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Implications of R Syntax in Intro Stats

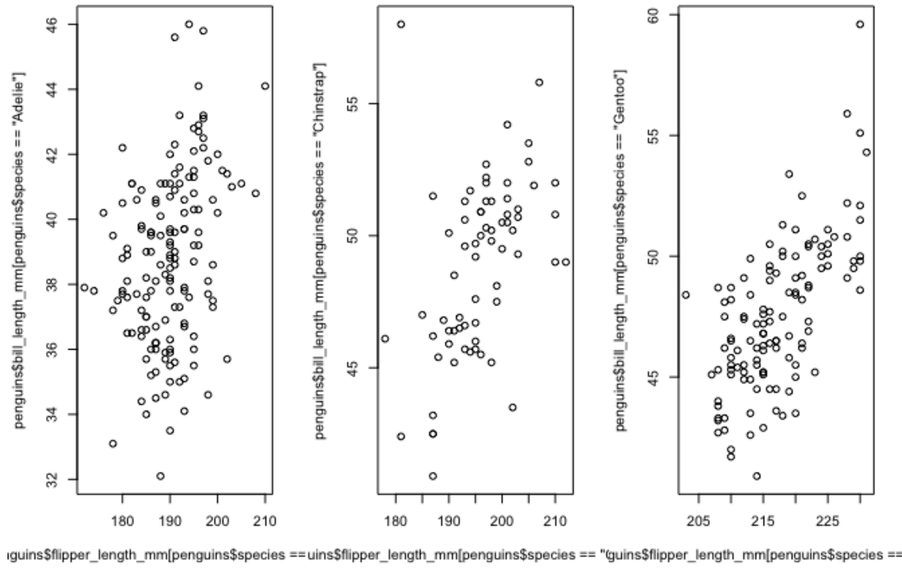
A minimal reproducible... statistics course

R syntax

```
library(palmerpenguins)
data("penguins")
```

base

```
par(mfrow = c(1, 3))
plot(penguins$flipper_length_mm[penguins$species == "Adelie"],
     penguins$bill_length_mm[penguins$species == "Adelie"])
plot(penguins$flipper_length_mm[penguins$species == "Chinstrap"],
     penguins$bill_length_mm[penguins$species == "Chinstrap"])
plot(penguins$flipper_length_mm[penguins$species == "Gentoo"],
     penguins$bill_length_mm[penguins$species == "Gentoo"])
```

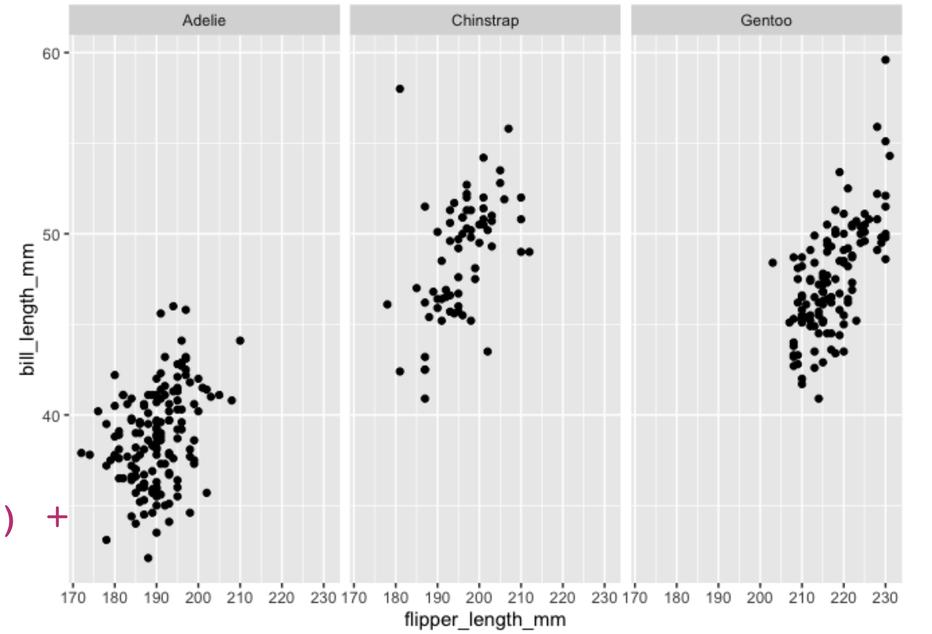


formula

```
library(mosaic)
gf_point(bill_length_mm ~ flipper_length_mm | species,
  data = penguins)
```

