

## Resources for Teaching K-12 Statistics (including Common Core Measurement and Statistics)

Please send suggestions for additional entries and comments to [cblumberg@gmail.com](mailto:cblumberg@gmail.com).

At the request of The Joint Committee of the American Statistical Association (ASA) and National Council of Teachers of Mathematics (NCTM) this document was created to provide a listing of sources of lesson plans, learning activities, videos, data sets and more to support the teaching of statistics, measurement, and probability as covered by the college and career preparation standards of various States including the Common Core State Standards (see <http://www.corestandards.org/Math/> for details). Many of the resources are also appropriate for AP Statistics courses. Except for resources developed by ASA or NCTM, everything listed is available at no or minimal cost.

We encourage K-12 and 2-year college users of this document to sign up for a free one-year trial ASA membership at <https://ww2.amstat.org/membership/k12teachers/>.

Those using this document are encouraged to read the 2nd edition of Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K-12 Curriculum Framework at <https://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx> (at the top on left hand column of that page). These guidelines were developed by the ASA and NCTM and published under the auspices of the ASA/NCTM Joint Committee on Curriculum in Statistics and Probability.

The first part of this document discusses resources which the ASA and/or National Council of Teachers of Mathematics (NCTM) were involved in developing. The second part discusses other general sources of lesson plans. The remaining parts describe other types of resources that teachers have asked to be included here. In particular, the various sections are:

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This document is available at <https://www.amstat.org/docs/default-source/amstat-documents/edu-k12-statresources.pdf?v=1.1>

## American Statistical Association (ASA) Resources

### Education Homepage of the American Statistical Association

<https://www.amstat.org/asa/education/home.aspx/index.cfm>

This is the central portal for ASA education resources. Besides listing some of the resources given in this document, the central portal contains additional statistics education resources covering Pre-K through graduate school and continuing education. Many of these can be reached by clicking on the “Education” tab in the ribbon near the top of the webpage.

### Bridging the Gap between Common Core State Standards and Teaching Statistics

<https://www2.amstat.org/education/btg/index.cfm> (for more information and free download)

ISBN: 9780983937517

Authors: Pat Hopfensperger, Tim Jacobbe, Deborah Lurie and Jerry Moreno

This document contains 20 detailed lesson plans/investigations for grades K to 8. Each investigation contains an overview, learning goals, references to Common Core Standards and NCTM Principles and Standards for School Mathematics, materials, estimated time, instructional plans (following the GAISE guidelines—see below), interpretation of results, assessments with answers, possible extensions and further references. Note: This book was co-published with NCTM.

### Focus on Statistics: Investigations for the Integration of Statistics into Grades 9-12 Mathematics Classrooms

Free downloadable copy at <https://www.statisticsteacher.org/statistics-teacher-publications/> and then scrolling down to “Focus on Statistics...”. Hardcopy can be bought at

[https://www.amazon.com/dp/1734223502/ref=sr\\_1\\_1?keywords=focus+on+statistics&qid=1580238832&sr=8-1](https://www.amazon.com/dp/1734223502/ref=sr_1_1?keywords=focus+on+statistics&qid=1580238832&sr=8-1).

ISBN: 978-1734223507

Authors: Patrick Hopfensperger, Sara Brown, and Henry Kranendonk

Consists of 19 investigations in statistics for grades 9–12. It is written to help classroom teachers implement key statistical concepts in their classrooms. Each investigation has an overview, learning goals, mathematical practice through a statistical lens, materials, instructional plans, and ideas for extensions. There are also links to pdf and Word versions of downloadable worksheets for each investigation at the bottom of the entry for this book. Note: This book is an ASA publication that is being sold via Amazon and other websites.

### Guidelines for Assessment and Instruction in Statistics Education (GAISE) Reports

<https://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx>

There are two GAISE reports—one for Grades K-12 and one for post-secondary statistics.

The new (second) edition of the K-12 report can be downloaded at

[https://www.amstat.org/asa/files/pdfs/GAISE/GAISEIIPreK-12\\_Full.pdf](https://www.amstat.org/asa/files/pdfs/GAISE/GAISEIIPreK-12_Full.pdf). It can also be purchased via Amazon at <https://www.amazon.com/Guidelines-Assessment-Instruction-Statistics-Education/dp/1734223510/>.

The first edition is at

[https://www.amstat.org/asa/files/pdfs/GAISE/GAISEPreK-12\\_Full.pdf](https://www.amstat.org/asa/files/pdfs/GAISE/GAISEPreK-12_Full.pdf) in English and at

<https://www.amstat.org/asa/files/pdfs/gaise/Spanish.pdf> in Spanish. The purpose of these

reports is to supplement the NCTM Principles and Standards (see

<https://www.nctm.org/standards/>), Common Core standards, and other State standards by developing detailed lesson plans at the beginning, intermediate, and more advanced levels using a four-step process of formulating questions, collecting data, analyzing data and interpretation of the results.

## **Census at School (USA)**

<https://ww2.amstat.org/censusatschool/>

This website is the U.S. component of a bigger international effort that was originally overseen by the International Centre for Statistical Education (ICSE) in the United Kingdom. “Under the direction of their teachers, students in grades 4–12 anonymously complete an online questionnaire, thus submitting the data to a national database. The questions ask about such things as the length of their right foot, height, favorite subject in school, and how long it takes them to get to school. Thirteen questions are common to every country participating in School, but each country adds its own questions specific to the interests of its students... After students have answered the survey, their teacher will have immediate access to their class results. These are used to teach statistical concepts, measurement, data analysis, and graphing, as well as to explore social concepts. Students can compare their class data with Census at random samples from other students around the country and with random samples of responses from the international database.” (quoted from <https://ww2.amstat.org/censusatschool/about.cfm>). For resources, including webinars, for using Census at School information as part of statistics lessons, see <https://ww2.amstat.org/censusatschool/resources.cfm>. For details of how to use this project (including its random sampler) with students, see the teacher instructions at <https://ww2.amstat.org/censusatschool/participantinstructions.cfm>.

## **People Count**

<https://www.statisticteacher.org/2020/04/03/teaching-module-people-count-and-their-data-stories/>

Author: Henry Kranendonk

“This module... examines counts by sex at birth and age in the United States, Kenya, and Japan [based on the] International Data Base of the United States Census Bureau (or IDB)... The theme of this module... [is to study] a country’s diversity based primarily on the distributions of ages and the implications connected to age. This module also looks back at age distributions... [over time]” (quoted from webpage at the URL above, where the module can be downloaded from). This module assumes only a knowledge of Algebra I and is consistent with Common Core Standards and those of many States.

## **Making Sense of Statistical Studies**

<https://ww2.amstat.org/education/msss/> (for description of the book)

<https://www.statisticteacher.org/statistics-teacher-publications/> and scrolling down to the free downloads part of “Making Sense of Statistical Studies” on the left-hand side of the page.

Authors: Roxy Peck and Daren Starnes with Henry Kranendonk and June Morita

The student “module consists of 15 hands-on investigations that provide students with valuable experience in designing and analyzing statistical studies. It is written for an upper middle-school or high-school audience having some background in exploratory data analysis and basic probability.” (quoted from website). The teacher’s module includes all pages from the student module with comprehensive notes that include for each activity: overview of the major ideas that are the focus of the investigation, prerequisite knowledge and skills, learning objectives, teaching tips, references, possible extensions, and suggested answers to questions posed in the activity. Free downloadable copies of both the teacher and student modules are available by clicking on the yellow “Download...” button on the right hand side at the bottom of the page or by going to <https://www.statisticteacher.org/statistics-teacher-publications/> and scrolling down to the downloads part of “Making Sense of Statistical Studies” on the left-hand side of the page.

### **Journal of Statistics and Data Science Education**

<https://www.tandfonline.com/toc/ujse21/current>

This is a free on-line journal. Although a few of the regular articles contain lesson plans, the main source of lesson plans, along with their relevant data, are the Data Sets and Stories articles (found near the end of each issue). All articles from the past (except for the years of 1999 and 2000) can be found at <https://www.tandfonline.com/loi/ujse20>. The 1999 & 2000 articles are at [http://jse.amstat.org/jse\\_archive.htm](http://jse.amstat.org/jse_archive.htm). In addition, there is an extensive JSE Data Archive at [http://jse.amstat.org/jse\\_data\\_archive.htm](http://jse.amstat.org/jse_data_archive.htm) that contains many of the data sets from the Data Sets and Stories articles and other useful data sets from 2014 and earlier.

### **Statistics Teacher (free online journal)**

<https://www.statisticsteacher.org/>

The audience for this journal is everyone interested in the teaching of statistics at the K-12 level, including the Common Core. Maintained by ASA on behalf of the ASA-NCTM Joint Committee on Curriculum in Statistics and Probability for Grades K-12. The journal contains articles, lesson plans, announcements, and special sections on assessment and on technology. Go to [http://asassoc.informz.net/ASASSOC/pages/st\\_signup](http://asassoc.informz.net/ASASSOC/pages/st_signup) to subscribe to receive email notification when the journal is updated.

### **StatisticsEducationWeb (STEW)**

<https://www.amstat.org/ASA/Education/STEW/home.aspx>

“STEW is an online resource for peer-reviewed lesson plans for K-12 teachers.... STEW lesson plans identify both the statistical concepts being developed and the age range appropriate for its use.... Teachers can navigate the site by grade level and statistical topic.” (quoted from website) Most of the lesson plans contain references to aid those that are using the Common Core standards. Starting in 2017, as new lessons are developed, they are appearing instead in the Statistics Teacher (see above for details) online journal.

### **The Statistics Teacher Network Newsletters**

<https://ww2.amstat.org/education/stn/index.html>

Past issues are excellent sources of lesson plans. They also contain a great deal of information relevant to K-12 teachers. Starting in 2017, the newsletters have been expanded to include more detailed lesson plans) and renamed as the Statistics Teacher (see above) online journal.

### **K-12 Statistics Education Webinars**

<https://www.amstat.org/asa/education/K-12-Statistics-Education-Webinars.aspx>

These are past webinars sponsored by ASA. Accompanying materials for each webinar are also on the site. Notices of future webinars are available to K-12 Teacher members of ASA via the K-12 listserv (see previous page) and to previous participants of the ASA MWM Statistics Workshops (see above).

### **K–12 Statistics Teacher Meetups**

<https://www.youtube.com/channel/UCESYnsheh2TclJIZW13sdBQ/videos> (for videos of past Meetups)

ASA offers free K–12 teacher meetups (via Zoom) to share resources and discuss K–12 statistics topics. Meetup topics have included assessment, applets, software resources, lesson plans & more. A few Meetups discuss the AP Statistics exam & grading (called “reading”) of it. To sign up to receive notices of future Meetups and/or make suggestions for future Meetups go to <https://docs.google.com/forms/d/e/1FAIpQLScvtUloeaxiJJvU-GyLGB9qRw7bEzx97iPmm3lIXRkMNiku1A/viewform>

## **Meeting Within a Meeting (MWM) Statistics Workshop for Mathematics and Science Teachers**

<https://www.amstat.org/asa/education/MWM/home.aspx>

"The MWM program provides middle- and high-school mathematics and science teachers an opportunity to discuss and apply the data analysis, data science, and statistical concepts embodied in the NCTM Catalyzing Change books and American Statistical Association's (ASA) *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Pre-K–12 Curriculum Framework*...from a statistical point of view and [to] study ways to assess student understanding of statistical concepts. They also will explore problems that require them to formulate statistical questions and collect, organize, analyze, and draw conclusions from data...The workshop is free, though space is limited and advance registration is required." (quoted from usual website). It is held yearly (usually in connection with the Joint Statistical Meetings) in late July or early August. Registration can be done by going to the MWM webpage URL given at the beginning of this entry.

