Lessons Learned from Teaching Programming in R Remote and In Person

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University of California Riveride

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University of California Riverside at a Glance

- Hispanic Serving Institution
- 101 Undergraduate Statistics Majors
- 166 Undergraduate Data Science Majors
- 51.8% First Generation College Student
- 45.6% Pell Grant Recipients

Introducing R to Undergraduate Students

- **STAT 010: *Introduction to Statistics I***
  - Equivalent to AP Statistics
  - Utilizes R in lectures, labs, prerecorded videos
- **STAT 011: *Introduction to Statistics II***
  - Linear regression, analysis of variance, and simple experimental designs
  - Utilizes R in lectures, labs, prerecorded videos
- **STAT 107: *Introduction to Statistical Computing With R***
  - Data management, statistical analysis and graphics, functions and packages, simple programming, and reproducible work
  - Primarily for STATS and DS majors

Enrollment

STAT 010

- 1800 per year
  - Aim to offer 1 in-person and 1 online section per quarter
  - 250 per section (100 per in summer)
- In-person enrollment limited by lab availability

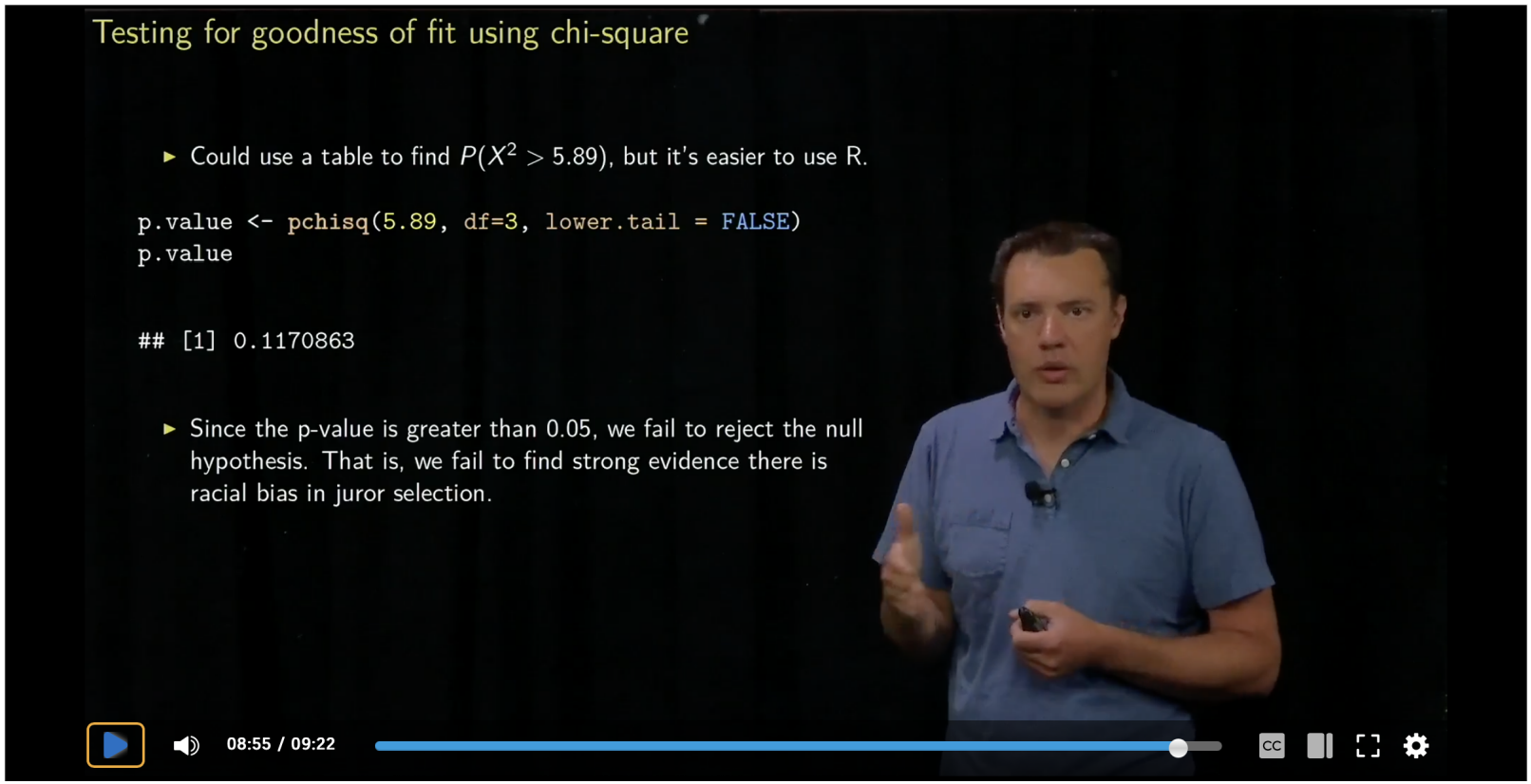
STAT 107

- 130 per year
  - 56 per section (25 per in summer)
- Virtual, Hybrid, In-Person