tidyverse

```
library(ggplot2)
ggplot(penguins, aes(x = flipper_length_mm, y = bill_length_mm)) +
  geom_point() +
  facet_grid(~species)
```



R syntax

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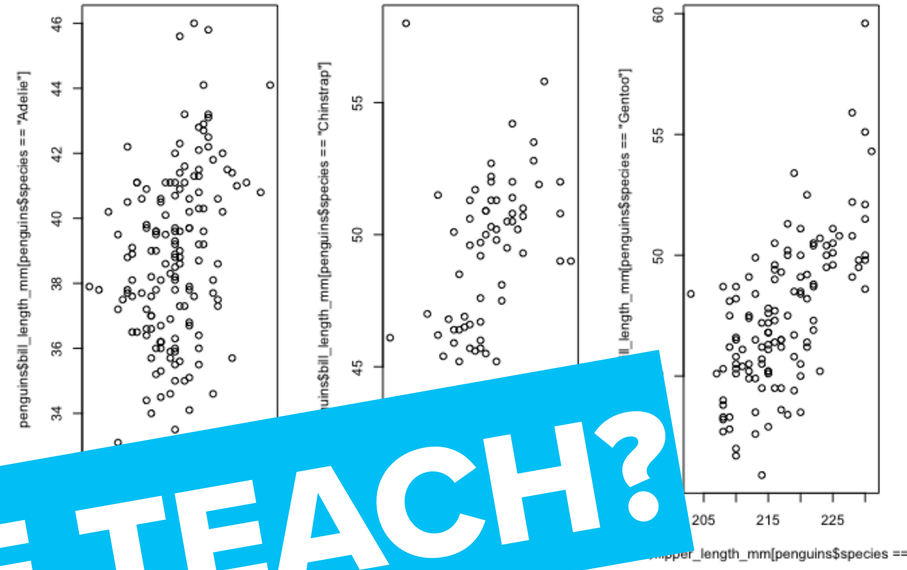
     penguins$bill_length_mm[penguins$species
plot(penguins$flipper_length_mm[
     penguins$bill_length
plot(penguins$
                                                    ],
                                                    Gentoo"])
```

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lib
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  data = penguins)
```

tidyverse

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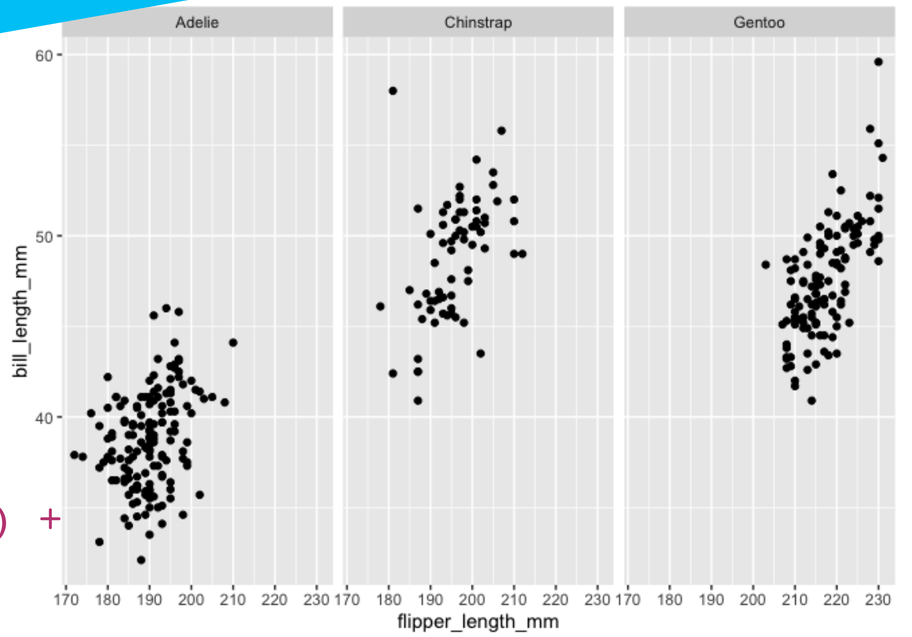