Note: For 2022, it was decided to have MWM held virtually on August 10 & 11. So, the description on the MWM website is particular to 2022. The information in the paragraph here is for when MWM is held in-person during the Joint Statistical Meetings. It has not been determined yet for 2023 as to whether MWM will be in-person or held virtually. If you are reading this entry by July 31, 2022 you can sign up for the workshop using the URL given above

## **College Majors Requiring Statistics**

<https://www.amstat.org/asa/files/pdfs/EDU-CollegeMajorsFlyer.pdf>

This one-page document is a comprehensive listing of college majors that require statistics. It can be very useful to show students that statistics is important to almost every field of study.

## **This is Statistics**

<https://thisisstatistics.org/>

This is a very useful website maintained by ASA to promote the field of statistics to the public. It has a general section and sections aimed at parents, students, educators and counselors. The website also includes links to videos and other resources. The webpage for educators is at <https://thisisstatistics.org/educators/>.

## **Data-Driven Mathematics**

This is a series of textbook modules funded that were specifically designed to integrate statistics and data analysis into mathematics courses throughout the secondary school curriculum. They provide realistic, real-world data situations for developing mathematical and statistical knowledge. Although written many years ago, they are very consistent with the standards of the various States, include those using the Common Core standards. The copyrights have been transferred from the original publisher to ASA. Each module has a student textbook and an accompanying Teacher's Edition. All can be downloaded for free.

*Advanced Modeling and Matrices*, by Burrill, Burrill, Landwehr, and Witmer

<https://www.amstat.org/asa/files/pdfs/ddmseries/AdvancedModelingandMatrices.pdf> for Student Edition and <https://www.amstat.org/asa/files/pdfs/ddmseries/AdvancedModelingandMatrices--TeachersEdition.pdf> for the Teacher's Edition

*Exploring Centers*, by Kranendonk and Witmer

<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringCenters.pdf> for Student Edition and <https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringCenters--TeachersEdition.pdf> for the Teacher's Edition

(continued on next page)

*Exploring Linear Relations*, by Burrill and Hopfensperger  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringLinearRelations.pdf> for Student Edition and

<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringLinearRelations--TeachersEdition.pdf> for the Teacher's Edition

*Exploring Projects*, by Errthum, Mastromatteo, O'Connor, and Scheaffer  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringProjects.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringProjects--TeachersEdition.pdf> for Teacher's Edition

*Exploring Regression*, by Burrill, Burrill, Hopfensperger, and Landwehr  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringRegression.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringRegression--TeachersEdition.pdf> for the Teacher's Edition.

*Exploring Symbols*, by Burrill, Clifford, and Scheaffer  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSymbols.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSymbols--TeachersEdition.pdf> for the Teacher's Edition

*Exploring Systems of Inequalities*, by Burrill and Hopfensperger  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSystemsofInequalities.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSystemsofInequalities--TeachersEdition.pdf> for the Teacher's Edition.

*Mathematics in a World of Data*, by Burrill, Clifford, Errthum, Kranendonk, Mastromatteo, and O'Connor  
<https://www.amstat.org/asa/files/pdfs/ddmseries/MathematicsinaWorldofData.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/MathematicsinaWorldofData--TeachersEdition.pdf> for the Teacher's Edition

*Modeling with Logarithms*, by Burrill, Clifford, and Landwehr  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ModelingwithLogarithms.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ModelingwithLogarithms--TeachersEdition.pdf> for the Teacher's Edition

*Probability Models*, by Hopfensperger, Kranendonk, and Scheaffer  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ProbabilityModels.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ProbabilityModels--TeachersEdition.pdf> for the Teacher's Edition

*Probability Through Data*, by Hopfensperger, Kranendonk, and Scheaffer  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ProbabilityThroughData.pdf> for Student Edition and  
<https://www.amstat.org/asa/files/pdfs/ddmseries/ProbabilityThroughData--TeachersEdition.pdf> for the Teacher's Edition

## **CHANCE**

<https://www.tandfonline.com/action/journalInformation?show=aimsScope&journalCode=uha20> and

**Significance** <https://www.significancemagazine.com/>

These two magazines have articles that emphasize entertaining or unusual interesting uses of statistics. Some can even be used as the basis for classroom lesson plans. Note: ASA K-12 and 2-year college teacher members have online access to all *CHANCE* issues and receive *Significance* in the mail. For information on a one-year free trial membership to ASA for K-12 teachers or 2-year college faculty, see page 1 of this document.

## **CHANCE Special Issues on Nurturing Statistical Thinking Before College**

Available on the web at <https://www.tandfonline.com/toc/uha20/28/3?nav=tocList> (Part 1) and <https://www.tandfonline.com/toc/uha20/28/4?nav=tocList> (Part 2). In addition, videos of webinars based on the articles on Nurturing Statistical Thinking are at <https://www.youtube.com/channel/UCmUHsGdPwsEsWZcF1Lt2Yqg>

While all articles are available to subscribers of *CHANCE* (see the entry just above), articles relevant to K-12 education and that are free access are:

*The Relationships Between Statistics and Other Subjects in the K-12 Curriculum* by Zalman Usiskin and Kathy Hall at <https://www.tandfonline.com/doi/full/10.1080/09332480.2015.1099361> (webinar discussing this article at [https://magazine.amstat.org/videos/education\\_webinars/Usiskin-StatisticsandotherSubjects.wmv](https://magazine.amstat.org/videos/education_webinars/Usiskin-StatisticsandotherSubjects.wmv))

*Data Surfing* by Kay Endriss and Michael McWilliams at <https://www.tandfonline.com/doi/full/10.1080/09332480.2015.1099367> (webinar related to the article is at [https://magazine.amstat.org/videos/education\\_webinars/DataSurfing.wmv](https://magazine.amstat.org/videos/education_webinars/DataSurfing.wmv))

*Collaboration in the Mathematical Sciences Community on Mathematical Modeling Across the Curriculum* by Peter R. Turner, Rachel Levy, and Kathleen Fowler at <https://www.tandfonline.com/doi/full/10.1080/09332480.2015.1120122>.

*The Big Picture: Preparing Students for a Data-centric World* by Nicole Lazar and Christine Franklin at <https://www.tandfonline.com/doi/full/10.1080/09332480.2015.1120128>.

*Taking a Chance in the Classroom: Modeling Statistical Thinking* by Daniel Kaplan at <https://www.tandfonline.com/doi/full/10.1080/09332480.2015.1120129>.

## **Curriculum Guidelines for Undergraduate Programs in Statistical Science**

<https://www.amstat.org/asa/education/Curriculum-Guidelines-for-Undergraduate-Programs-in-Statistical-Science.aspx> (home page)

<https://www.amstat.org/docs/default-source/amstat-documents/edu-guidelines2014-11-15.pdf> (downloadable copy of complete guidelines)

These guidelines are suggestions for the content and instruction for undergraduate majors in statistical science. High school teachers will benefit from looking at these guidelines so that they know what their students who get interested in Statistics will study at the undergraduate level. In addition, the following white papers associated with the guidelines are also worth looking at:

*Ethics for Undergraduates* by Steve Cohen at <https://www.amstat.org/asa/files/pdfs/EDU-EthicsUndergraduates.pdf>

*What Teachers Should Know about the Bootstrap: Resampling in the Undergraduate Statistics Curriculum* by Tim Hesterberg at <https://www.amstat.org/asa/files/pdfs/EDU-ResamplingUndergradCurriculum.pdf> (this article is also available at

<https://arxiv.org/format/1411.5279v1.pdf>). A closely related article by T. Hesterberg is at <https://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1089789>.

## **Statistics and Data Science Related Competitions, Grants, Scholarships, Fellowships, Internships, Travel Awards, and Other Awards/Honors for Students, Educators, and Early-Career Professionals**

This document can be downloaded by going to <https://stattrak.amstat.org/recognition/> or <https://stattrak.amstat.org/resources/> and then scrolling down and clicking on "Comprehensive Listing of Statistics and Data Science Related Competitions, Awards and More".

This listing is for students and educators at all levels. Many of the activities in first section on Competitions can be used in the classroom. Students can then submit entries into many of these competitions and possibly earn prizes. There are also some entries in the document's other sections that are appropriate for K-12 students and educators.

## **The American Statistician Special Issue on Statistics and the Undergraduate Curriculum (Volume 69, Issue 4, 2015)**

<https://amstat.tandfonline.com/toc/utas20/69/4> and then scroll down past the new articles.

This special issue of The American Statistician is an outgrowth of the curriculum guidelines for undergraduate programs (see just above for details) and is devoted to how to prepare students to engage with data in their work and focuses on statistics and the undergraduate curriculum. While this journal is not normally free access, the introduction and one article in this issue are open access and relevant to the K-12 curriculum:

(Introduction) *Teaching the Next Generation of Statistics Students to “Think With Data”*: Special Issue on Statistics and the Undergraduate Curriculum by Nicholas J. Horton & Johanna S.

Hardin at <https://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1094283>. This introduction has over 100 useful references.

*What Teachers Should Know About the Bootstrap: Resampling in the Undergraduate Statistics Curriculum* by Tim C. Hesterberg at

<https://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1089789>

There are also several non-free access articles in this issue that are relevant to K-12 statistics.

## **Home pages of ASA Sections and Interest Groups with a focus on the Teaching of Statistics**

### ***Statistics and Data Science Education***

<https://community.amstat.org/statisticaleducationsection/home>

### ***Teaching of Statistics in the Health Sciences***

<https://community.amstat.org/TSHS/home>

Both have links to blogs, lists of presentations and other things. Many of the things linked to are appropriate for K-12 Statistics.

### ***History of Statistics Interest Group***

<https://community.amstat.org/historyofstats/home>

The members of this group are very interested in helping teachers integrate the history of statistics into their classrooms. The activities they have developed thus far are at

<https://community.amstat.org/historyofstats/ourlibrary/new-item2>.

### ***Online Teaching Resources and Discussion community of the ASA***

<https://community.amstat.org/communities/community-home?CommunityKey=9c8a2ecb-45a6-469d-894e-5254e00d619f>

This community was created in response to the Covid-19 crisis to have a discussion forum for those teaching remotely. Participants must be members of ASA. See page 1 of this document for information on free and reduced-price memberships for K-12 and 2-year college faculty.



## National Council of Teachers of Mathematics (NCTM) Resources

### Principles and Standards for School Mathematics

<https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/>

The Standards of the various States and the Common Core Standards for statistics and probability have their basis in the National Council of Teachers of Mathematics (NCTM) Principles and Standard for School Mathematics. This document gives detailed explanations and examples for each of the standards separated by grade level.

### Common Core Standards homepage

<https://www.nctm.org/standards/mathcommoncore/>

As the name implies, this is a comprehensive webpage for NCTM and non-NCTM resources related to the Common Core. It is broken down into Elementary, Middle School, High School and Leadership portions, which can be reached by links near the bottom of this homepage. Since the NCTM Common Core Standards homepage is a general website, to help the users of this document, NCTM resources that are highly relevant to statistics and probability are listed in the rest of this section.

