Week 1: Getting Started

Joshua M. Rosenberg, Alex Lishinski

January 21, 2022

Agenda

1. Introductions to one another
2. A brief introduction to data science
3. First activity: Visualizing data in RStudio!
4. Discussion of the syllabus
5. Check–out

Part 1/5: Introductions (to one another)

#whoami

- Joshua Rosenberg, Ph.D.
- Contact:
  - @jrosenberg6432
  - jmrosenberg@utk.edu
  - https://joshuamrosenberg.com
- Assistant Professor, STEM Education, University of Tennessee, Knoxville
- Dad (2 year old toddler)
- Primary areas of interest:
  - Science education
  - Data science (for) education
  - Data science in education
- Former HS science teacher
- Presently PI or Co–PI for three NSF grants

#whoami

- Alex Lishinski, Ph.D.
- Contact:
  - @html034
  - @html034@fosstodon.org
  - alishins@utk.edu
  - https://alexlishinski.com
- Postdoctoral researcher, CS Education, University of Tennessee, Knoxville
- Dad (3 year old toddler)
- Primary areas of interest:
  - Computer Science education
  - Quantitative research methods
  - Data science in education
- Former philosopher

Breakout rooms!

Starting with whomever had a snack or meal most recently, discuss . . .

1. What is something you're good at but don't particularly like to do?
2. What is something you like to do but aren't particularly good at?
3. Why are you interested in data science?

(10 minutes)

Part 2/5: Introductions (to the class)

Course FAQ

Q – What data science background does this course assume?

A – None.

Q – Is this an intro stat course?

A – While statistics $\neq$ data science, they are very closely related and have tremendous of overlap. Hence, this course is a great way to get started with statistics. However this course is *not* your typical high school statistics course.

Q – Will we be doing computing?

A – Yes.

Course FAQ

Q – Is this an intro CS course?

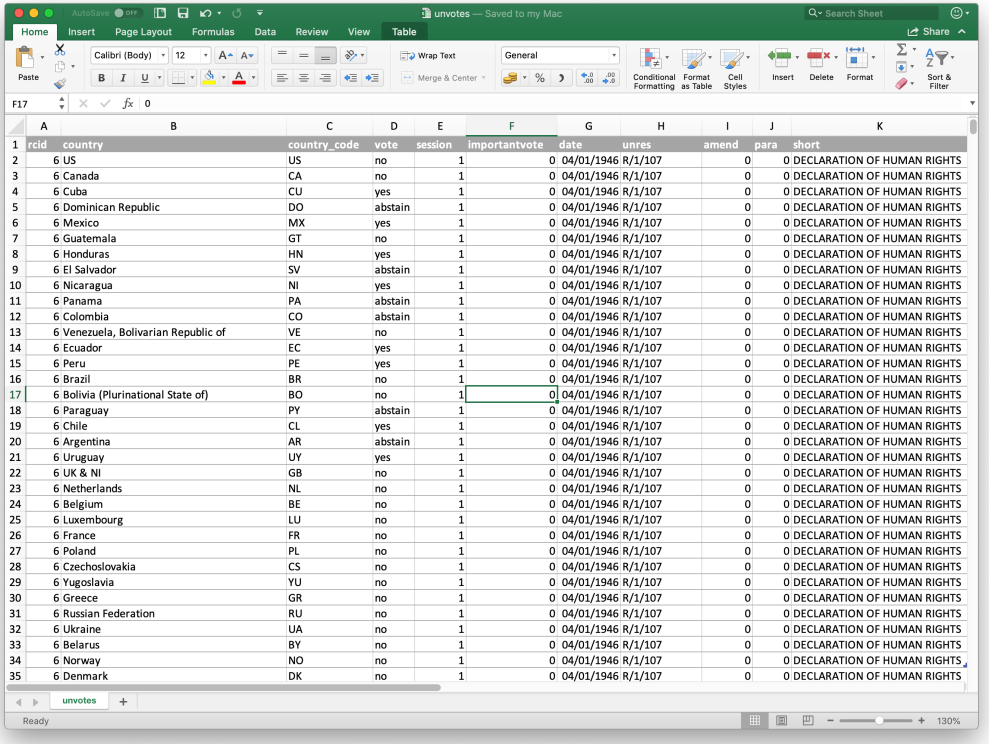
A – No, but many themes are shared.

Q – What computing language will we learn?

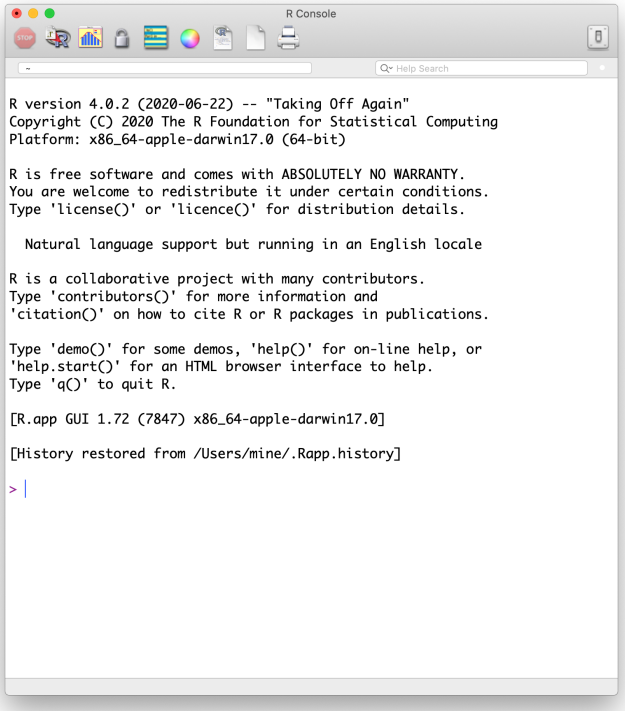
A – R.