STAT 010 Online

- Developed high-quality online version
  - Funded by Innovative Learning Technology Initiative (ILTI)
  - Synchronous, fully online with collaborative and active learning components
- R
  - TA guided labs
  - Many student's also use R instead of tables (e.g. Normal, t, ...)
  - Primary goal is early **exposure**

STAT 010 Topic Videos



STAT 010 Labs

Exploratory analysis

Load the `nc` data set into our workspace.

```
download.file("http://www.openintro.org/stat/data/nc.RData", destfile = "nc.RData")
load("nc.RData")
```

We have observations on 13 different variables, some categorical and some numerical. The meaning of each variable is as follows.

variable	description
`fage`	father's age in years.
`mage`	mother's age in years.
`mature`	maturity status of mother.
`weeks`	length of pregnancy in weeks.
`premie`	whether the birth was classified as premature (premie) or full-term.
`visits`	number of hospital visits during pregnancy.
`marital`	whether mother is `married` or `not married` at birth.
`gained`	weight gained by mother during pregnancy in pounds.
`weight`	weight of the baby at birth in pounds.
`lowbirthweight`	whether baby was classified as low birthweight (`low`) or not (`not low`).
`gender`	gender of the baby, `female` or `male`.
`habit`	status of the mother as a `nonsmoker` or a `smoker`.
`whitemom`	whether mom is `white` or `not white`.

1. What are the cases in this data set? How many cases are there in our sample?

As a first step in the analysis, we should consider summaries of the data. This can be done using the `summary` command:

```
summary(nc)
```

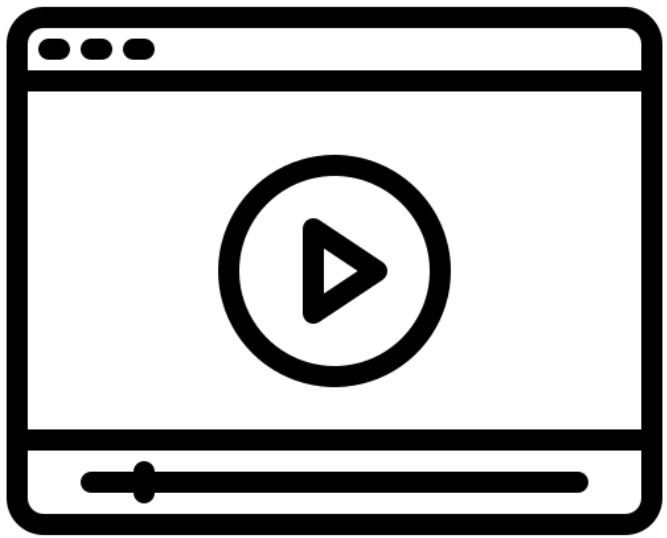
- Using *OpenIntro Statistics* labs
- Group assignments

STAT 107

- Live Instruction
- Primary goal is to gain skills for future classes
- Projects
  - Similar to notes
  - Challenge problems
  - "Creative"
- Lab assignments
  - Can be discussed

Use of Videos

- FAQ, Troubleshooting, Main Concepts
- Solutions
- Syllabus
- Instructor Absences



Assignments

- Virtual Submissions
- Response Survey
- Designated questions that can be freely discussed
- Rmarkdown troubleshooting

Assignments

```
---
title: "Untitled"
author: "Rebecca Kurtz-Garcia"
date: "January 6, 2023"
output: html_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```{r cars}
summary(cars)
```