### Illustrations

<https://illustrations.nctm.org/>

“Lessons and interactives searchable by NCTM’s Principles and Standards and by the Common Core State Standards. [It has over] 700 lesson plans [and over]100 activities; these are virtual manipulatives, applets, and games” (quoted from <https://illustrations.nctm.org/Content.aspx?id=58>). The easiest way to access the statistics and probability content is to go to the search box on the right-hand side of the homepage and click on the “NCTM Standards” option and then choose the desired grade levels and the “Data Analysis & Probability” options in the search box.

### Thinking and Reasoning with Data and Chance, 68th Yearbook (2006)

ISBN: 9780873535885

Editors: Portia C. Elliott and Gail F. Burrill

Covers Grades 3 through 12. It “focuses on students’ and teachers’ learning in statistics centered on a set of activities. Topics include the relation between mathematics and statistics, the development and enrichment of mathematical concepts through the use of statistics, and a discussion of the research related to teaching and learning statistics.” (quoted from old website) It is now out-of-print. However, many copies are available through the usual resale websites.

### Learning and Teaching Measurement, 65th Yearbook (2003)

ISBN: 9780873535397

Editor: Douglas H. Clements

Covers Grades Pre-K through 12. It “presents current thinking about the learning and teaching of measurement, including students’ understanding, the mathematics of measurement, estimation and approximation, connections, and pedagogy. The companion booklet, which not only illustrates some of the issues from the yearbook but also contains activities that go beyond the content, contains teaching notes and ready-to-use handouts.” (quoted from old website) It is now out-of-print. However, many copies are available through the usual resale websites.

### **Focus in High School Mathematics: Reasoning and Sense Making in Statistics and Probability**

<https://www.nctm.org/store/Products/Focus-in-High-School-Mathematics--Reasoning-and-Sense-Making-in-Statistics-and-Probability/>

ISBN: 9780873536424

(As an e-book) [https://www.nctm.org/Store/Products/Focus-in-High-School-Mathematics--Statistics-and-Probability-\(Download\)/](https://www.nctm.org/Store/Products/Focus-in-High-School-Mathematics--Statistics-and-Probability-(Download)/)

ISBN: 9780873537650

Authors: J Michael Shaughnessy, Beth Chance and Henry Kranendonk

“Six investigations illustrate how to help high school students develop their skills in working with data. The investigations emphasize the roles of reasoning and sense making in defining a statistical question and collecting, analyzing, and interpreting data to answer it. The authors examine the key elements of statistical reasoning identified in *Focus in High School Mathematics: Reasoning and Sense Making* and elaborate on the associated reasoning habits.” (quoted from website)

### **Statistical Questions from the Classroom**

[https://www.nctm.org/Store/Products/Statistical-Questions-from-the-Classroom-\(POD\)/](https://www.nctm.org/Store/Products/Statistical-Questions-from-the-Classroom-(POD)/)

ISBN: 9780873536332

Authors: J Michael Shaughnessy and Beth Chance

“This little book presents eleven short discussions of some of the most frequently asked questions about statistics, questions that are consistently raised by statistics students and by classroom teachers alike. Some questions such as “What is the difference between a sample and a sampling distribution?” or “What is a margin of error?” or “What is a p-value?” involve major concepts in statistics. Other questions such as “Why are deviations squared?” or “Why do we divide by  $n - 1$  instead of  $n$ ?” deal with some of the more technical aspects of the mathematics in statistical theory. The authors offer teachers of statistics some quick insight and support in understanding these issues and explaining these ideas to their own students. Examples and visual representations of the ideas are included.” (quoted from website)

### **Regularly Published Journals**

Almost every issue of these journals has articles on statistics. In order of grade levels covered:

“Teaching Children Mathematics”

<https://www.nctm.org/publications/teaching-children-mathematics/>

“Mathematics Teaching in the Middle School”

<https://www.nctm.org/publications/mathematics-teaching-in-the-middle-school/>

“Mathematics Teacher”

<https://www.nctm.org/publications/mathematics-teacher/>

“Mathematics Teacher Educator”

<https://www.nctm.org/Publications/mathematics-teacher-educator/>

### **Making Sense of Data**

<https://www.nctm.org/store/Products/Curriculum-and-Evaluation-Standards-for-School-Mathematics--Addenda-Series-Grades-K-6--Making-Sense-of-Data/>

ISBN-10 for out-of-print original version: 0873533186

ISBN-13 for print on demand version: 9780873533188

Authors: Mary M. Lindquist and Jan Luquire

This booklet (and the two listed below) is part of NCTM’s Addenda series. It contains 7 chapters, one for each grade of K through 6, with descriptions of classroom investigations that include activities, master copies of student pages and student questions.

### **Dealing with Data and Chance**

<https://www.nctm.org/store/Products/Curriculum-and-Evaluation-Standards-for-School-Mathematics--Addenda-Series-Grades-5-8--Dealing-with-Data-and-Chance/>

ISBN-10 for out-of-print original version: 0873533216

ISBN-13 for print on demand version: 9780873533218

Authors: Judith S. Zawojewski with Gary Brooks, Lynn Dinkelkamp, Eunice D. Goldberg, Howard Goldberg, Arthur Hyde, Tess Jackson, Marsha Landau, Hope Martin, Jeri Nowakowski, Sandy Paull, Albert P. Shulte, Philip Wagreich and Barbara Wilmot

This booklet (and the ones listed directly and below) is part of NCTM's Addenda series. It is aimed at the Grades 5-8 level and contains classroom activities that illustrate data gathering, communication, problem solving, reasoning and connections.

### **Data Analysis and Statistics**

<https://www.nctm.org/store/Products/Curriculum-and-Evaluation-Standards-for-School-Mathematics--Addenda-Series-Grades-9-12--Data-Analysis-and-Statistics/>

ISBN-10 for out-of-print original version: 0873533291

ISBN-13 for print on demand version: 9780873533294

Authors: Gail Burrill, John C. Burrill, Pamela Coffield, Gretchen Davis, Jan de Lange, Diann Resnick and Murray Siegel

This booklet (and the two listed above) is part of NCTM's Addenda series. It is aimed at the Grades 9-12 level. It describes ways of integrating statistics into the curriculum via numerous examples. It has special "Try This" parts that have exercises, problems and explorations for use with students.

### **Canadian Correlations to NCTM Common Core Standards**

<https://www.nctm.org/canadiancorrelations/>

Matches up the standards for various Canadian provinces with the NCTM standards.

### **Navigations**

"The Navigations series translates the five strands of NCTM's *Principles and Standards for School Mathematics* into action and illustrates the growth and connectedness of content areas from prekindergarten through grade 12.... Each book includes a supplemental CD-ROM that features interactive electronic activities to use with students, printable PDF files of all activity pages, articles from NCTM's journals and interactive applets." (quoted from old NCTM website).

The ones most relevant to statistics and probability are:

Navigating through Data Analysis and Probability in Prekindergarten–Grade 2 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-and-Probability-in-Prekindergarten%E2%80%93Grade-2-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-and-Probability-in-Prekindergarten%E2%80%93Grade-2-(with-CD-ROM)/)

Navigating through Measurement in Prekindergarten–Grade 2 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Measurement-in-PreKindergarten%E2%80%93Grade-2-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Measurement-in-PreKindergarten%E2%80%93Grade-2-(with-CD-ROM)/)

Navigating through Data Analysis and Probability in Grades 3-5 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-and-Probability-in-Grades-3%E2%80%935-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-and-Probability-in-Grades-3%E2%80%935-(with-CD-ROM)/)

Navigating through Measurement in Grades 3-5 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Measurement-in-Grades-3%E2%80%935-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Measurement-in-Grades-3%E2%80%935-(with-CD-ROM)/)

(entry continued on next page)

Navigating through Discrete Mathematics in Prekindergarten–Grade 5 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Discrete-Mathematics-in-Prekindergarten---Grade-5-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Discrete-Mathematics-in-Prekindergarten---Grade-5-(with-CD-ROM)/)

Navigating through Data Analysis in Grades 6-8 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-in-Grades-6%E2%80%938-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-in-Grades-6%E2%80%938-(with-CD-ROM)/)

Navigating through Probability in Grades 6-8 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Probability-in-Grades-6%E2%80%938-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Probability-in-Grades-6%E2%80%938-(with-CD-ROM)/)

Navigating through Mathematical Connections in Grades 6-8 (with CD-ROM)

[https://www.nctm.org/Store/Products/Navigating-through-Mathematical-Connections-in-Grades-6-8-\(with-CD-ROM\)/](https://www.nctm.org/Store/Products/Navigating-through-Mathematical-Connections-in-Grades-6-8-(with-CD-ROM)/)

Navigating through Discrete Mathematics in Grades 6-12 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Discrete-Mathematics-in-Grades-6-12-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Discrete-Mathematics-in-Grades-6-12-(with-CD-ROM)/)

Navigating through Data Analysis in Grades 9-12 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-in-Grades-9%E2%80%9312-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Data-Analysis-in-Grades-9%E2%80%9312-(with-CD-ROM)/)

Navigating through Probability in Grades 9-12 (with CD-ROM)

[https://www.nctm.org/store/Products/Navigating-through-Probability-in-Grades-9%E2%80%9312-\(with-CD-ROM\)/](https://www.nctm.org/store/Products/Navigating-through-Probability-in-Grades-9%E2%80%9312-(with-CD-ROM)/)

### **Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 6-8**

<https://www.nctm.org/store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8/>

ISBN: 9780873536721

(As an electronic download) [https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8-\(Download\)/](https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8-(Download)/)

ISBN: 9780873538534

Authors: Gary Kadar, Tim Jacobbe, Patricia Wilson and Rose Mary Zbiek

This book is part of the NCTM Essential Understanding Series. “This book focuses on essential knowledge for mathematics teachers about statistics. It is organized around four big ideas, supported by multiple smaller, interconnected ideas *essential understandings*... [Going] beyond a simple introduction to statistics, the book will broaden and deepen ... understanding of one of the most challenging topics for students and teachers. It will help ... engage...students, anticipate their perplexities, avoid pitfalls, and dispel misconceptions... [Users] also learn to develop appropriate tasks, techniques, and tools for assessing students’ understanding of the topic.” (quoted from website)

### **Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 9-12**

<https://www.nctm.org/store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12/>

ISBN: 9780873536769

(As an electronic download) [https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12-\(Download\)/](https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12-(Download)/)

ISBN: 9780873538527

Authors: Roxy Peck, Rob Gould, Stephen Miller and Rose Mary Zbiek

This book is part of the NCTM Essential Understanding Series). “... [It] examines five big ideas and twenty-four related essential understandings for teaching statistics in grades 9–12. The

authors distinguish mathematical and statistical models, explore distributions as descriptions of variability in data, focus on the fundamentals of testing hypotheses to draw conclusions from data, highlight the importance of the data collection method, and recognize the need to examine bias, precision, and sampling method in evaluating statistical estimators ... [The] authors discuss the growth of students' ideas about statistics and examine challenges to teaching, learning, and assessment. They intersperse their discussion with questions for teachers' reflection." (quoted from website). See next entry for a companion to this book.