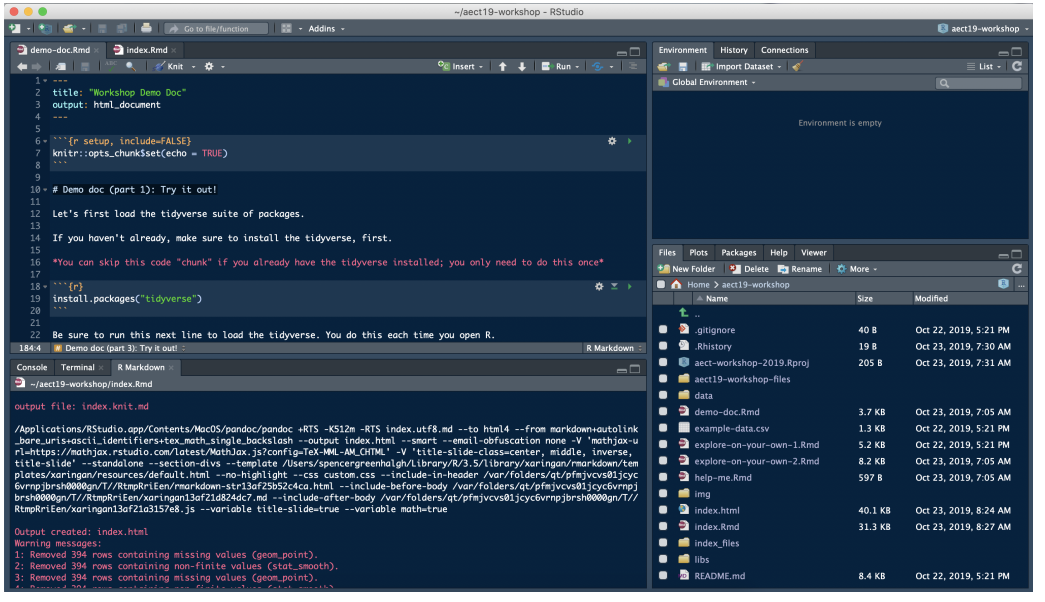
Q: Why not language X?

A: We can discuss that over coffee.

