

## **1-25-19 WORKSHOP - TEACHING DATA SCIENCE & APPLIED STATISTICS: PEDAGOGICAL STRATEGIES & RESOURCES**

**NOTE:** this document is a work in progress; additions are most welcome. An electronic copy is at <http://bit.ly/2FJyOTp>

### **REPORTS**

1. National Academies of Sciences, Engineering, and Medicine (2018). [\*\*Data Science for Undergraduates: Opportunities and Options\*\*](#). Washington, DC: The National Academies Press. <https://doi.org/10.17226/25104>  
*Sets forth a vision for the emerging discipline of data science at the undergraduate level, including core principles and skills undergraduates should learn, and pedagogical issues that must be addressed to build effective data science education programs. Includes final report as well as slides and videos from related webinars.*
2. National Research Council (2015). [\*\*Training Students to Extract Value from Big Data: Summary of a Workshop\*\*](#). Washington, DC: The National Academies Press. <https://doi.org/10.17226/18981>  
*Sections on: The Need for Training: Experiences & Case Studies; Principles for Working with Big Data; Courses, Curricula and Interdisciplinary Programs; Shared Resources; and Lessons (Whom, How, and What to Teach)*

### **BOOKS**

3. Andrew Gelman and Deborah Nolan (2017). [\*\*Teaching Statistics: A Bag of Tricks, 2<sup>nd</sup> ed.\*\*](#) Oxford University Press.  
[Link to e-book \(1<sup>st</sup> ed.\)](#) via EBSCOhost on HOLLIS  
*Provides a wealth of demonstrations, activities, examples and projects that involve active student participation. Includes course plans for introductory statistics, statistics for social scientists, as well as material for more advanced courses such as decision theory, Bayesian statistics, sampling, and data science.*
4. Mark E. Ware, David E. Johnson, eds. (2000). [\*\*Handbook of Demonstrations and Activities in the Teaching of Psychology: Introductory, Statistics, Research Methods, and History\*\*](#). Lawrence Erlbaum and Psychology Press.  
[HOLLIS link](#)  
*Section on Statistics (63 pp.) includes Making Statistics Relevant, Generating Data, Teaching Concepts and Principles, and Exploring Pedagogical Strategies.*

### **ARTICLES**

5. George Cobb (2015). [\*\*Mere Renovation is Too Little Too Late: We Need to Rethink our Undergraduate Curriculum from the Ground Up\*\*](#), *The American Statistician*, 69:4, 266-282. DOI: [10.1080/00031305.2015.1093029](https://doi.org/10.1080/00031305.2015.1093029)  
*Responds to calls for change in how statistics is taught to undergraduates by pushing major revisions, making "fundamental concepts accessible" and minimizing "prerequisites to research." Provoked [40 responses](#), including Jim Albert and Mark Glickman's "Attracting Undergraduates to Statistics through Data Science."*
6. Joseph Blitzstein & Xiao-Li Meng (2010). [\*\*Nano-Project Qualifying Exam Process: An Intensified Dialogue Between Students and Faculty\*\*](#), *The American Statistician*, 64:4, 282-290.  
*Describes the use of "nano-projects" (big-picture questions split into bite-sized pieces) in a Ph.D. course and qualifying exams, to transform testing into an extended dialogue between students and faculty, thus deepening learning.*
7. Michele DiPietro (2009). [\*\*Diversity Content as a Gateway to Deeper Learning: The Statistics of Sexual Orientation\*\*](#). *Diversity and Democracy* 12:3, 12-13. Association of American Colleges & Universities.  
*Describes ways to use questions from LGBT civil rights debates to teach statistical concepts and practices, including gathering data, synthesizing information, drawing conclusions, and generalizing conclusions to a larger population.*
8. Candace Schau & Nancy Mattern (1997). [\*\*Use of Map Techniques in Teaching Applied Statistics Courses\*\*](#). *The American Statistician*, 51:2, 171-175.  
*Describes mapping techniques (e.g., graphic organizers, concept maps) that help statistics students understand connections among important concepts, as well as serving as resources for instructional planning and assessment.*