WHICH SHOULD WE TEACH?

I did a semester-long, head-to-head comparison of formula and tidyverse syntaxes

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Why?

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Why?

- To get some data

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Why?

- To get some data
- Constraints breed creativity

The results

- Some things are easy (RMarkdown, inference)
- Some things are hard
  - Formula: dealing with/explaining missing data

```
options(na.rm = TRUE)
mean(body_mass_g ~ species, data = penguins, na.rm = TRUE)
cor(body_mass_g ~ species, data = penguins, use = "complete.obs")
```

  - Tidyverse: dealing with/explaining two categorical variables

```
penguins %>%
  group_by(sex, island) %>%
  summarize(n = n()) %>%
  mutate(prop = n / sum(n))
#> # A tibble: 4 × 4
#> # Groups:   sex [2]
#>   sex    island     n  prop
#>   <fct>  <fct>  <int> <dbl>
#> 1 female Biscoe    80 0.567
#> 2 female Dream     61 0.433
#> 3 male   Biscoe    83 0.572
#> 4 male   Dream     62 0.428
```

```
library(infer)
penguins %>%
  prop_test(
    response = island,
    explanatory = sex,
    alternative = "two-sided",
    order = c("female", "male")
  )
#> # A tibble: 1 × 6
#>   statistic chisq_df p_value alternative lower_ci upper_ci
#>       <dbl>    <dbl>   <dbl> <chr>          <dbl>    <dbl>
#> 1  1.78e-30        1    1.00 two.sided     -0.127    0.117
```

The results

- A minimal reproducible... statistics course doesn't need many functions
  - formula section saw 37 functions
  - tidyverse section saw 50

function	times
`library()`	30
`set()`	18
`mean()`	17
`gf_histogram()`	14
`read.csv()`	14