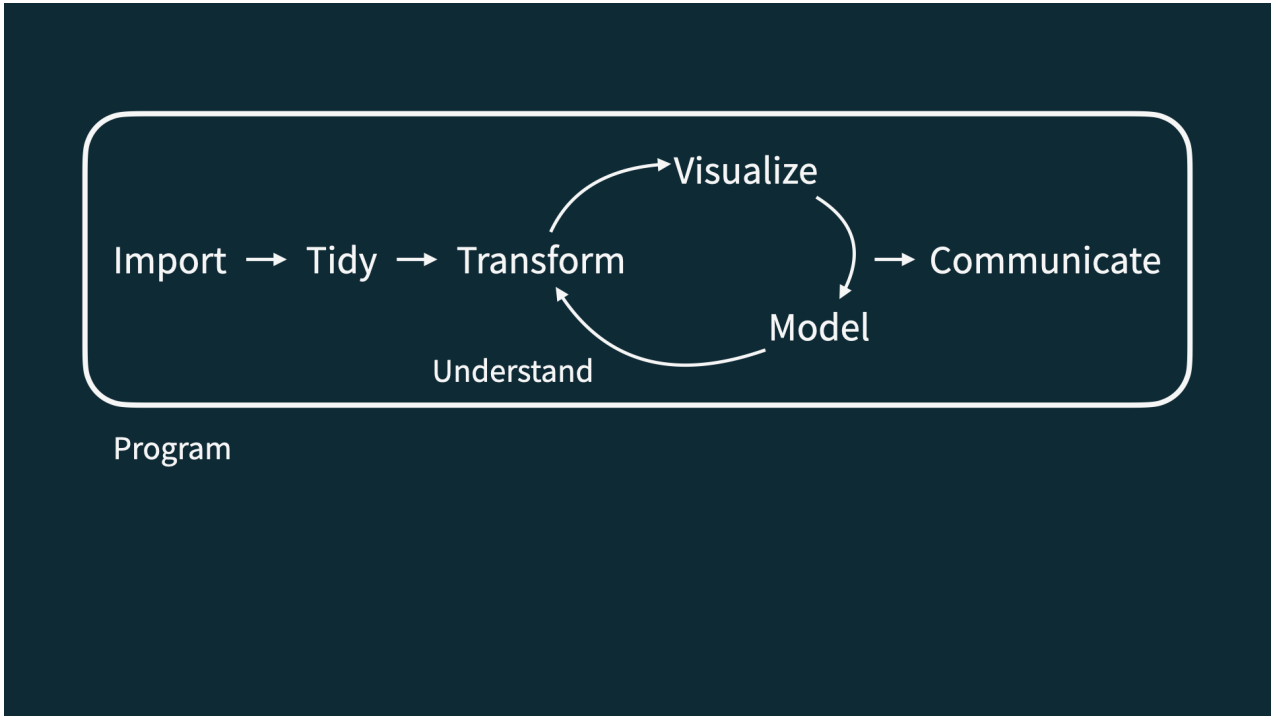


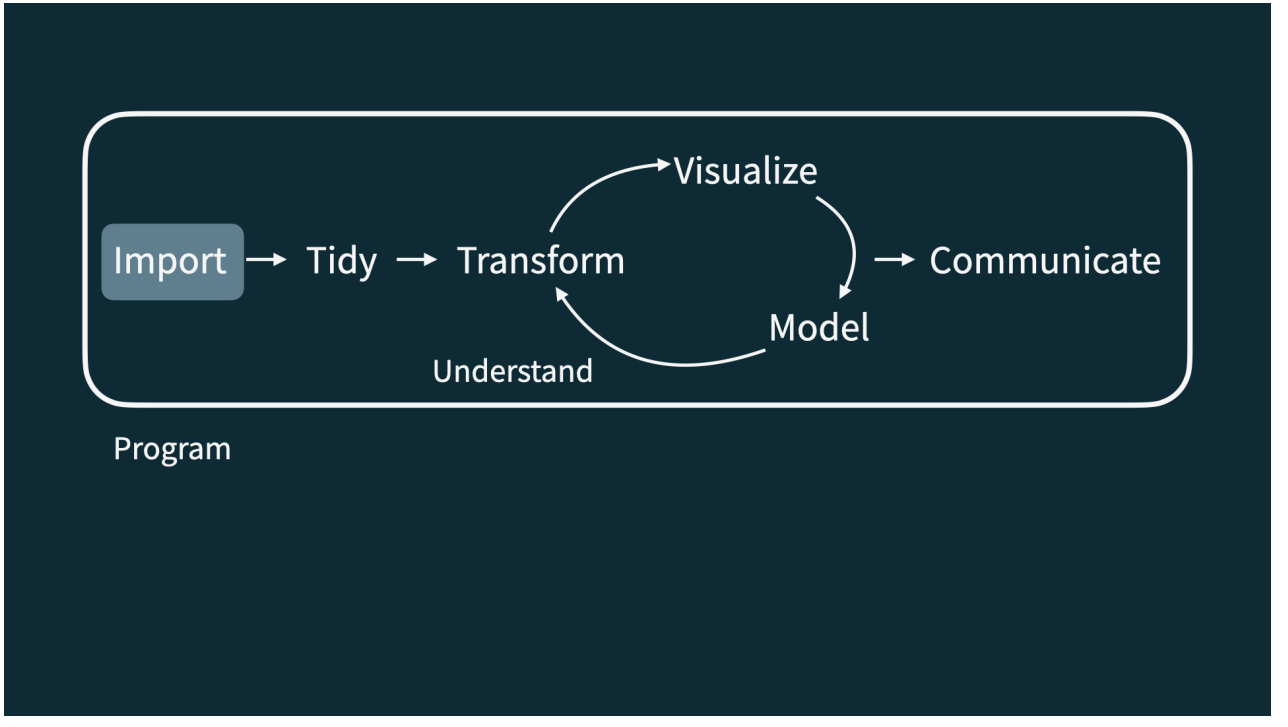
	A	B	C	D	E	F	G	H	I	J	K
1	rcid	country	country_code	vote	session	importantvote	date	unres	amend	para	short
2	6	US	US	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
3	6	Canada	CA	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
4	6	Cuba	CU	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
5	6	Dominican Republic	DO	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
6	6	Mexico	MX	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
7	6	Guatemala	GT	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
8	6	Honduras	HN	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
9	6	El Salvador	SV	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
10	6	Nicaragua	NI	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
11	6	Panama	PA	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
12	6	Colombia	CO	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
13	6	Venezuela, Bolivarian Republic of	VE	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
14	6	Ecuador	EC	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
15	6	Peru	PE	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
16	6	Brazil	BR	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
17	6	Bolivia (Plurinational State of)	BO	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
18	6	Paraguay	PY	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
19	6	Chile	CL	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
20	6	Argentina	AR	abstain	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
21	6	Uruguay	UY	yes	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
22	6	UK & NI	GB	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
23	6	Netherlands	NL	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
24	6	Belgium	BE	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
25	6	Luxembourg	LU	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
26	6	France	FR	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
27	6	Poland	PL	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
28	6	Czechoslovakia	CS	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
29	6	Yugoslavia	YU	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
30	6	Greece	GR	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
31	6	Russian Federation	RU	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
32	6	Ukraine	UA	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
33	6	Belarus	BY	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
34	6	Norway	NO	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS
35	6	Denmark	DK	no	1	0	04/01/1946	R/1/107	0	0	DECLARATION OF HUMAN RIGHTS