9. Judith D. Singer & John B. Willett (1990). [Improving the Teaching of Applied Statistics: Putting the Data Back into Data Analysis](#). *The American Statistician*, 44:3, 223-230.  
*Argues that artificial data sets should be replaced with real ones, enabling students to acquire analytic skills in an authentic context, and instructors to demonstrate how statistical analysis is used to model real world phenomena. Includes characteristics of data sets effective for instruction, and an annotated bibliography of over 100 data sources.*

## **BLOGS / WEB RESOURCES**

10. [Statistical Sage Blog](#)  
*A wide range of ideas from Hal Kiess and Bonnie Green (authors of [Statistical Concepts for the Behavioral Sciences](#)). See especially their [Posts on Pedagogy](#) – e.g.,*
- [A Review of Tips for Teaching Applied Statistics](#)
  - [Bain’s Approach to What Makes a Great Statistics Professor](#)
  - [Using Mathematica Demonstrations to Visualize Statistical Concepts](#)
11. [Teaching by the Case Method](#) - [C. Roland Christensen Center for Teaching and Learning](#), HBS  
*Features substantive sections on Preparing to Teach, Leading in the Classroom, and Providing Assessment & Feedback, as well as a Sample Class (with video clips, teaching plan, assignment questions), and Tip Sheets.*
12. [Explicit Direct Instruction in Programming Education](#), Felienne Hermans  
*The case for teaching introductory programming by explicit direction, assessments, and didactic methods, with references to new studies on the effectiveness of various teaching techniques in learning code. Keynote at the 2019 RStudio Conference.*
13. [Teaching with Cases](#) - [SLATE \(Strengthening Learning and Teaching Excellence\) Initiative](#), HKS  
*Features a range of resources on case teaching, including videos of Master Case Teachers, and strategies on Common Pitfalls in Case Teaching, Developing Teaching Plans, and Preparing Students to Learn with Cases.*
14. [Case Teaching as Practiced Across Disciplines and Professions at Harvard](#) - Panel at [HILT 2016 Conference](#)  
*Scroll down for 36” video of discussion with Carolyn Wood and Archon Fung (HKS), Matt Miller (HGSE), and V.G. Narayanan (HBS), exploring questions such as: What are some common forms of cases, and which forms best serve different types of learning goals? How might case teaching differ across disciplinary domains and departments?*

## **RECENT RELATED HARVARD INITIATIVES**

15. [CASTLE \(Coordinating and Advancing Statistical Teaching and Learning\) Workshop](#) - April 11-12, 2014  
Joe Blitzstein, Dave Harrington, Xiao-Li Meng  
*Goals included gathering people teaching statistics across Harvard; sharing experiences in teaching statistics in a wide variety of fields; discussing statistical needs of students at all levels; coordinating / collaborating on future courses.*
16. [Bok Exploratory Seminar on Data Literacy Connector Courses](#) - April 6-7, 2016  
Xiao-Li Meng (Statistics, Harvard), Ani Adhikari (Statistics, UC Berkeley), Andrej Milivojevic (History, UC Berkeley)  
*Seminar investigated a [model created at the University of California, Berkeley](#) to teach data literacy through enrolling in a set of linked courses that are accessible and relevant for a broad range of students.*
17. [Curriculum Mapping Project](#) - [Applied Quantitative Methods](#) - 2017-18  
Subu Subramanian  
*Goals included identifying courses across Harvard that apply statistics to social science problems; defining a community of practice, especially on courses for non-statisticians; helping advise students on course selection.*

**18. [Harvard Data Science Initiative Conference](#) - Oct. 17-18, 2018**

*Conference showcased research and education activities through panels, keynotes, workshops, and tutorials featuring faculty from across Harvard and other institutions.*