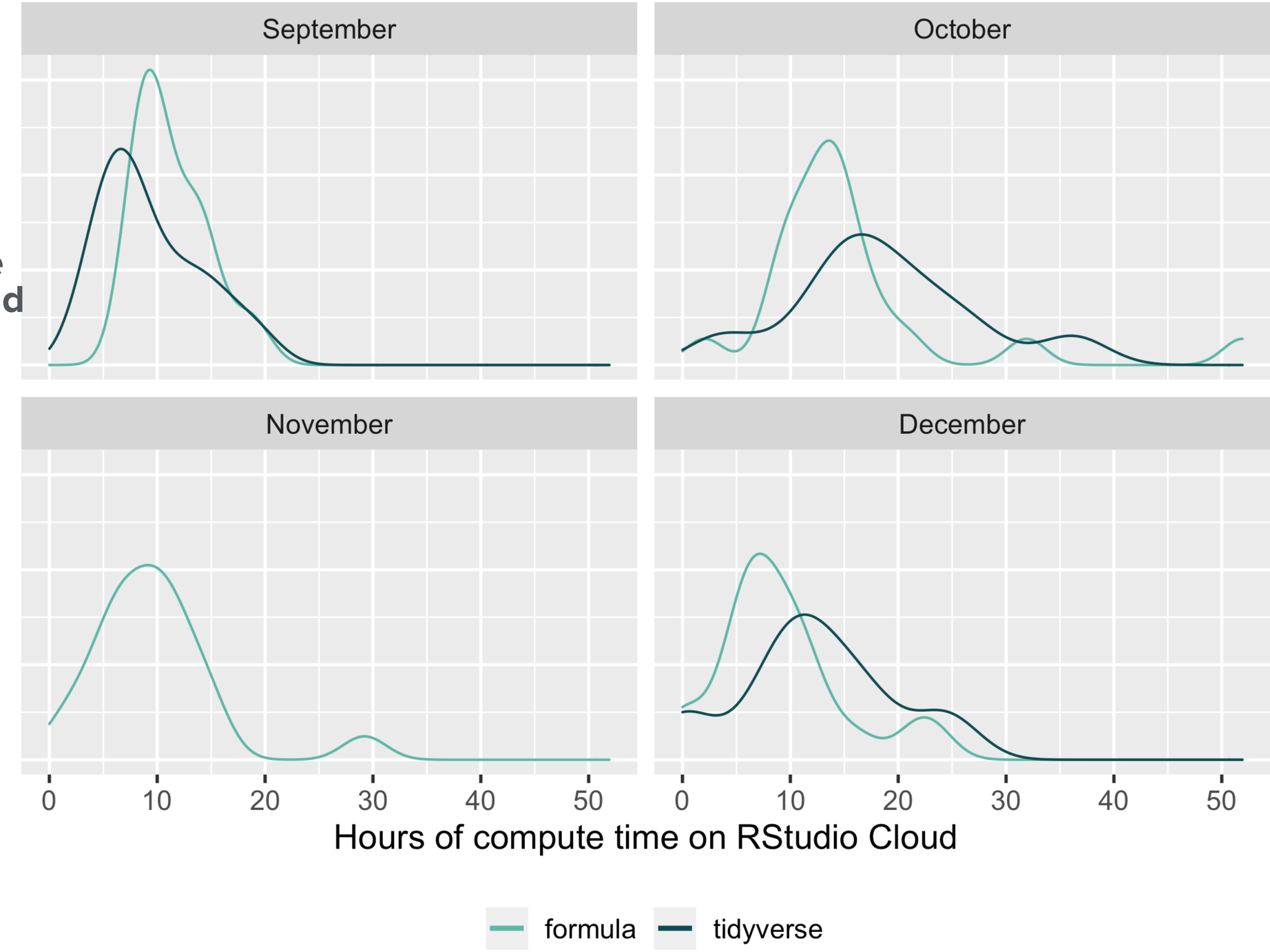
formula section

function	times
`summarize()`	36
`library()`	30
`ggplot()`	29
`aes()`	28
`drop_na()`	23