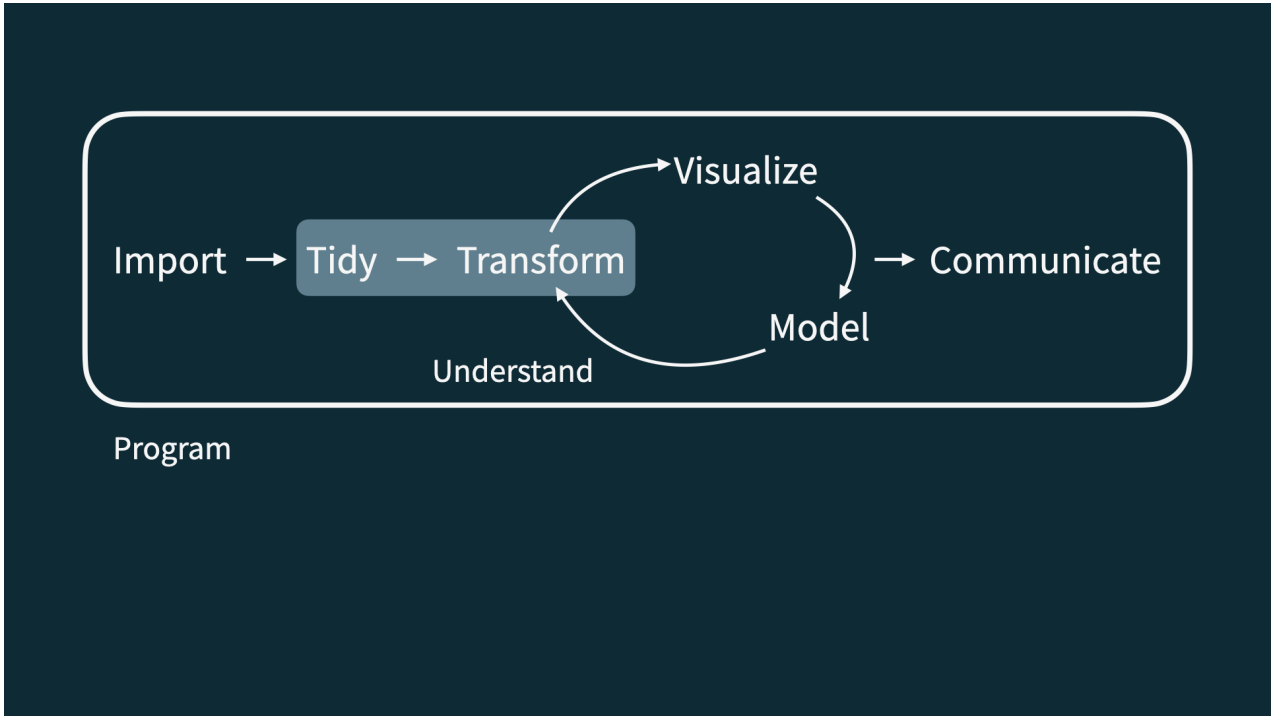

R Console
Help Search
R version 4.0.2 (2020-06-22) -- "Taking Off Again"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
[R.app GUI 1.72 (7847) x86_64-apple-darwin17.0]
[History restored from /Users/mine/.Rapp.history]
>

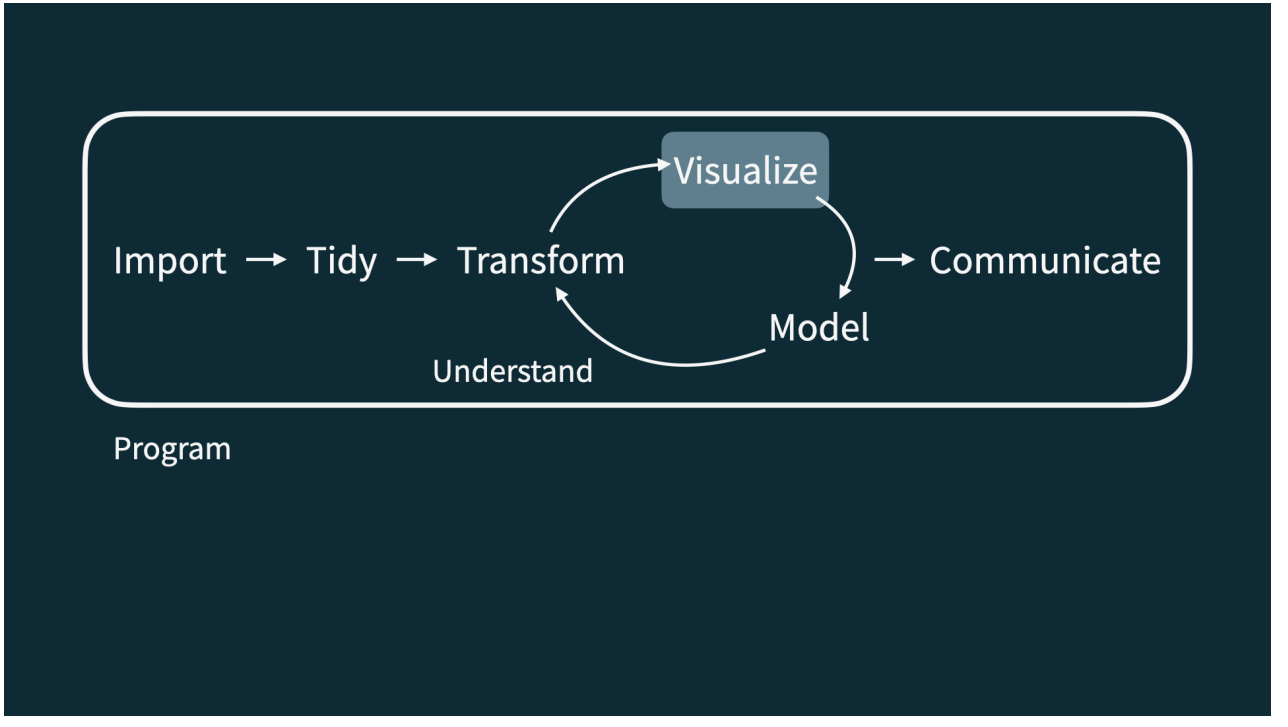

~/aect19-workshop - RStudio
demo-doc.Rmd
index.Rmd
Knit
Insert
Run
---
title: "Workshop Demo Doc"
output: html_document