### **Putting Essential Understanding into Practice: Statistics, 9-12**

<https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice--Statistics,-9-12/>

ISBN: 9780873537377

(As an electronic download) [https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-\(Download\)/](https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-(Download)/)

ISBN: 9780873539159

Authors: Terry Crites and Roy St. Laurent

This is a companion to the book [Developing Essential Understanding...](#) of the previous entry. "The authors demonstrate how to use this multifaceted knowledge to address the big ideas and essential understandings that students must develop for success with statistics—not only in their current work, but also in higher-level mathematics and a myriad of real-world contexts. Explore rich, research-based strategies and tasks that show how students are reasoning about and making sense of statistics. Use ... these ... to build on their understanding while identifying and correcting misunderstandings..." (quoted from website)

### **Developing Data Graph Comprehension (3<sup>rd</sup> Edition)**

<https://www.nctm.org/store/Products/Developing-Data-Graph-Comprehension,-third-edition/>

ISBN: 9780873536516

(As an electronic download) [https://www.nctm.org/Store/Products/Developing-Data-Graph-Comprehension-in-Grades-K-8,-third-edition-\(Download\)/](https://www.nctm.org/Store/Products/Developing-Data-Graph-Comprehension-in-Grades-K-8,-third-edition-(Download)/)

ISBN: 9780873537971

Author: Frances Curcio

[Has] 30 Classroom-ready activities that emphasize exploration, investigation, reasoning, and communication... This book offers teachers and teacher educators practical ideas for incorporating graph reading and quantitative literacy into instructional programs. Activities include objectives, vocabulary, materials, questions for discussion, and ideas for summarizing that are meant to guide students in data collection, representation, and interpretation." (quoted from website)

### **Working with Data: Statistics Casebook (Developing Mathematical Ideas series)**

ISBN-13: 978-0769027913 and ISBN-10: 0769027911

Authors/Contributors: Susan Jo Russell, Deborah Schifter, Virginia Bastable, Clifford Konold, Traci L. Higgins

This book is related to the previous entry. "Participants work with the collection, representation, description, and interpretation of data. They learn what various graphs and statistical measures show about features of the data, study how to summarize data when comparing groups, and consider whether the data provide insight into the questions that led to data collection." (quoted from Amazon description). No longer available from NCTM website. However, many copies are available through the usual resale websites. See next entry for a related textbook.

**Statistics: Modeling with Data Casebook**

<https://www.nctm.org/Store/Products/Statistics--Modeling-with-Data-Casebook/>

ISBN: 9780873539371

(As an electronic download) [https://www.nctm.org/Store/Products/Statistics--Modeling-with-Data-Casebook-\(Download\)/](https://www.nctm.org/Store/Products/Statistics--Modeling-with-Data-Casebook-(Download)/)

ISBN: 9780873539586

Authors: Susan Jo Russell, Deborah Schifter, and Virginia Bastable

“The *Modeling with Data Casebook* was developed as the key resource for participants’ Developing Mathematical Ideas seminar experience. The twenty-eight cases, written by teachers describing real situations and actual student thinking in their classrooms, provide the basis of each session’s exploration of using data to model real-world contexts by collecting, representing, describing, and interpreting data.” (quoted from website). There is also a facilitator’s package that contains additional materials to accompany this textbook. For more information on it, go to <https://www.nctm.org/Store/Products/Statistics--Modeling-with-Data-Facilitators-Package/>. See previous entry for a related textbook.

## Resources Developed by ASA Committees and Published Elsewhere

### **Exploring Data (Second Edition)**

ISBN-10: 0866516131 ISBN-13: 9780866516136 (Student Edition)

ISBN-10: 0866513221 (Teacher's Edition)

Authors: James M. Landwehr and Ann E. Watkins

This book is the first book of four in the Quantitative Literacy Series (along with the next three books described below). It contains 45 investigations, sorted by statistical topic, which are set up as worksheets for students. This book covers basic descriptive statistics and plots. It assumes no prior knowledge of statistics or of algebra. In addition, there is a Teacher's Edition with detailed lesson plans. The student and teacher books are now out-of-print. However, many copies are available through the usual resale websites. Can be used in Grades 5 to 12.

### **Exploring Probability**

ISBN-10: 0866513337 ISBN-13: 978-0866513333

ISBN-10: 0866513345 (Teacher's Edition)

Authors: Claire M. Newman, Thomas E. Obremski and Richard L. Scheaffer

This is one of the 4 books in the Quantitative Literacy Series (along with the book described above and the two books described below). The book was written specifically for high school students with minimal mathematics background. It is a series of 44 investigations set up as worksheets for students. Although written before the NCTM Principles and Standards for School Mathematics existed, it covers probability in the manner advocated by the Common Core and other State standards. It even covers conditional probability. In addition, there is a Teacher's Edition with detailed lesson plans. The student and teacher books are now out-of-print. Many copies are available through the usual resale websites. Can be used in Grades 6 to 12.

### **Exploring Surveys and Information from Samples**

ISBN-10: 0866513396 ISBN-13: 978-0866513395

ISBN-10: 086651340X (Teacher's Edition)

Authors: James M. Landwehr, Jim Swift and Ann E. Watkins

This is one of the 4 books in the Quantitative Literacy Series (along with the 2 books described above and the book described below). This book was written specifically for high school students with minimal mathematics background. It is a series of 32 investigations set up as worksheets for students. Although written before the NCTM Principles and Standards for School Mathematics existed, it covers much of the material on analyzing the results from surveys in the manner advocated by the Common Core and other State standards. In addition, there is a Teacher's Edition with detailed lesson plans. The student and teacher books are now out-of-print. However, many copies are available through the usual resale websites. Can be used in Grades 6 to 12.

### **The Art and Techniques of Simulation**

ISBN-10: 0866513361 ISBN-13: 9780866513364

ISBN-10: 086651337X (Teacher's Edition)

Authors: Mrudulla Gnanadesikan, Richard L. Scheaffer, & Jim Swift

This is one of the 4 books in the Quantitative Literacy Series (along with the 3 books described above). This book contains 30 investigations of real-world topics that use simulation to solve them. The simulations are set up as worksheets for students. Books are now out-of-print. However, many copies are available through the usual resale websites. Can be used in Grades 7 to 12.

## **ASA-CRC Series on Statistical Reasoning in Science and Society**

<https://www.routledge.com/ASA-CRC-Series-on-Statistical-Reasoning-in-Science-and-Society/book-series/CRCASASERSTAREA>

The purpose of this series of books is:

- to highlight “the...role of statistical and probabilistic reasoning in many areas.
- [have] Concepts presented assuming minimal background in Mathematics and Statistics.
- [be accessible to] A broad audience including ...the general public and courses in high schools and colleges.
- [cover] Topics include Statistics in wide-ranging aspects of professional and everyday life” (quoted from website)

Present books in the series are listed below. All come in hardback, paperback & e-book formats.

**Visualizing Baseball** by Jim Albert

ISBN 9781498782753

<https://www.routledge.com/Visualizing-Baseball/Albert/p/book/9781498782753>

**Errors, Blunders, and Lies: How to Tell the Difference** by David S. Salsburg

ISBN 9781498795784

<https://www.routledge.com/Errors-Blunders-and-Lies-How-to-Tell-the-Difference/Salsburg/p/book/9781498795784>

**Data Visualization: Charts, Maps, and Interactive Graphics** by Robert Grant

ISBN 9781138707603

<https://www.routledge.com/Data-Visualization-Charts-Maps-and-Interactive-Graphics/Grant/p/book/9781138707603>

**Improving Your NCAA® Bracket** by Tom Adams ISBN 9781138597747

<https://www.routledge.com/Improving-Your-NCAA-Bracket-with-Statistics/Adams/p/book/9781138597747>

**Statistics and Health Care Fraud: How to Save Billions** by Tahir Ekin

ISBN 9781138197428

<https://www.routledge.com/Statistics-and-Health-Care-Fraud-How-to-Save-Billions/Ekin/p/book/9781138197428>

**Measuring Crime: Behind the Statistics** by Sharon L. Lohr

ISBN 9781138489073

<https://www.routledge.com/Measuring-Crime-Behind-the-Statistics/Lohr/p/book/9781138489073>

**Measuring Society** by Chaitra H. Nagaraja

ISBN 9781138035980

<https://www.routledge.com/Measuring-Society/Nagaraja/p/book/9781138035980>

**Monitoring the Health of Populations by Tracking Disease Outbreaks: Saving Humanity from the Next Plague** by Steven E Rigdon and Ronald D. Fricker, Jr.

ISBN 9781138742345

<https://www.routledge.com/Monitoring-the-Health-of-Populations-by-Tracking-Disease-Outbreaks-Saving/Rigdon-Jr/p/book/9781138742345>

**Debunking Seven Terrorism Myths Using Statistics** by Andre Python

ISBN 9780367472245

<https://www.routledge.com/Debunking-Seven-Terrorism-Myths-Using-Statistics/Python/p/book/9780367472245>

**Achieving Product Reliability: A Key to Business Success** by Necip Doganaksoy, William Q. Meeker and Gerald J. Hahn

ISBN 9781138054004

<https://www.routledge.com/Achieving-Product-Reliability-A-Key-to-Business-Success/Doganaksoy-Meeker-Hahn/p/book/9781138054004>



**Protecting Your Privacy in a Data-Driven World** by Claire McKay Bowen

ISBN 9780367640743

<https://www.routledge.com/Protecting-Your-Privacy-in-a-Data-Driven-World/Bowen/p/book/9780367640743>

**Statistics Behind the Headlines** by A. John Bailer and Rosemary Pennington

ISBN 9780367902520

<https://www.routledge.com/Statistics-Behind-the-Headlines/Bailer-Pennington/p/book/9780367902520>

**Backseat Driver: The Role of Data in Great Car Safety Debates** by Norma Faris Hubele

ISBN 9780367472306

<https://www.routledge.com/Backseat-Driver-The-Role-of-Data-in-Great-Car-Safety-Debates/Hubele/p/book/9780367472306>

### **Elementary Quantitative Literacy (EQL) Series**

Authors: Carolyn Bereska, L. Carey Bolster, Cyrilla H. Bolster, and Richard Scheaffer

- ***Exploring Statistics in the Elementary Grades, Book One***

ISBN-10: 1572323442 ISBN-13: 9781572323445

- ***Exploring Statistics in the Elementary Grades, Book Two***

ISBN-10: 1572323450 ISBN-13: 9781572323452

These were written by a team of elementary school teachers and statisticians to introduce the key ideas and lessons in data analysis and probability in the K–6 mathematics curriculum. The books are now out-of-print. However, many copies are available through the usual resale websites.

### **Statistics: A Guide to the Unknown, 4th Edition**

ISBN-10: 0534372821 ISBN-13: 9780534372828

Authors: Roxy Peck, George Casella, George W. Cobb, Roger Hoerl, Deborah Nolan, Robert Starbuck and Hal Stern

“Published in partnership with the American Statistical Association, this collection of intriguing essays describes important applications of statistics and probability in a wide variety of fields. Instead of teaching methods, the essays illustrate past accomplishments and current uses of statistics and probability. Examples of surveys, questionnaires, experiments, and observational studies are included to help the student better understand the importance of and the influence of statistics.” (quoted from old Cengage website). Each essay, in combination with its accompanying questions for students, can be used as the basis for lesson plans in grade 9 to 12. It is now out of print. However, many copies are available through the usual resale websites. The 3<sup>rd</sup> edition of this book (see below) is also worth looking at.