tidyverse section

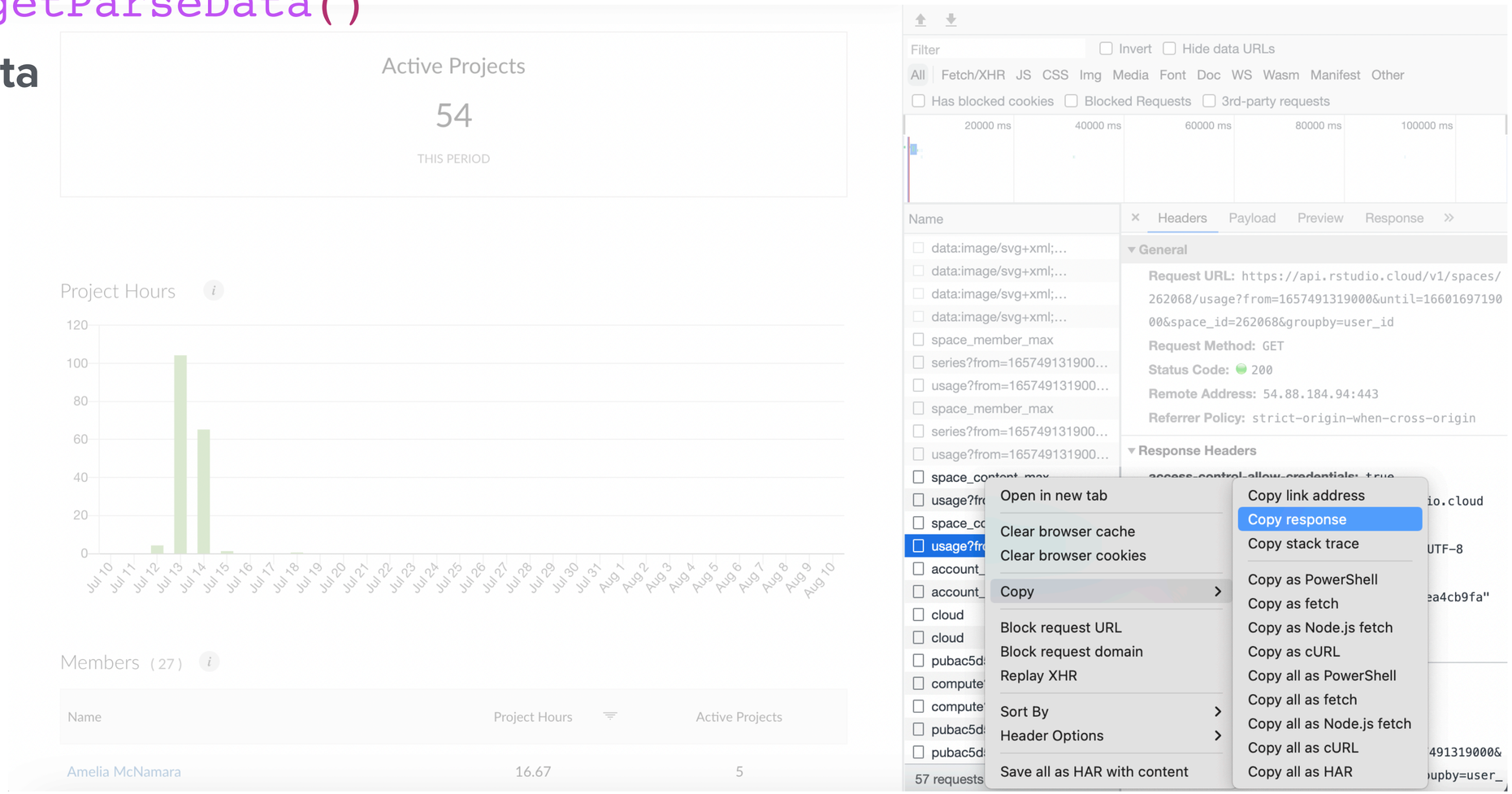
The results

- Students spent more time on RStudio.cloud in the tidyverse section
- Why? ¯_(ツ)_/¯



Want to try this yourself?

- Function data: `getParseData()`
- Rstudio.cloud data



Pre-print

- Teaching modeling in introductory statistics: A comparison of formula and tidyverse syntaxes
- https://arxiv.org/abs/2201.12960

Teaching modeling in introductory statistics: A comparison of formula and tidyverse syntaxes

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Abstract

This paper reports on a head-to-head comparison run in a pair of introductory statistics labs, one conducted fully in the formula syntax, the other in tidyverse. Analysis of incidental data from YouTube and RStudio Cloud show interesting distinctions. The formula section appeared to watch a larger proportion of pre-lab YouTube videos, but spend less time computing on RStudio Cloud. Conversely, the tidyverse section watched a smaller proportion of the videos and spent more time computing. Analysis of lab materials showed that tidyverse labs tended to be slightly longer in terms of lines in the provided RMarkdown materials, but not in minutes of the associated YouTube videos. The tidyverse labs exposed students to slightly more distinct R functions, but both labs relied on a quite small vocabulary of consistent functions, which can provide a starting point for instructors interested in teaching introductory statistics in R. Analysis of pre- and post-survey data show no differences between the two labs, so students appeared to have a positive experience regardless of section. This work provides additional evidence for instructors looking to choose between syntaxes for introductory statistics teaching.

Keywords: R language, instruction, data science, statistical computing

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THANK YOU

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https://arxiv.org/abs/2201.12960

https://github.com/AmeliaMN/STAT220-labs

https://github.com/AmeliaMN/ComparingSyntaxForModeling