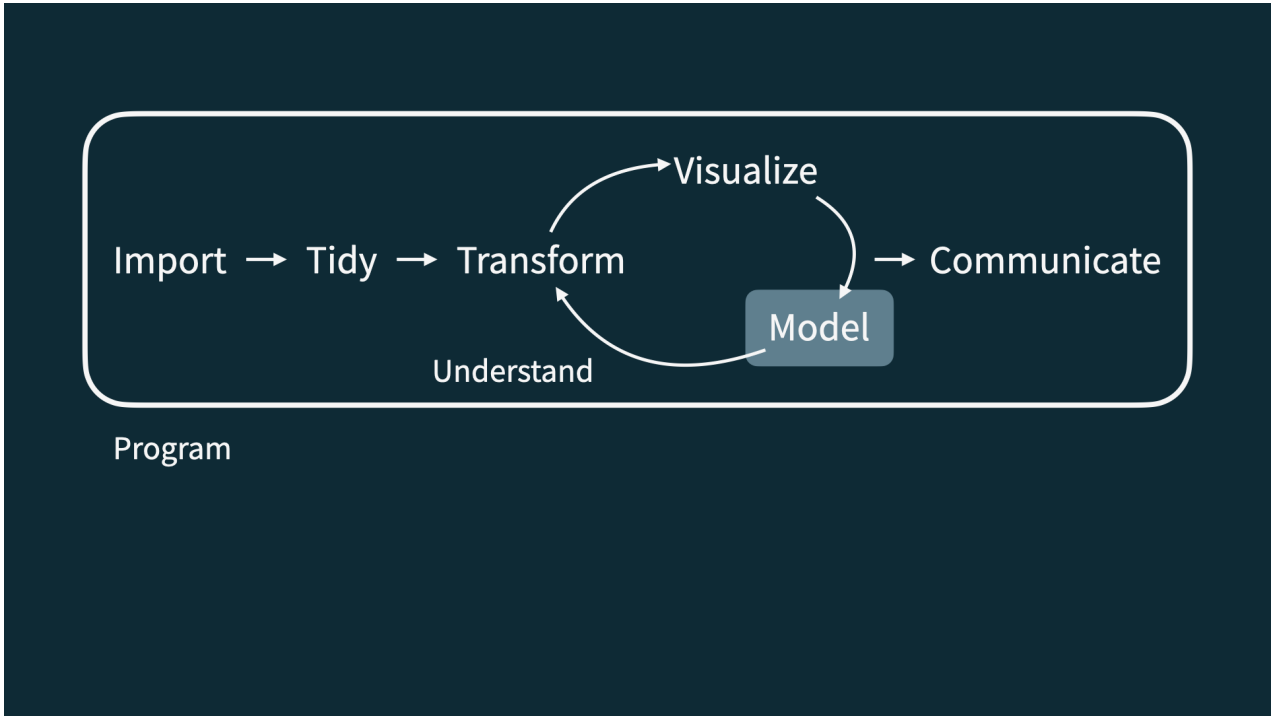
```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```
Demo doc (part 1): Try it out!
Let's first load the tidyverse suite of packages.
If you haven't already, make sure to install the tidyverse, first.
You can skip this code "chunk" if you already have the tidyverse installed; you only need to do this once
```{r}
install.packages("tidyverse")
```
Be sure to run this next line to load the tidyverse. You do this each time you open R.
184:4
Demo doc (part 3): Try it out!
R Markdown
Console
Terminal
R Markdown
~/aect19-workshop/index.Rmd
output file: index.knit.md
/Applications/RStudio.app/Contents/MacOS/pandoc/pandoc +RTS -K512m -RTS index.utf8.md --to html4 --from markdown+autolink_bare_uris+ascii_identifiers+tex_math_single_backslash --output index.html --smart --email-obfuscation none -V 'mathjax-url=https://mathjax.rstudio.com/latest/MathJax.js?config=TeX-MML-AM_CHTML' -V 'title-slide-class=center, middle, inverse, title-slide' --standalone --section-divs --template /Users/spencergreenhalgh/Library/R/3.5/library/xaringan/rmarkdown/templates/xaringan/resources/default.html --no-highlight --css custom.css --include-in-header /var/folders/qt/pfmjvcvs01jcyc6vrnpjbrsh0000gn/T//RtmpRriEen/rmarkdown-str13af25b52c4ca.html --include-before-body /var/folders/qt/pfmjvcvs01jcyc6vrnpjbrsh0000gn/T//RtmpRriEen/xaringan13af21d824dc7.md --include-after-body /var/folders/qt/pfmjvcvs01jcyc6vrnpjbrsh0000gn/T//RtmpRriEen/xaringan13af21a3157e8.js --variable title-slide=true --variable math=true