### **Statistics: A Guide to the Unknown, 3rd Edition**

ISBN-10: 0534094929 and ISBN-13: 9780534094928

Edited by Judith M. Tanur, Frederick Mosteller and William H. Kruskal. This book is similar in format to the 4<sup>th</sup> edition (see above). But it has a totally different set of essays which, although somewhat dated, are also worth looking at. It is now out of print. However, many copies are available through the usual resale websites

### **AMATYC (American Mathematical Association of Two-Year Colleges) Webinar Series**

<https://amatyc.org/page/Webinars>

In cooperation with the ASA/AMATYC Joint Committee a continuing seminar series related to introductory statistics topics has been developed. The above link goes to the listing of all AMATYC seminars since 2011.

## Other Sources of Lesson Plans

### EngageNY

<https://www.engageny.org/common-core-curriculum> with statistics items in the mathematics part. This website comes highly recommended by many teachers. “The...materials on EngageNY are designed to be adopted or adapted. Educators will find both PDF and Word versions available for their use. Some lessons provide detailed instructions or recommendations but it is important to note that **the lessons are not scripts** and rather they should be viewed as vignettes so that the reader can imagine how the class could look. Lessons ... allow for teacher preference and flexibility so that what is happening in the classroom can both meet students' needs and be in service to the shifts and the standards.... [T]he Tristate/EQuIP rubric

[<https://www.engageny.org/resource/tri-state-quality-review-rubric-and-rating-process> helps teachers] ...evaluate the quality, rigor, and alignment of ... adapted lessons... [T]he Math modules include a significant number of problem sets so that students have ample opportunity to practice and apply their knowledge.” (quoted from website)

They also have questions from the past several years at <https://www.engageny.org/3-8>... and translated into Arabic, Bengali, Chinese, English, Haitian Creole, Korean, Russian and Spanish at <https://www.engageny.org/resource/released-2021-3-8-mathematics-state-test-questions-translated-editions>.

The most relevant modules for statistics and probability are:

Grade 6—Module 6 at <https://www.engageny.org/resource/grade-6-mathematics-module-6>

Grade 7—Module 5 at <https://www.engageny.org/resource/grade-7-mathematics-module-5>

Grade 8—Module 6 at <https://www.engageny.org/resource/grade-8-mathematics-module-6>

Algebra I—Module 2 at <https://www.engageny.org/resource/algebra-i-module-2> and Module 5 at <https://www.engageny.org/resource/algebra-i-module-5>

Algebra II—Module 4 at <https://www.engageny.org/resource/algebra-ii-module-4>

Precalculus and Advanced Topics--Module 5 at

<https://www.engageny.org/resource/precalculus-and-advanced-topics-module-5>

These modules also have translations into Arabic, Bengali, Chinese and Spanish. However, some modules only have translations into some of these languages.

### Illustrative Mathematics

<https://www.illustrativemathematics.org/content-standards>

With a few clicks the user can get a list of activities (called “tasks”) to match any particular Common Core standard from Grades K to 12. Each activity is accompanied by a list of which standards it covers, the task itself, commentary, and solutions. Although tied to the Common Core in terms of organization, teachers in states with other standards have found these activities useful.

### Concord Consortium STEM Resources

<https://learn.concord.org/>

Has a wide variety of resources, including many that involve various uses of statistics and statistical modeling. Resources include appropriate grade levels (including some with different versions for the various grade levels) and how they match with various standards (including both Common Core and Next Generation Science Standards). While many are under the category of Mathematics, the other categories also contain many activities that use statistics and measurement. There is also a data science portion at <https://concord.org/our-work/research-projects/#data-science-education>. Once on the page, scroll down the page to get to the data science activities.

## **CAUSEweb.org (Consortium for the Advancement of Undergraduate Statistics Education)**

<https://www.causeweb.org/cause/>

Although this website is concerned with undergraduate statistics, many of its resources, including its webinars and “fun” page, are appropriate for secondary schools. The webinars can be found at <https://www.causeweb.org/cause/webinars>. The fun page is at <https://www.causeweb.org/cause/resources/fun>.

### **Mathematics Vision Project**

“The Mathematics Vision Project (MVP) curriculum has been developed to realize the vision and goals of the New Core Standards of Mathematics. The Comprehensive Mathematics Instruction (CMI) framework is an integral part of the materials.” (quoted from previous homepage). For each course there are downloadable student lessons (most are worksheet-based) and teacher notes at both the regular and honors level. The “honors” editions for each module are located by scrolling down each page.

The most appropriate modules for statistics are:

Algebra—Module 9: Modeling Data at <https://www.mathematicsvisionproject.org/algebra.html>

Geometry—Module 8: Probability at <https://www.mathematicsvisionproject.org/geometry.html>

Algebra II—Module 9: Statistics at <https://www.mathematicsvisionproject.org/algebra-ii.html>

Secondary I—Module 9: Modeling Data at <https://www.mathematicsvisionproject.org/secondary-mathematics-i.html> (available in both English and Spanish)

Secondary II—Module 9: Probability at <https://www.mathematicsvisionproject.org/secondary-mathematics-ii.html> (available in both English and Spanish)

Secondary III—Module 9: Statistics at <https://www.mathematicsvisionproject.org/secondary-mathematics-iii.html> (available in both English and Spanish).

### **Mathematics Georgia Standards of Excellence (GSE)**

<https://www.georgiastandards.org/georgia-standards/pages/math.aspx>

The State of Georgia has developed comprehensive frameworks and lesson plans for implementing their State standards. These are easily adaptable to other States. Below, by grade level, the units where probability, statistics and/or data collection are discussed are listed.

Grade 3—Unit 6 (Measurement) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/3rd-Math-Unit-6.pdf>

Grade 5—Unit 6 (Volume and Measurement) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/5-Math-Unit-6.pdf>

Grade 6—Unit 6 (Statistics) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/6th-Math-Unit-6.pdf>

Grade 7—Unit 5 (Inferences) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/7th-Math-Unit-5.pdf> AND Unit 6 (Probability) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/7th-Math-Unit-6.pdf>

Grade 8—Unit 6 (Linear Models and Tables) at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/8th-Math-Unit-6.pdf>

### **Online Statistics Education: An Interactive Multimedia Course of Study**

<https://onlinestatbook.com/2/>

As the name implies this is a multimedia course of study that covers the first two courses of undergraduate statistics for those majoring in non-technical areas. It can be used as a source of ideas for teaching topics in statistics that are part of the secondary school curriculum or as a source for teachers to improve their own knowledge of statistics.

### **The Utah Middle School Math Project**

Homepage at <http://utahmiddleschoolmath.org/>

The homepage explains the background of the project, but does not link to the free units they developed. For each unit there is a student workbook, parent workbook, mathematical foundations booklet and teacher materials. The links below go to the appropriate statistics units for grades 6 to 8. Once on the main URL given here, then click on student materials or teacher materials. At times for the teacher materials, you must type in a password of mmaise.

Grade 6—Go to <http://utahmiddleschoolmath.org/6th-grade/> then once on student or teacher page, scroll down to Ch 4.

Grade 7—Go to <http://utahmiddleschoolmath.org/7th-grade/> then once on student or teacher page, scroll down to Ch 1 and Ch 7.

Grade 8—Go to <http://utahmiddleschoolmath.org/8th-grade/> then once on student or teacher page, scroll down to Ch 6

### **U.S. Census Bureau Statistics in School Lesson Plans and More**

<https://www.census.gov/programs-surveys/sis.html> This is the opening page for the lesson plans and other resources for K-12 students and teachers that have been developed for the U.S. Census Bureau for distribution. Once on the webpage, scroll down to near the bottom of the page and click on the “How to Navigate the Statistics in Schools Website” video to learn more about how to access the Statistics in School activities, lesson plans, and other resources for students and teachers. For each lesson there are teaching notes (called the “teacher version”) and step-by-step student activities (called the “student version”).

### **Statistics: Power from Data!**

<https://www150.statcan.gc.ca/n1/edu/power-pouvoir/toc-tdm/5214718-eng.htm>

Developed by Statistics Canada (the official agency for statistics in Canada), this is a modified version of the Australian book, Statistics: A Powerful Edge! (see below). It was developed for secondary school students. It was created using comments from teachers about topics they would like to see covered and includes exercises and lesson plans. The version in French is at <https://www150.statcan.gc.ca/n1/edu/power-pouvoir/toc-tdm/5214718-fra.htm>

### **Statistics: A Powerful Edge! (2<sup>nd</sup> edition)**

[http://www.ausstats.abs.gov.au/ausstats/free.nsf/0/86DAB2444C5B43E4CA256ADB00163218/\\$File/Statistics%20-%20a%20powerful%20edge.pdf](http://www.ausstats.abs.gov.au/ausstats/free.nsf/0/86DAB2444C5B43E4CA256ADB00163218/$File/Statistics%20-%20a%20powerful%20edge.pdf)

This “is a resource book from the Australian Bureau of Statistics (ABS) about getting the most from statistics. It is published for secondary students of Mathematics and...teachers...Along with extensive text, the book contains exercises to help students consolidate their understanding of presented material.” (quoted from website). Even though it is more than 20 years old, it has a wide variety of resources applicable to the Common Core and other State Standards.

### **Gapminder**

<https://www.gapminder.org/resources/>

“Gapminder is a non-profit venture – a modern “museum” on the Internet – promoting sustainable global development and achievement of the United Nations Millennium Development Goals.” (quoted from an older version of Gapminder’s mission statement). Although most of the content is concerned with global development, there is a huge variety of resources here for Grades 9 to 12. The resources are sorted into data, videos, downloads, for teachers, labs and more. The data and videos parts are described further in the “Sources of Data” and “Videos” sections later on in this document.

### **A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas**

<https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts>

Editors: Helen Quinn, Heidi Schweingruber and Thomas Keller

This framework was used as the basis for the Next Generation Science Standards (see next entry). It “draws on current scientific research—including research on the ways students learn science effectively” (quoted from website). There is a free downloadable copy on the website.

### **Next Generation Science Standards**

<https://www.nextgenscience.org/get-to-know>

Although written for science, there is much that can be used in teaching statistics and probability (especially in the elementary grades).

### **Teaching Statistics**

<https://onlinelibrary.wiley.com/journal/14679639>

This journal is specifically aimed at teachers from Pre-K through Grade 12, with an emphasis on articles that can easily be adapted for use in classrooms. While receiving the complete copy of each issue has a cost, many of the articles can be accessed for free on its website.

### **Technology Innovations in Statistics Education**

[https://escholarship.org/uc/uclastat\\_cts\\_tise](https://escholarship.org/uc/uclastat_cts_tise)

No-cost journal that has articles that describe “how to better teach statistics with technology or how to better teach technology.... [at] any level of education, including graduate and post-graduate education, professional development, college, and K-12.” (quoted from Aims and Scope webpage of the website).

