the confidence level for a confidence interval that is equivalent to a one-sided hypothesis test at the 1% significance level? *Hint: Draw a picture and mark the confidence level in the center.*

(a) 0.80

(b) 0.90

(c) 0.95

(d) 0.98

(e) 0.99

Classroom response systems

- Clickers are one good option
  - Pro: No distraction, can use for "closed book" assessments, can be used to track participation
  - Con: "Unitasker", expensive
- Another option is an online polling system, e.g. PollEverywhere [DEMO]
- Think about how they factor into overall assessment (anything ¡5% of grade does not get sufficient student attention)

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Flipped classroom

Flipped classroom definition

- The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed.

- Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions.

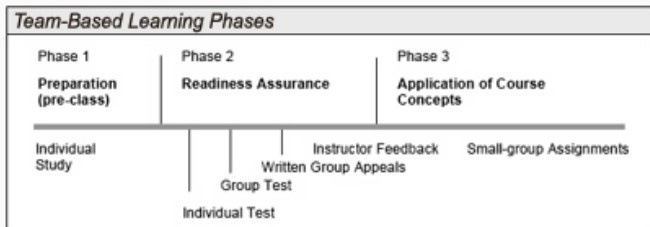## Flipped classroom definition

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Team-based learning (TBL)

TBL Definition

Team-Based Learning is an evidence based collaborative learning teaching strategy designed around units of instruction, known as "modules," that are taught in a three-step cycle:

1. preparation
2. in-class readiness assessment
3. application exercises

Team-Based Learning Phases

Phase 1	Phase 2	Phase 3
Preparation (pre-class)	Readiness Assurance	Application of Course Concepts

Individual Study — Group Test — Written Group Appeals — Instructor Feedback — Small-group Assignments

Individual Test

Preparing students for the preparation stage

- List of clear learning objectives for the module
- Textbook reading and/or videos
- Practice questions

Readiness assessment

- Individual, and then as a Team
- Delivered via a method that allows the instructor to quickly view results to determine which questions to review
- Questions should be very clearly tied to learning objectives
- Good RA design: Average student who studied can get a roughly 80% individually, and 100% as a team
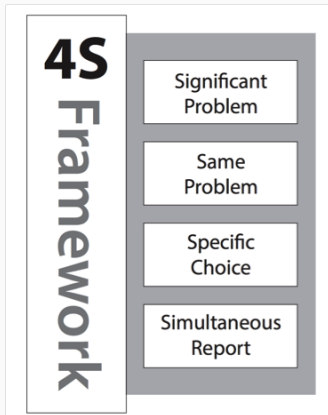
What are your thoughts on the following aspects of team creation?
What are pros and cons that you can think of for each option?

- Formation: Student choice vs. assigned
- Consistency: Same team throughout the semester vs. changing
- Makeup: Homogenous vs. heterogenous with respect to background in course material

Challenges for large clases

- Need for additional instructor / TA bodies in the class
- Timing of active components
- "Simultaneous reveal" of application exercises
- Managing team dynamics

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What are advantages / disadvantages for using team based learning pedagogy in your class?

Hybrid models

- Don't feel like you have to limit yourself to the strict definition of a specific pedagogy

- Think about how you can borrow ideas from various pedagogies to make the most of your course

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Ex: Sta 101 - Intro Stats

- Course is divided into seven learning units.
- Each unit has a set of learning objectives and required and suggested readings, videos, etc. Students are expected to watch the videos and/or complete the readings and familiarize themselves with the learning objectives.
- Begin the unit with a readiness assessment: 10 multiple choice questions that you answer using clickers and then re-take in teams using scratch off sheets.
- Rest of the class split between discussion of the material and application exercises completed in teams. All class materials posted on course website.
- Within each unit complement learning with problem sets and labs.
- Wrap up each unit with a performance assessment.

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Regardless of pedagogy

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... you should have a

- detailed syllabus that clearly outlines all expectations and course logistics
- a well organized course website (better – for you – if some components are public!)

Visit a class

Visit a class

- Visit one (or more) classes (not lab session) between now and November 6
- You're welcomed to visit my class: STA 112FS - TuTh 10:05 - 11:20 at Link Classroom 1
- Reach out to any other faculty member to ask for their permission for a visit and whether there is a particular day they prefer you attend