Output created: index.html
Warning messages:
1: Removed 394 rows containing missing values (geom_point).
2: Removed 394 rows containing non-finite values (stat_smooth).
3: Removed 394 rows containing missing values (geom_point).
Environment
History
Connections
Import Dataset
List
Global Environment
Environment is empty
Files
Plots
Packages
Help
Viewer
New Folder
Delete
Rename
More
Home > aect19-workshop
Name
Size
Modified
.gitignore 40 B Oct 22, 2019, 5:21 PM
.Rhistory 19 B Oct 23, 2019, 7:30 AM
aect-workshop-2019.Rproj 205 B Oct 23, 2019, 7:31 AM
aect19-workshop-files
data
demo-doc.Rmd 3.7 KB Oct 23, 2019, 7:05 AM
example-data.csv 1.3 KB Oct 22, 2019, 5:21 PM
explore-on-your-own-1.Rmd 5.2 KB Oct 22, 2019, 5:21 PM
explore-on-your-own-2.Rmd 8.2 KB Oct 23, 2019, 7:05 AM
help-me.Rmd 597 B Oct 23, 2019, 7:05 AM
img
index.html 40.1 KB Oct 23, 2019, 8:24 AM
index.Rmd 31.3 KB Oct 23, 2019, 8:27 AM
index_files
libs
README.md 8.4 KB Oct 22, 2019, 5:21 PM

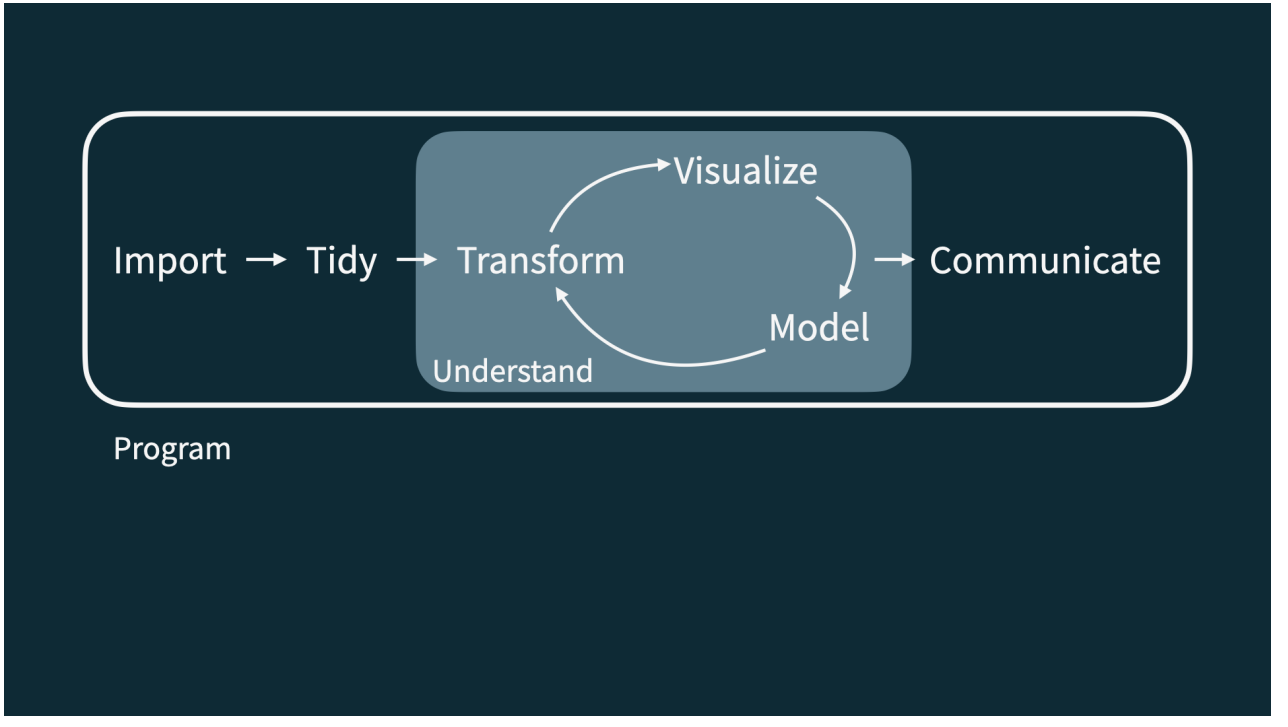

Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program


Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program


Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program

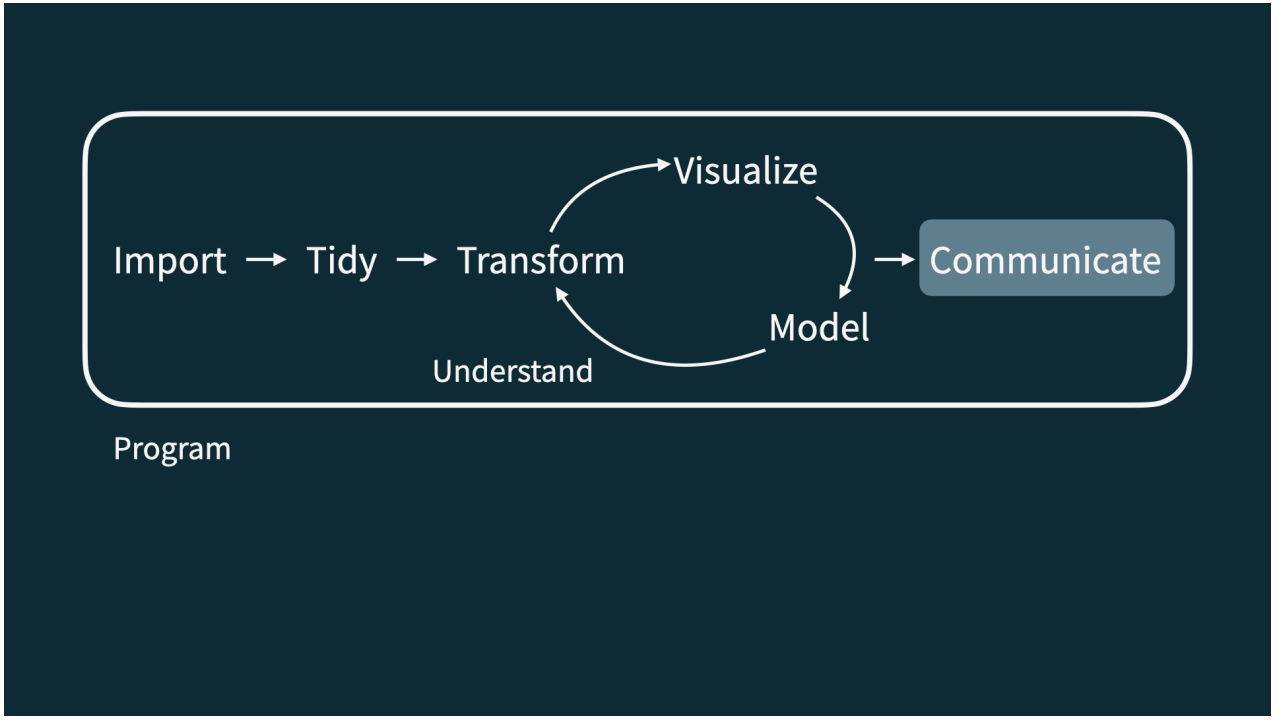

Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program

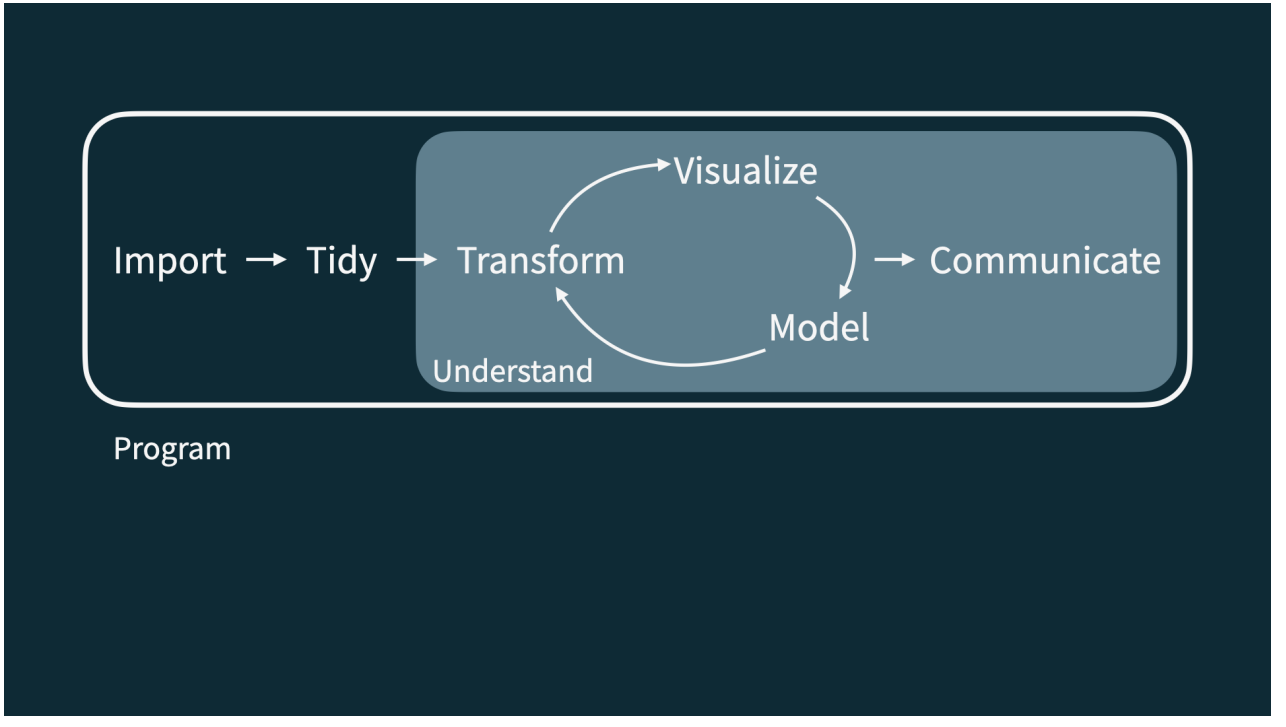

Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program

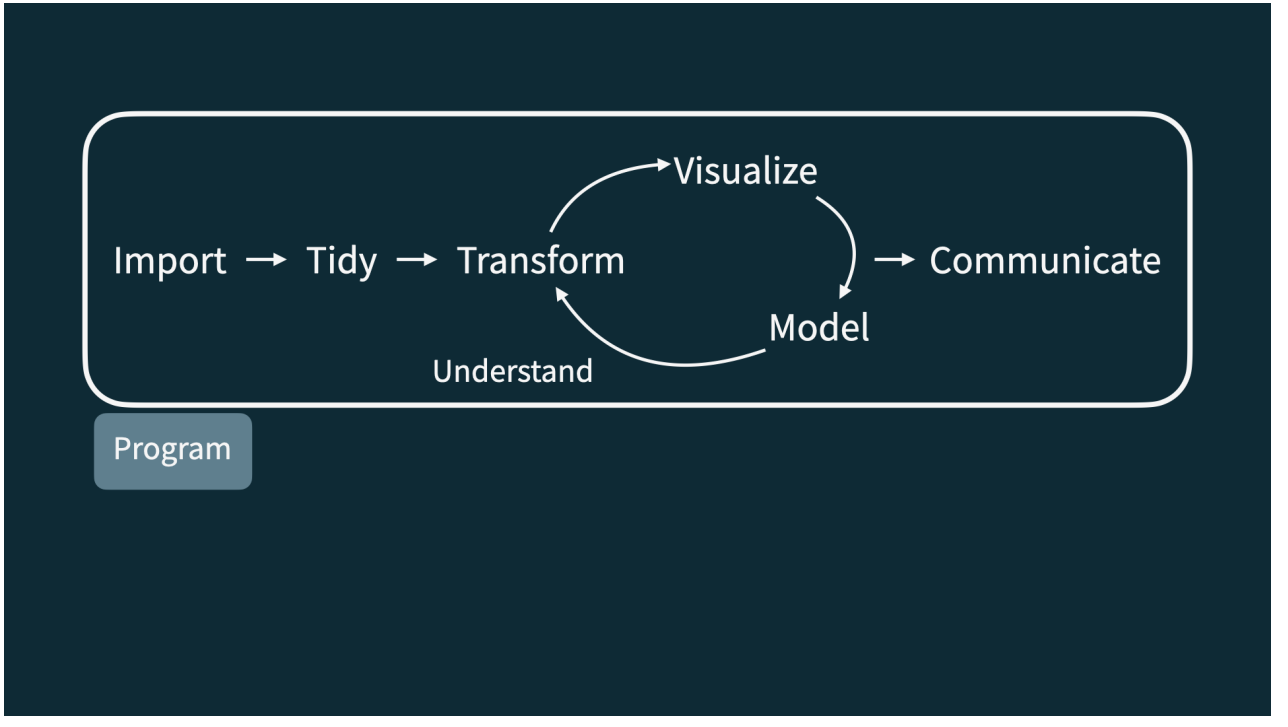

Import
Tidy
Transform
Visualize
Model
Understand
Communicate
Program