## Lesson Plans and Other Resources in Spanish and Other Languages

### Guidelines for Assessment and Instruction in Statistics Education (GAISE) Reports

Only the 1<sup>st</sup> edition of GAISE K-12 report has been translated into Spanish. The direct link to the Spanish translation of K-12 version is <https://www.amstat.org/asa/files/pdfs/gaise/Spanish.pdf>. There are two GAISE reports—one for Grades K-12 and one for post-secondary statistics. The K-12 version emphasizes the important ideas (such as variability) that the NCTM Principles and Standards (see <https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/>), Common Core Standards, and other State Standards are addressing by developing detailed lesson plans at the beginning, intermediate, and more advanced levels using a four-step process of formulating questions, collecting data, analyzing data & interpretation of the results.

### Talleres de Alfabetización Estadística (Workshops in Statistical Literacy)

<https://alfabetizacionestadistica.wordpress.com/nuestros-talleres/>

The objectives of this project were to develop and disseminate a set of strategies applicable to teaching of middle school statistics. Although it was developed for use in Argentina, it is heavily influenced by the Common Core standards and can easily be adapted to U.S. classrooms. It is only available in Spanish.

### Mathematics Vision Project

<https://www.mathematicsvisionproject.org/>

“The Mathematics Vision Project (MVP) curriculum has been developed to realize the vision and goals of the New Core Standards of Mathematics. The Comprehensive Mathematics Instruction (CMI) framework is an integral part of the materials.” (quoted from previous homepage). The materials are written as a 3-year sequence called Secondary Mathematics I, Secondary Mathematics II and Secondary Mathematics III. For each year there are downloadable student lessons (most are worksheet-based) and teacher notes at both the regular and honors level. However, only the regular level student modules are available in Spanish. The most appropriate modules for statistics are:

Secondary I—Module 9: Modeling Data at <https://www.mathematicsvisionproject.org/secondary-mathematics-i.html>

Secondary II—Module 9: Probability at <https://www.mathematicsvisionproject.org/secondary-mathematics-ii.html>

Secondary III—Module 9: Statistics at <https://www.mathematicsvisionproject.org/secondary-mathematics-iii.html>

### Project MOSAIC Little Books for Learning R Programming Language

<https://github.com/ProjectMOSAIC/LittleBooks/blob/master/README.md> (English versions)

<https://github.com/fjaraavilaa/MOSAIC-LittleBooks-Spanish> (Spanish versions)

Authors: Randall Pruim, Nicholas Horton, and Daniel Kaplan

The books that are relevant to teaching Common Core statistics are:

#### ***“Start Teaching Statistics Using R***

...presents overview of our approach...with R and an introduction to our primary R toolkit.”

#### ***A Student's Guide to R***

This book is organized by analysis method & demonstrates how to do the statistical analyses typically covered in an Intro Stats course. It can serve as a reference for both students & faculty. In addition to these books, the authors have stored many useful materials in English at <https://cran.r-project.org/web/packages/mosaic/index.html>. In particular, there is a four-page handout called “**Minimal R for Intro Stats**” on the website or directly at <https://cran.r-project.org/web/packages/mosaic/vignettes/MinimalRqgq.pdf>.

## Visual Understanding Applets

<https://www.vusoft.eu/apps/>

Authors: Carel van de Giessen and Piet van Blokland

These applets were developed for use in Common Core classrooms and many of them include simulation capabilities. They come highly recommended by several Common Core statistics teachers and can be used in any course using statistics in Grades 7 to 12. Also available in Spanish, German, Turkish, Dutch, Polish, Swedish, French, Russian, Italian, Portuguese, Chinese and Japanese. To select the language you want, click on the menu near the top of the webpage.

## Statistics: Power from Data! (Les statistiques: le pouvoir des données!)

<https://www150.statcan.gc.ca/n1/edu/power-pouvoir/toc-tdm/5214718-eng.htm> (English version)

<https://www150.statcan.gc.ca/n1/edu/power-pouvoir/toc-tdm/5214718-fra.htm> (French version)

Developed by Statistics Canada (the official agency for statistics in Canada), this is a modified version of the Australian book, Statistics: A Powerful Edge! (see below). It was developed for secondary school students. It was created using comments from teachers about topics they would like to see covered and includes exercises and lesson plans.

## PISA (Programme for International Student Assessment) Questions

<https://www.oecd.org/pisa/test/> (for questions from 2012, 2015 and 2018)

<https://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm> (for questions from 2000, 2003, 2006 and 2012)

PISA is the international effort (under the auspices of OECD) in mathematics to compare mathematics knowledge (and knowledge in other areas) across the world. This webpage contains items from past PISA assessments. The items were designed to be administered to 15-year-old students. Many of those shown on the website directly or indirectly assess statistical literacy. Some of the questions are available in French.

## EngageNY Sample Questions for the Mathematics Tests

<https://www.engageny.org/resource/released-2021-3-8-mathematics-state-test-questions-translated-editions> (for 2021 questions)

<https://www.engageny.org/resource/released-2019-3-8-mathematics-state-test-questions-translated-editions> (for 2019 questions)

These sample questions are in Arabic, Bengali, Spanish, Chinese, English, Haitian Creole, Korean and Russian. They are matched to the New York State standards (which are close to the Common Core standards) they cover. In addition, there are explanations for the correct answers and even for the wrong answers—which explain for the teacher what the students' misunderstandings may be. Note: Not all questions are translated into all languages.

## EngageNY Lesson Plans

The most relevant modules for statistics and probability are:

Grade 6—Module 6 at <https://www.engageny.org/resource/grade-6-mathematics-module-6>

Grade 7—Module 5 at <https://www.engageny.org/resource/grade-7-mathematics-module-5>

Grade 8—Module 6 at <https://www.engageny.org/resource/grade-8-mathematics-module-6>

Algebra I—Module 2 at <https://www.engageny.org/resource/algebra-i-module-2> and Module 5 at <https://www.engageny.org/resource/algebra-i-module-5>

Algebra II—Module 4 at <https://www.engageny.org/resource/algebra-ii-module-4>

These modules also have translations into Arabic, Bengali, Chinese and Spanish. However, some modules only have translations into some of these languages.

**StatLine**

<https://opendata.cbs.nl/statline/#/CBS/en/>

StatLine is the central data site of Statistics Netherlands for public use. It is extremely user friendly and allows the user to make queries, histograms, tables, and other graphics as well as to see summary statistics. The link above is for the version in English. The Dutch language version is at <https://opendata.cbs.nl/statline/#/CBS/nl/>.



## Data Science Teaching Resources

### Concord Consortium STEM Resources

<https://learn.concord.org/>

Has a wide variety of resources, including many that involve various uses of statistics and statistical modeling. Resources include appropriate grade levels (including some with different versions for the various grade levels) and how they match with various standards (including both Common Core and Next Generation Science Standards). While many are under the category of Mathematics, the other categories also contain many activities that use statistics and measurement. There is also a data science portion at <https://concord.org/our-work/research-projects/#data-science-education>.

### Common Online Data Analysis Platform (CODAP)

<https://codap.concord.org/>

A free, online data analysis platform developed by the Concord Consortium that offers many useful and fun features, such as linked graphs and features for working with nested/hierarchical data. Their dynamic data science page is at <https://learn.concord.org/dynamic-data-science>. Many useful materials for teaching data science are at <https://codap.concord.org/for-educators/>.

### UC Berkeley Data Science Academic Resource Kit

<https://data.berkeley.edu/education/ark>

“This page is intended as an overall guide to the open-source resources for teaching data science. ... Many of these resources were developed specifically at Berkeley but others as part of broader open source collaborations (e.g., Project Jupyter). In almost all cases the content and source code are open to use [and modification.]”. (Quoted from webpage)

### Mobilize Introduction to Data Science

<https://www.introdatascience.org/>

This curriculum is currently being taught in high schools. It teaches students to reason with, and think critically about, data in all forms. The various Standards for secondary school statistics and probability (including Common Core Standards) relevant to data science are covered. More details are at <https://www.introdatascience.org/introduction-to-data-science-curriculum>. A complete copy of the curriculum can be obtained for free by filling out the form at <https://www.mobilizingcs.org/ids-request>.

### Data 8: The Foundations of Data Science

<http://data8.org>

This college course is completely free-access, and even includes a textbook. But much of it can be used at the secondary school level. The course teaches critical concepts and skills in computer programming and statistical inference using real-world data using both Python and Jupyter notebooks. The textbook, Computational and Inferential Thinking: The Foundations of Data Science, can be downloaded from <https://inferentialthinking.com/chapters/intro.html>.

### Data Science in a Box

<https://datasciencebox.org/>

Introductory data science course, including datasets, lectures, homework assignments, labs, exams & projects. The course focuses on data exploration, visualization & analysis to investigate patterns, model outcomes, and make predictions. Problems & case studies are based on real-world questions and data. Students program in R.

## **RStudio Primers**

<https://rstudio.cloud/learn/primers>

A set of interactive tutorials that serve as an introduction to data science. Although based on R (and teach important introductory portions of R), the tutorials do not assume a knowledge of R.

## **Tidyverse**

<https://www.tidyverse.org/> and <https://www.tidyverse.org/packages/>

Tidyverse is a collection of R packages designed for data science. All packages share an underlying philosophy and common APIs.

## **A Whirlwind Tour of Python**

Author: Jake VandePlas

<https://jakevdp.github.io/WhirlwindTourOfPython/>.

An “introduction to essential features of the Python language, aimed at [those] ... who are already familiar with programming in another language. The material is particularly designed for those who wish to use Python for data science and/or scientific programming.”

## Applets and Similar Websites with Interactive Activities

If you have trouble running some of these applets that are in Java, explanations of what to do are at <http://www.rossmanchance.com/applets/JavaHelp.html> (for PCs) and [https://www.youtube.com/watch?v=u6\\_n-qR1B\\_M](https://www.youtube.com/watch?v=u6_n-qR1B_M) (for Macs)

### Visual Understanding Applets

<https://www.vusoft.eu/apps/>

Authors: Carel van de Giessen and Piet van Blokland

These applets were developed for use in Common Core classrooms and many of them include simulation capabilities. They come highly recommended by several Common Core statistics teachers and can be used in any course using statistics in Grades 7 to 12. Also available in Spanish, German, Turkish, Dutch, Polish, Swedish, French, Russian, Italian, Portuguese, Chinese and Japanese. To select the language, click on the menu near the top of the webpage.

### Rossman/Chance Applet Collection

<http://www.rossmanchance.com/applets/index2021.html> &

<http://www.rossmanchance.com/applets/>

This is a comprehensive set of applets for many of the topics covered in secondary school statistics. They can be used in Grades 6 to 12.

### Statkey

<http://lock5stat.com/statkey/>

Contains many applets and very nice data visualization tools in the “Descriptive Statistics and Graphs” section. Comes highly recommended by secondary Common Core teachers for use in any classroom. One very nice feature for classroom use is that the software can be downloaded into Chrome and used without Internet access in its regular format or in its presentation mode. There is a “Help” key at the bottom left.

### Stat-Attic

[http://sapphire.indstate.edu/~stat-attic/index.php?topic\\_id=GR](http://sapphire.indstate.edu/~stat-attic/index.php?topic_id=GR)

“This site contains links to and descriptions of over 600 applets that can be used for demonstrations or analysis of topics commonly covered in introductory statistics courses.” (quoted from the website). Many of these applets contain lesson plans or lesson plans can easily be developed from them. Some only run in Java. Many are applicable for Grades 6 to 12.

