

# Supporting Undergraduate Research Skills

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Preparing to Teach Workshop, July 27, 2019

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<https://github.com/mine-cetinkaya-rundel/preparing-to-teach>

- Why are research skills important?
- Research opportunities
- Infrastructure for research

# ASA Guidelines for Undergraduate Programs in Statistics (2014)

- Graduates should be expected to write clearly, speak fluently, and construct effective visual displays and compelling written summaries
- They should demonstrate ability to collaborate in teams and to organize and manage projects
- They should be able to communicate complex statistical methods in basic terms to managers and other audiences and visualize results in an accessible manner
- There is pedagogical value in having students practice communication to identify gaps in their understanding.
- Communication skills need to dovetail with students' technical and statistical knowledge: excellent communication of inappropriate or incorrect analyses is counterproductive.

# Data Science for Undergraduates (NASEM 2018)

*The National Academies of*  
SCIENCES • ENGINEERING • MEDICINE

## CONSENSUS STUDY REPORT

# DATA SCIENCE FOR UNDERGRADUATES OPPORTUNITIES AND OPTIONS



Finding 2.3: A critical task in the education of future data scientists is to instill data acumen. This requires exposure to key concepts in data science, real-world data and problems that can reinforce the limitations of tools, and ethical considerations that permeate many applications.

<https://nas.edu/envisioningds>

Key concepts involved in developing data acumen include the following:

- Mathematical foundations,
- Computational foundations,
- Statistical foundations,
- Data management and curation,
- Data description and visualization,
- Data modeling and assessment,
- Workflow and reproducibility,
- Communication and teamwork,
- Domain-specific considerations, and (last but not least. . . )
- Ethical problem solving.

# Example: Communication and teamwork

Key communication and teamwork concepts/skills that would be important for all students in their data science programs and critical for their success in the workforce are the following:

- Ability to understand client needs,
- Clear and comprehensive reporting,
- Conflict resolution skills,
- Well-structured technical writing without jargon, and
- Effective presentation skills.

# Why are research skills important?

AAC&U High impact practices  
(<https://www.aacu.org/leap/hips>)

**Collaborative Assignments and Projects** Collaborative learning combines two key goals: learning to work and solve problems in the company of others, and sharpening one's own understanding by listening seriously to the insights of others, especially those with different backgrounds and life experiences. Approaches range from study groups within a course, to team-based assignments and writing, to cooperative projects and research.



# Why are research skills important?

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**Undergraduate Research** Many colleges and universities are now providing research experiences for students in all disciplines. Undergraduate research, however, has been most prominently used in science disciplines. With strong support from the National Science Foundation and the research community, scientists are reshaping their courses to connect key concepts and questions with students' early and active involvement in systematic investigation and research.

# Why are research skills important?

AAC&U High impact practices  
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**Undergraduate Research (cont.)** The goal is to involve students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to answer important questions.





National Science Foundation  
WHERE DISCOVERIES BEGIN

NSB

Research Areas

Funding

Awards

[Home](#)

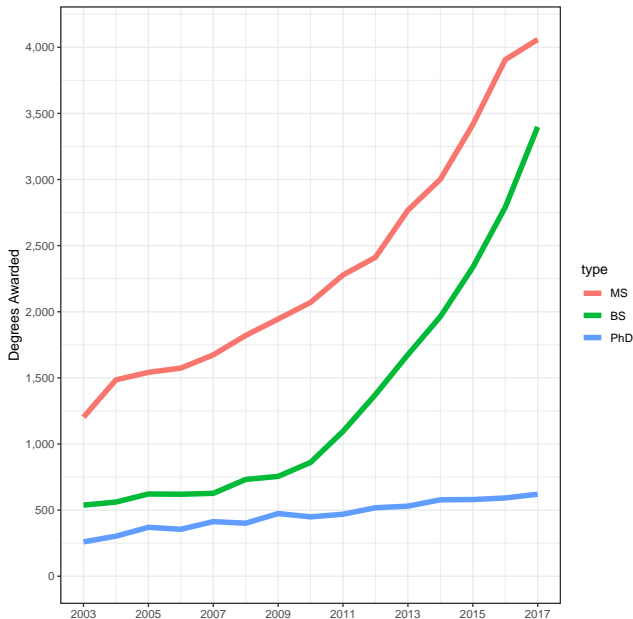
## REU Sites

### REU Sites: Mathematical Sciences

Please report errors in the list below by writing to [reu.dms@nsf.gov](mailto:reu.dms@nsf.gov).

[Search Again](#)

# Statistics Graduates: How do we Scale Up?



- USPROC (Undergraduate Statistics Project Competition)  
<https://www.causeweb.org/usproc>
  - USCLAP Undergraduate Class Project Competition
  - USRESP Undergraduate Research Project Competition



What Is ASA  
Datafest?

Hosting an Official  
ASA DataFest

## What Is ASA DataFest?

The American Statistical Association (ASA) DataFest is a competition where undergraduate students work around the clock to analyze a real-world data set.

DataFest was founded at UCLA in 2011. Each year, students from across the country are invited to participate. In 2012, over 100 students gathered for 48 intense hours to analyze a data set provided by the Thomas 7

# Infrastructure for Research Projects (quick demos as time is available)

- RPubS.com
- github.com
- bookdown





**RPubs** brought to you by RStudio

# ***Easy web publishing from R***

Write R Markdown documents in RStudio.

Share them here on RPubs. (It's free, and could be you.)

**Get Started**

Data

Analysis

References

Appendix

# UN Votes

*Mine Çetinkaya-Rundel*

2018-07-28

Let's take a look at the voting history of countries i data from the **unvotes** package. Additionally, we w the analysis, and the **DT** package for interactive di

```
library(tidyverse)
library(unvotes)
library(lubridate)
library(DT)
```

# Real-world tools, engaged students

GitHub Education helps students, teachers, and schools access the tools and events they need to shape the next generation of software development.



## GitHub Classroom

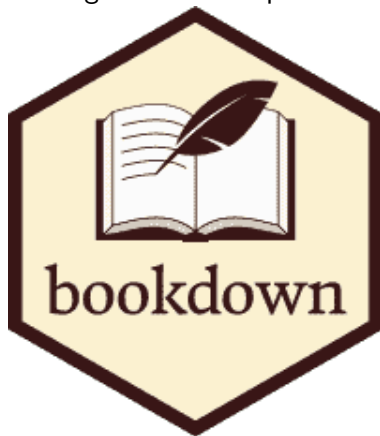
The power of the Git and GitHub workflow, scaled for the needs of students.



## GitHub Education Community

Where veteran teachers share tips, tricks, and scripts.

## Writing books and reports using R Markdown



# How to Sustain?

- Faculty development (eCOTS, USCOTS, CAUSE, JSM, webinars)
- Regional affiliations (for joint undergraduate conferences)
- Local acknowledgemnt (value of creating these opportunities for students)
- More support for REU's to address dramatic growth in undergraduate statistics and data science majors

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