```
## # A tibble: 5 x 2
##   date             season
##   <chr>            <chr>
## 1 23 January 2017  winter
## 2 4 March 2017     spring
## 3 14 June 2017     summer
## 4 1 September 2017 fall
## 5 ...              ...

]
```


Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program


Import
Tidy
Transform
Visualize
Model
Understand
Communicate
Program


Visualize
Import
Tidy
Transform
Communicate
Model
Understand
Program

What we learned from your survey responses (thank you!)

- Everyone uses spreadsheet software
- You're (mostly) confident that you can solve problems with respect to analyzing data, but are less confident with respect to using statistical software
- You have impressive backgrounds and professional experiences
- For many, programming and using statistics correctly can be intimidating
- You're a bit more interested in preparing data for analyses than we thought (cool!)

Pedagogical framework

Constructivist

You'll be involved in the process of building new capabilities (and knowledge and skills) with support from others and carefully–chosen scaffolds.

1. You will be doing a great deal of the work
2. Then, we will discuss what we did and how it applies

Over–arching design

The pedagogical framework *plays out* in the following specific ways:

1. You'll first see some brief examples to give you a sense of what's possible
2. You'll be using R Markdown to try things out
3. You'll have a chance to share your ideas and thoughts about what you've done; it will also give me a chance to hear from you about what you did

A little motivation theory

Expectancy–value theory

- We choose things that we are *confident* that we can do well and that are *valuable* to us
- We do these in a sociocultural *context*: our sense of belonging impacts what we choose to do

An argument for this class

- This presentation will make the argument that **you can use R and RStudio to solve problems that are important to you**
- In doing so, you can **participate in a cool community of data scientists in education**

Why learn R?

- It is capable of carrying out basic and complex statistical analyses
- It is able to work with data small (n = 30) and large (n = 100,000+) efficiently
- It is a programming language and so is quite flexible
- There is a great, inclusive community of users and developers (and teachers)
- It is increasingly used in education
- It can help you to carry out your educational analyses in open and trustworthy ways
- It is cross–platform, open–source, and freely–available

RMarkdown

- RMarkdown is a data analysis "notebook" that combines text with code and output
- It is a great file type to use when beginning to use R and to create reproducible analyses
- It is fun to use because you can generate different types of output (Word, PDF, and even web–based)

Let's look at a bit of code together

What do you think this code will do?