### Book of Apps for Statistics Teaching (BOAST)

<https://sites.psu.edu/shinyapps/>

Developed by statistics students and faculty at Penn State University. Although this an extensive collection of apps for the college level, many are applicable to high school statistics.

### Little Apps (part of StatPREP project of ASA and other professional societies)

<http://www.statprep.org/LittleAppSite/> (direct link to the apps)

<https://statprep-activities.netlify.com/> (direct link to classroom activities using the apps)

These apps have been developed as part of the StatPREP project. They are easy to use and are accompanied by teacher guides on how to use them in introductory statistics courses.

### Statlets

<http://www.math.usu.edu/~schneit/CTIS/>

Some of these applets are at a level beyond Common Core. However, those applets still may be very useful to teachers trying to improve their own knowledge of statistics and probability. You can access the applets directly by clicking on the pictures on the homepage given here.

### **Rice Virtual Lab in Statistics Simulations/Demonstrations**

<http://www.onlinestatbook.com/2/index.html> (in the right-hand column)

This website has 35 simulations/demonstrations. Most require the use of Java. Each comes with instructions, an explanation of the statistical concepts, and student exercises. They can be used in Grade 9 to 12. Note: A short description of each of these simulations is at

[http://onlinestatbook.com/stat\\_sim/index.html](http://onlinestatbook.com/stat_sim/index.html)

### **Data Games**

<http://ccssgames.com/>

“Playing computer games creates a lot of data, which usually disappear when the game is over. But in Data Games...[students] learn to analyze data that are saved, learning math and data skills...Short videos show... how to play each game and use data from... [the] game play to develop winning strategies.” (quoted from website). They can be used in Grades 5 to 12.

### **Stat2 Games**

<https://www.stat2games.sites.grinnell.edu/>

This website has 12 games (along with instructions) for students and a detailed instructor manual for each game. Although these games are designed for a second course in statistics at the undergraduate level, much of what is on the website can be used in secondary school statistics courses. To get the instructions for each game, click on its name near the top of the webpage given here.

## Videos

### BetterLesson

[https://teaching.betterlesson.com/browse/common\\_core](https://teaching.betterlesson.com/browse/common_core)

This website has thousands of free video-based lessons along with written commentary for teachers and worksheets for students. The lessons are broken down by grade level. The number of videos/lessons relevant to measurement and statistics by subject matter are: Statistics (824 videos/lessons), Measurement (563) and Data Analysis and Probability (252).

### Against All Odds: Inside Statistics

<https://www.learner.org/series/against-all-odds-inside-statistics/>

This is a complete free-of-cost introductory statistics course based on videos. This is a totally new version developed by Annenberg Learner (the producers of the original version in the 1980's). It is at the level that most high school students should be able to understand. It contains videos, on-line tools, teacher guides and student guides.

### Gapminder (Videos)

<https://www.gapminder.org/videos/>

There are 77 videos here on a variety of topics related to sustainable world growth over time and for a variety of indicators. Each video comes with links to the data being used in it. They can be used in Grades 9 to 12.

### Khan Academy (Grades K to Undergraduate)

<https://www.khanacademy.org/math>

The appropriated materials are broken down by grade level on this webpage. The ones relevant to Common Core Statistics are under Measurement and Data, Data and Statistics, Data and Modeling, or Statistics and Probability depending on the grade level.

Note: While using this website you will constantly get a screen asking for donations. You can just scroll down it to get to the content you want without paying money or signing on.

### Khan Academy (Grades 6 to 12) direct links to introductory statistics courses

<https://www.khanacademy.org/math/statistics-probability> and

<https://www.khanacademy.org/math/probability> (Despite the name of this second URL, this is an introductory high school statistics course, with less probability than the first URL)

These links go to its materials (mostly videos) for statistics and probability. While the two webpages have substantial overlap, there are enough differences to make it worthwhile looking at both of them. The topics covered include scatterplots, dotplots, boxplots, stem and leaf displays, correlation, fitting lines (including regression), data distributions, two-way tables, study design, probability, binomial probability and normal distributions.

Note: While using these websites you will constantly get a screen asking for donations. You can just scroll down it to get to the content you want without paying money or signing on.

### GeorgiaStandards.org Statistics Videos for Teachers

<https://www.georgiastandards.org/Georgia-Standards/Pages/CCGPS-Statistics-Video-Training.aspx>

There are 4 videos in this series: [Introduction](#), [Association of two quantitative variables](#), [Association of two categorical variables](#), and [Collection of data and study design](#). The introduction to each video will say "Mathematics". But all of these videos are about statistics.

## Sources of Data (Including Case Studies)

### Journal of Statistics and Data Science Education

<https://www.tandfonline.com/toc/ujse21/current> (goes to latest issue of the journal)

This is a free on-line journal. The main source of data (along with lesson plans) is the Data Sets and Stories articles (found near the end of most issues). All articles from the past (except for the years of 1999 and 2000) can be found at <https://www.tandfonline.com/loi/ujse20>. The 1999 & 2000 articles (along with all articles and other published materials from 1993 to 2014) are at [http://jse.amstat.org/jse\\_archive.htm](http://jse.amstat.org/jse_archive.htm). In addition, there is an extensive JSE Data Archive at [http://jse.amstat.org/jse\\_data\\_archive.htm](http://jse.amstat.org/jse_data_archive.htm) that contains many of the data sets from the Data Sets and Stories articles and other useful data sets from 2014 and earlier.

### A Little Stats

<http://alittlestats.blogspot.com/p/data-sources.html>

This long list of data sets was created by a high school teacher and is designed specifically for those involved in teaching Common Core statistics. However, it is appropriate for all courses at the secondary school level that include statistics. The website has multiple datasets in areas of high interest to secondary and post-secondary students. These include Arts & Entertainment, Education, Health, Sports, Social Science, Weather and more. The website also has tabs on the top to access other resources useful to secondary and post-secondary faculty.

### Data is plural

<https://www.data-is-plural.com/>

Has a large number of datasets. Best part is that new ones are added almost weekly.

### Data.Gov

<https://www.data.gov/>

This website has over 337,400 data sets from over 100 organizations at the City, County, State and Federal government levels. There are also some very useful data tools on this website at <https://resources.data.gov/> on the website. A few large federal agencies that have easily accessible datasets are listed next in this document.

### U.S. Census Bureau

<https://data.census.gov/cedsci/> and <https://www.census.gov/data/what-is-data-census-gov.html>

These websites contain links to a huge variety of data sets, tools, articles, data visualizations, mobile apps, software, maps and more in the context of surveys and of the national Census. The vision for [the website at the 2<sup>nd</sup> URL]...is to improve the customer experience by making data available from one centralized place so that data users spend less time searching for data and content, and more time using it. To go directly to the tools use <https://www.census.gov/data/data-tools.html>.

### College Scorecard Data from U.S. Department of Education

<https://collegescorecard.ed.gov/data/>

"Here, you can get the data behind the College Scorecard, as well as other data on federal financial aid and earnings information. These data provide insights into the performance of schools eligible to receive federal financial aid, and offer a look at the outcomes of students at those schools." (quoted from the website). There is also documentation available at <https://collegescorecard.ed.gov/data/documentation/> and a glossary at <https://collegescorecard.ed.gov/data/glossary/>.

### **FRED (of the Federal Reserve Bank system)**

<https://fred.stlouisfed.org/>

“This site offers a wealth of economic data and information to promote economic education and enhance economic research. The widely used database FRED is updated regularly and allows 24/7 access to regional and national financial and economic data.” (quoted from earlier version of <https://research.stlouisfed.org/about.html>). Also includes some international data. Many of the over 816,000 datasets from 107 sources are downloadable directly into Excel and come with detailed explanatory notes and an easy-to-use graphing tool.

### **Data.gov.uk**

<https://data.gov.uk/>

Has datasets from a variety of UK sources that are available in various downloadable formats.

### **UK Data Service**

<https://www.ukdataservice.ac.uk/>

“The UK Data Service is a comprehensive resource funded by the ESRC to support researchers, teachers and policymakers who depend on high-quality social and economic data. Here you will find a single point of access to a wide range of secondary data including large-scale government surveys, international macrodata, business microdata, qualitative studies and census data from 1971 to...[the present]. All are backed with extensive support, training and guidance to meet the needs of data users, owners and creators.” (quoted from an earlier version of the website). The website includes user guides and teacher resources at <https://www.ukdataservice.ac.uk/use-data/teaching>.

### **Data Catalog of the World Bank**

<https://datacatalog.worldbank.org/getting-started>

“The Data Catalog is designed to make World Bank’s development data easy to find, download, use, and share. It includes data from the World Bank’s [microdata](#), [finances](#) and [energy data](#) platforms, as well as datasets from the [open data catalog](#). There are different ways to access and download datasets.” (quoted from URL given here). Has over 5300 datasets.

### **The World Factbook (of the CIA)**

<https://www.cia.gov/the-world-factbook/>

This website comes highly recommended by several teachers as a source of interesting datasets. It is “produced for US policymakers and coordinated throughout the US Intelligence Community, marshals facts on every country, dependency, and geographic entity in the world. We share this information with the people of all nations in the belief that knowledge of the truth underpins the functioning of free societies. The Factbook provides information on the history, people, government, economy, geography, communications, transportation, military, and transnational issues for [266] world entities.” (quoted from earlier version of website)

### **IPUMS (Integrated Public Use Microdata Series)**

<https://www.ipums.org/>

This group of 9 separate websites is sponsored by the Minnesota Population Center. It has a wide variety of population & sample data from the US and over 100 countries including special website connections for health, environment, and more. Use <https://usa.ipums.org/usa/> to go directly to the US data. Use <https://international.ipums.org/international/> to go directly to the international data. There is also a teachers’ resource page with explanations and connections to the many links to IPUMS materials at <https://ipums.org/support/teaching-resources>,

### **Pew Research Center Website**

<https://www.pewresearch.org/>

Pew Research Center is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping America and the world. It conducts public opinion polling and other social science research. To link directly to datasets and other research tools use <https://www.pewresearch.org/tools-and-resources/>.

### **Sports Reference**

<https://www.sports-reference.com/>

Has an amazing amount of data and summary statistics for the following sports: Baseball, Basketball, Football, Ice Hockey and Soccer. For each sport there are links to professional, college and amateur teams (including the Olympics) both in North America and elsewhere. Warning: The Stathead portion of the website has a charge. The rest of the website is free-of-charge.

### **baseballsavant**

<https://baseballsavant.mlb.com/>

This site has lots of information about baseball statistics. Some are located on the “statistics” choice on the menu across the top of the homepage. Other choices occur on the menu across the top and throughout the rest of the webpage at the URL given here.

### **Gapminder (Data Portion)**

<https://www.gapminder.org/data/> (homepage)

This website has numerous indicators available directly from this webpage and has links for 3 Github repositories: Systema Globalis (indicators inherited from Gapminder World and still being updated); Fast Track (indicators compiled manually); and World Development Indicators (direct copy from World Bank). Each can be downloaded as a CSV and/or Excel data file.

### **FiveThirtyEight**

<https://fivethirtyeight.com/>

The head of FiveThirtyEight is Nate Silver, who is famous for his election predictions. This website of the FiveThirtyEight group covers news, sports and features from a statistical viewpoint using correct methods and write-ups that are extremely easy to follow. There are over 100 datasets with explanations of all the variables and sample analyses and graphics for each dataset at <https://data.fivethirtyeight.com/>. In addition, they have newsletters (<https://fivethirtyeight.com/newsletter/>) that anyone can subscribe to.