Including Plots
```

Untitled

Rebecca Kurtz-Garcia

January 6, 2023

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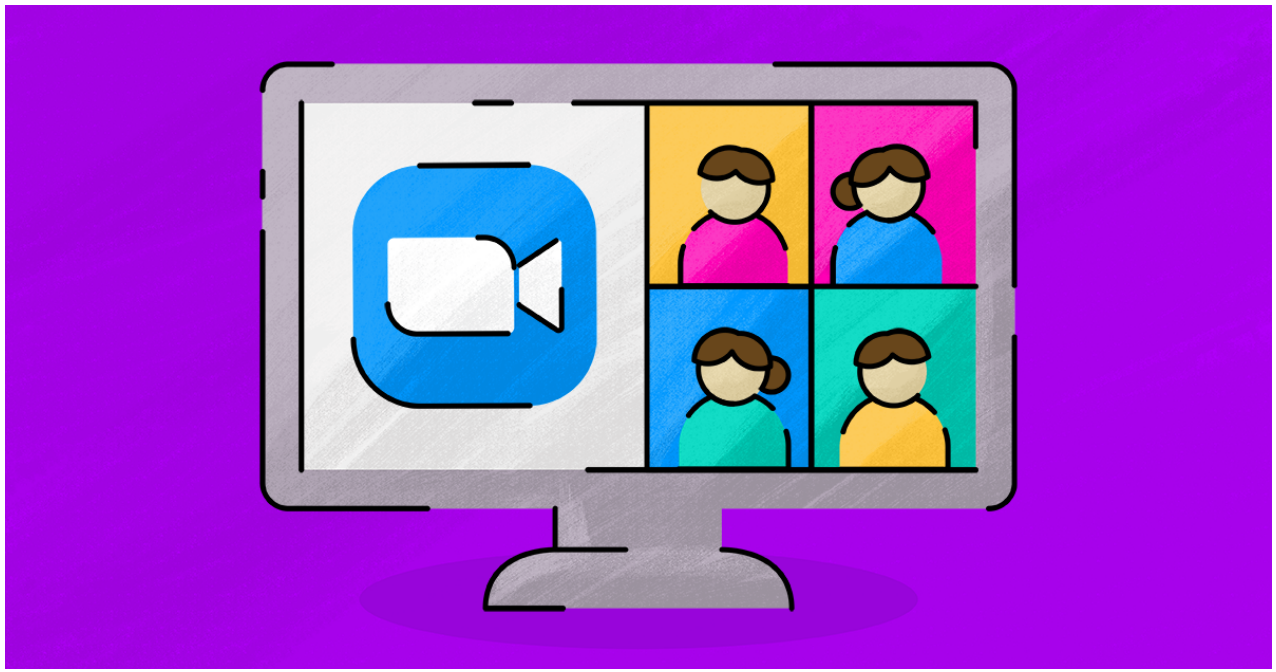
```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
```

Office Hours

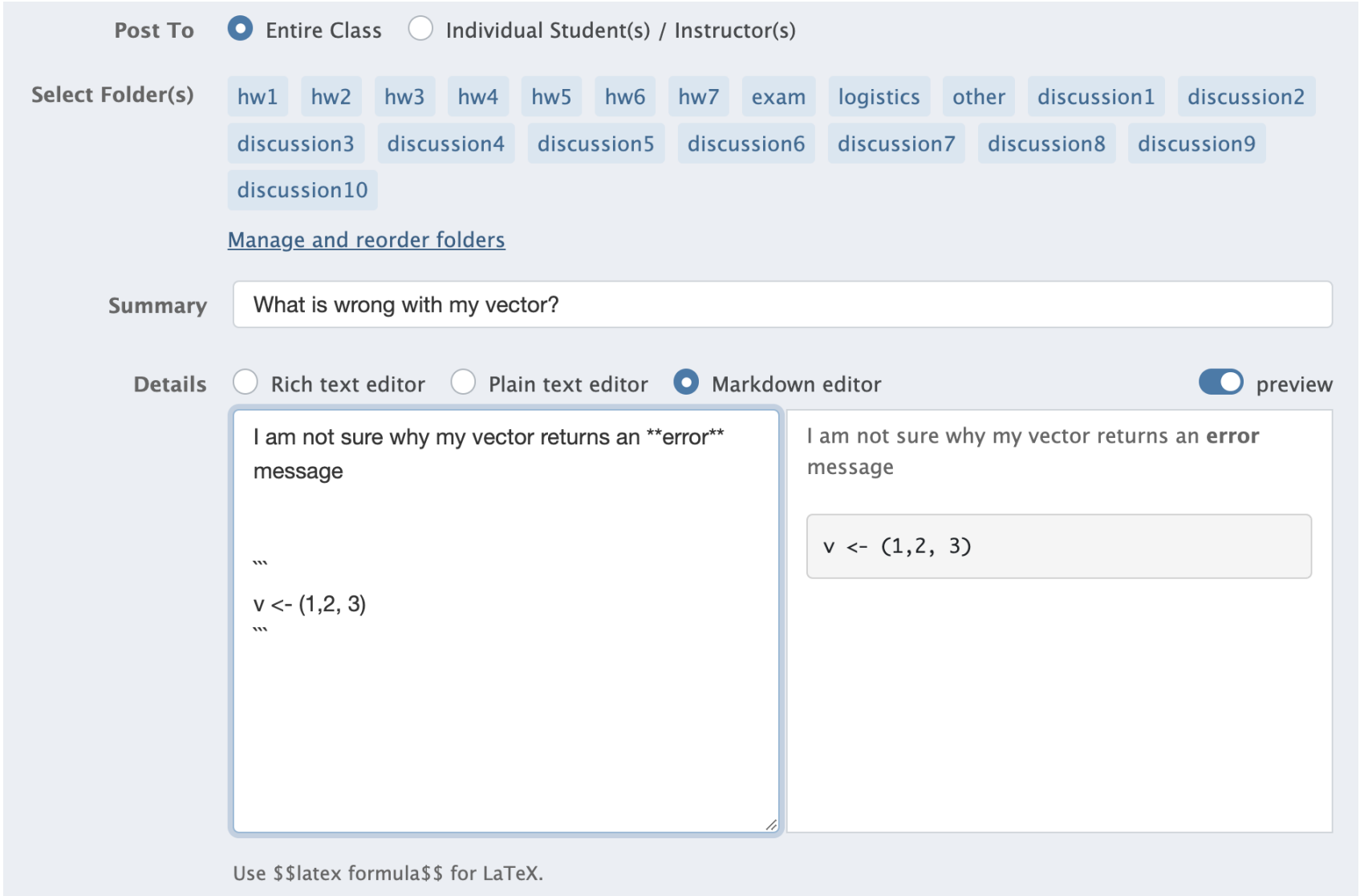
- Virtual or Hybrid format
- Study breakout rooms



Interaction Tools

- Surveys (virtual/in-person)
- Discussing problems with classmates
- Piazza, Discord, Slack

Piazza


Post To
Entire Class
Individual Student(s) / Instructor(s)
Select Folder(s)
hw1
hw2
hw3
hw4
hw5
hw6
hw7
exam
logistics
other
discussion1
discussion2
discussion3
discussion4
discussion5
discussion6
discussion7
discussion8
discussion9
discussion10
Manage and reorder folders
Summary
What is wrong with my vector?
Details
Rich text editor
Plain text editor
Markdown editor
preview
I am not sure why my vector returns an **error** message
```
v <- (1,2, 3)
```
I am not sure why my vector returns an error message
v <- (1,2, 3)
Use $$latex formula$$ for LaTeX.

Participation

- Balance of in-person and virtual opportunities
  - Piazza activity
  - Instructor Piazza daily-ish question
  - Office hours participation
  - In-class participation
  - Attendance
- Peer evaluation (group assignments)

Introducing R to Graduate Students

Graduate Programming/Statistics Bootcamp

- Always virtual
- Computing in R for research
- Specifically designed for incoming underserved students
- Open to all graduate students after initial enrollment period

STAT 206: *Statistical Computing*

- STAT students usually take this their 1st quarter on campus
- Popular with external graduate students
- Elective for online engineering MS program

Diversity, Equity, and Inclusion

- Virtual tools are becoming standard
- Virtual/In-person classroom etiquette
- Choosing battles
  - Open Access vs Traditional Textbooks
  - Digital vs Physical Submissions
  - Study Spaces
  - Flexibility vs Structure

Virtual Benefits

- Videos of key concepts and FAQ
- Digital assignment submissions
- Office hours
- Asynchronous discussion boards
- Classroom tracking/statistics
- “People that are students” rather than “students that are people” mentality

Considerations Going Forward

- Dominate clear stream of information
- Curating resources
- Facilitating interaction

Challenges Going Forward

- Integrated platforms (Piazza, Gradescope, Canvas, Google Forms)
- Changing Technology
- Grading
- In-person evaluation

Contact

Thank You!

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- Rebecca Kurtz-Garcia (rkurt001@ucr.edu)