```
sci_mo_processed %>%
  filter(percentage_earned >= .60) %>%
  select(student_id, course_id, percentage_earned))
```

Let's look at a bit of code together

```
sci_mo_processed %>%
  filter(percentage_earned >= .60) %>%
  select(student_id, course_id, percentage_earned)
```

```
## # A tibble: 563 x 3
##    student_id course_id     percentage_earned
##         <dbl> <chr>                     <dbl>
##  1      43146 FrScA-S216-02             0.677
##  2      44638 OcnA-S116-01              0.757
##  3      47448 FrScA-S216-01             0.661
##  4      47979 OcnA-S216-01              0.677
##  5      48797 PhysA-S116-01             0.865
##  6      51943 FrScA-S216-03             0.855
##  7      52446 PhysA-S116-01             0.824
##  8      53447 FrScA-S116-01             0.676
##  9      53475 FrScA-S116-02             0.820
## 10      53475 FrScA-S216-01             0.808
## # … with 553 more rows
```

Let's look at a bit of code together

What do you think this code will do?

```
sci_mo_processed %>%
  filter(percentage_earned >= .60) %>%
  arrange(desc(percentage_earned)) %>%
  select(student_id, course_id, percentage_earned, TimeSpent)
```

Let's look at a bit of code together

```
sci_mo_processed %>%
  filter(percentage_earned >= .60) %>%
  select(student_id, course_id, percentage_earned, TimeSpent)
```

```
## # A tibble: 563 x 4
##    student_id course_id     percentage_earned TimeSpent
##         <dbl> <chr>                     <dbl>     <dbl>
##  1      43146 FrScA-S216-02             0.677   1555.
##  2      44638 OcnA-S116-01              0.757   1383.
##  3      47448 FrScA-S216-01             0.661    860.
##  4      47979 OcnA-S216-01              0.677   1599.
##  5      48797 PhysA-S116-01             0.865   1482.
##  6      51943 FrScA-S216-03             0.855      3.45
##  7      52446 PhysA-S116-01             0.824   1390.
##  8      53447 FrScA-S116-01             0.676   1479.
##  9      53475 FrScA-S116-02             0.820     NA
## 10      53475 FrScA-S216-01             0.808   1867.
## # … with 553 more rows
```

Part 3/5: Tutorial

First in-class tutorial: Data viz!

- Navigate to https://github.com/making-data-science-count/s21-intro-to-data-sci-methods-in-ed/find/main
- Begin to type "tutorials"
- Find `tutorials-week-1.Rmd`
- Download this file by right-clicking it and then open it within RStudio
- Walk through the steps

Part 4/5: Syllabus

Organization of the class

- Class website: https://making-data-science-count.github.io/s21-intro-to-data-sci-methods-in-ed/
- Canvas: for submitting assignments and checking grades
- Slack: for communication
- Email: also for communication
- Zoom: for synchronous classes

Part 5/5: Check–out

Random note(s)

- Free rstudio::conf(): https://rstudio.com/conference/ (today until 8 am PT tomorrow, 1/22/2021)

Discuss in base groups (or, if there is insufficient time, in Slack)

- What is one thing you learned today?
- What questions do you still have?