### **ICPSR (Inter-University Consortium for Political and Social Research)**

<https://www.openicpsr.org/openicpsr/search/studies#>

This website has data sets from over 6200 studies. Many of the studies have more than one dataset. Also, there are materials for teaching using their data at <https://www.icpsr.umich.edu/web/pages/instructors/>

### **StatLine**

<https://opendata.cbs.nl/statline/#/CBS/en/>

StatLine is the central data site of Statistics Netherlands for public use. It is extremely user friendly and allows the user to make queries, histograms, tables, and other graphics as well as to see summary statistics. The link above is for the version in English. The Dutch language version is at <https://opendata.cbs.nl/statline/#/CBS/nl/>.



**Rice Virtual Lab in Statistics Case Studies**

[http://onlinestatbook.com/case\\_studies\\_rvls/index.html](http://onlinestatbook.com/case_studies_rvls/index.html)

Although there are only 9 case studies here, they are worth exploring. They come with detailed explanations of how the data were collected, the raw data, some analyses, and how to do the analyses in various statistical packages. Some even give questions for students to answer.

**ProPublica Datastore**

<https://www.propublica.org/datastore/datasets>

Has datasets on a wide variety of topics of which many are free to use. However, some have a cost to use. One nice feature of ProPublica datasets is that they have more complete descriptions than most other dataset sources.

## Statistics and the Media (Including Graphical Displays)

### What's Going On in This Graph?

There are 3 different parts to this project:

1. <https://www.nytimes.com/column/whats-going-on-in-this-graph> for the most recent activity. By scrolling down past recent activity, you can see & use all past activities as far back as 2020.
2. <https://www.amstat.org//ASA/Whats-Going-on-in-this-Graph.aspx> By scrolling down this webpage, you will reach on the right-hand side a list of resources for teachers
3. <https://docs.google.com/document/d/1X9ECSnq1T12Fw402vmo4Lgz3w-cXNSJw/edit> for listing of activities sorted by statistics/mathematics topic they cover.

This is a joint effort of the ASA and the New York Times Learning Network (see next entry), with the objective of having students think critically about graphs. Every Thursday during the school year (September through May), a new activity is released that is related to an interesting graph published recently in the New York Times. Individuals and classes can then make comments interpreting this graphic. Also, by clicking on the “What’s Going on in this Graph?” link for each graph, it is possible to see comments made by others. Six days later, on Wednesdays, there is a moderated discussion on the website of the graph. Finally, two days later on Fridays, a link to the original graph and the article that accompanied it will be posted along with related statistical nuggets that might help students more fully make sense of the graph.

### The Learning Network (of the New York Times)

<https://www.nytimes.com/section/learning>

This is the New York Times website for teachers, parents and students in grades 5-12. It covers all areas of learning with an emphasis for many of the webpages/activities on data and statistics. The What’s Going On in This Graph? activity described above is one example. The teacher resource page is at <https://www.nytimes.com/2019/09/02/learning/current-events-teaching-resources.html>.

### Science and News: A Marriage of Convenience

<https://www2.amstat.org/meetings/jsm/2016/webcasts/index.cfm> (and then scroll down to ASA President’s Invited Address)

This is a video of a talk given by Joe Palca of NPR (National Public Radio) at the 2016 Joint Statistical Meetings. Its abstract is “Science doesn’t fit comfortably into the news format. News is about things that are happening today, things that are or will change people’s lives, things that involve life or death. Science is incremental, occurs over long sweeps of time, and in many cases can be safely ignored. True “breakthroughs” are few and far between, and yet in the procrustean bed of the news media, everything sounds like a breakthrough. I’ll describe examples of this awkward marriage, and propose an alternative model for presenting science in the news media.” (Copied from

<https://www2.amstat.org/meetings/jsm/2016/onlineprogram/AbstractDetails.cfm?abstractid=321845>)

### Stats + Stories: The Statistics Behind the Stories and the Stories Behind the Statistics

<https://statsandstories.net/episodes>

This is a series of over 230 oral “podcasts”. Each episode features a guest and a story that involves statistics. The link here goes to the list of all episodes.

## Simulation Tools

### Statkey

<http://lock5stat.com/statkey/>

This website contains many simulation tools under its “Bootstrap Confidence Intervals” and “Randomization Hypothesis Tests” section. There are also very nice data visualization tools in the “Descriptive Statistics and Graphs” section. The website comes highly recommended by secondary school teachers for use in any classroom. One very nice feature for classroom use is that the software can be downloaded into Chrome and used without Internet access in its regular format or in its presentation mode. There is a “Help” key at the bottom left.

### Visual Understanding Applets

<https://www.vusoft.eu/apps/>

Authors: Carel van de Giessen and Piet van Blokland

These applets were developed for use in Common Core classrooms and many of them include simulation capabilities. They come highly recommended by several Common Core statistics teachers and can be used in any course using statistics in Grades 7 to 12. Also available in Spanish, German, Turkish, Dutch, Polish, Swedish, French, Russian, Italian, Portuguese, Chinese & Japanese. To select a language, click on menu near top of webpage.

### Stat-Attic

[http://sapphire.indstate.edu/~stat-attic/index.php?topic\\_id=GR](http://sapphire.indstate.edu/~stat-attic/index.php?topic_id=GR)

“This site contains links to and descriptions of over 600 applets that can be used for demonstrations or analysis of topics commonly covered in introductory statistics courses.” (quoted from the website). Many of these applets contain simulations.

### The Art and Techniques of Simulation

ISBN-10: 0866513361 ISBN-13: 9780866513364

ISBN-10: 086651337X (Teacher’s Edition)

Authors: Mrudulla Gnanadesikan, Richard L. Scheaffer, & Jim Swift

This book contains 30 investigations of real-world topics that use simulation to solve them. The simulations are set up as worksheets for students. In addition, there is a Teacher’s Edition with detailed lesson plans. The student and teacher books are now out-of-print. However, many copies are available through the usual resale websites.

## Random Number Generators and Random Samplers

### Excel

To generate random numbers between two integers (say, c and d), enter the formula =randbetween(c,d) in a cell. Dragging it to other cells produces more random integers. This is sampling with replacement. Warning: Each time you click on a cell it regenerates the random number in that cell.

### Rossman/Chance Random Number Generator

<http://www.rossmanchance.com/applets/2021/randomnumbers/GenRandom01.htm>

This is an easy-to-use applet. It even allows the choice between sampling with replacement and sampling without replacement.

### Statkey

<http://lock5stat.com/statkey/>

On this main webpage, there are random samplers in the “Sampling Distributions” line for creating sampling distributions for means and proportions. These can be done for data sets supplied by the authors or the users can enter their own data set using the “Edit Data” tab. There is a “Help” key at the bottom left.

## Technology (Including, but not limited to, Statistical Calculators and Statistical Software Packages)

### iNZight

<https://inzight.nz/index.php>

<https://inzight.nz/install/> (webpage with downloadable versions for Windows, Macs, and Linux)

This software is heavily used in secondary schools in New Zealand. It does all of the statistical procedures that are part of the Common Core. An introductory video with more information on iNZight is at <https://www.youtube.com/watch?v=og88LeHxupA>. Other introductory videos that are part of the project can be reached via this introductory video.

See the next entry for an online version of the software.

### inzight lite

<https://lite.docker.stat.auckland.ac.nz/>

"Inzight lite is a simple data analysis system which was initially designed for high school students to help explore data fast and easy without having to learn complex statistical software. By popular demand, it has been extended to support 3D graphics, multivariate analysis, and time series analysis. inzight lite is an online version of the full software, which goes a long way to make it more accessible to a wide range of users." (quoted from website)

Videos with more information about inzight lite are:

"A first look into iNZight lite" at <https://www.youtube.com/watch?v=KHCCcGigeeg> and

"Loading Example data sets" at <https://www.youtube.com/watch?v=1iBkWUqUVBM>

### Project MOSAIC Little Books for Learning R Programming Language

<https://github.com/ProjectMOSAIC/LittleBooks/blob/master/README.md> (English versions)

<https://github.com/fjaraavilaa/MOSAIC-LittleBooks-Spanish> (Spanish versions)

Authors: Randall Pruim, Nicholas Horton, and Daniel Kaplan

The books most relevant to teaching secondary school statistics (including Common Core) are:

**"Start Teaching With R** [\[view\]](#) [\[download\]](#)

This book presents instructors with an overview of our approach to teaching statistics with R and an introduction to our primary R toolkit.

**A Student's Guide to R** [\[view\]](#) [\[download\]](#)

This book is organized by analysis method and demonstrates how to perform all of the statistical analyses typically covered in an Intro Stats course. It can serve a good reference for both students and faculty." (quoted from website).

In addition to these books, the authors have stored many useful materials at <https://cran.r-project.org/web/packages/mosaic/vignettes/mosaic-resources.html>.

### Some Additional Resources for Beginners for using R

This list is suggestions from others. It is not comprehensive. It only includes free resources.

**The R Guide** by Jason Owen at <http://lib.stat.cmu.edu/R/CRAN/doc/contrib/Owen-TheRGuide.pdf>

**The R Commander: A Basic-Statistics GUI for R** by John Fox and Milan Bouchet-Valat at <https://socialsciences.mcmaster.ca/jfox/Misc/Rcmdr/>

#### **RStudio Primers**

<https://rstudio.cloud/learn/primers>

A set of interactive tutorials that serve as an introduction to data science. Although based on R (and teach important introductory portions of R), the tutorials do not assume a knowledge of R.

## JupyterHub

<https://jupyter.org/hub>

“JupyterHub ... gives users access to computational environments and resources without burdening the users with installation and maintenance tasks. Users - including students ... - can get their work done in their own workspaces on shared resources which can be managed efficiently by system administrators.

JupyterHub runs in the cloud or on your own hardware, and makes it possible to serve a pre-configured data science environment to any user in the world. It is customizable and scalable, and is suitable for small and large teams, academic courses, and large-scale infrastructure.” (quoted from website)

Note: Jupyter stands for Julia, Python, and R.

## ***Effective Graphs with Microsoft-R-Open*** by Naomi Robbins and Joyce Robbins

<https://info.microsoft.com/CO-AAIoT-CNTNT-FY16-03Mar-Effective-Graphs-with-Microsoft-R-Open-Registration.html>

In addition, a Github site, <https://www.github.com/nbrgraphs/mro>, is available for downloading an electronic version of this document, individual code scripts for graphs, and code scripts for ggplot2 versions of many of the graphs.

## **Statistics Online Computational Resource (SOCR)**

<http://www.socr.ucla.edu/SOCR.html>

“Statistics Online Computational Resource (SOCR)... provides portable online aids for probability and statistics education, technology based instruction and statistical computing... The core SOCR educational and computational components include: Distributions (interactive graphs and calculators), Experiments (virtual computer-generated analogs of popular games and processes), Analyses (collection of common web-accessible tools for statistical data analysis), Games (interfaces and simulations to real-life processes), Modeler (tools for distribution, polynomial and spectral model-fitting and simulation), Graphs, Plots and Charts (comprehensive web-based tools for exploratory data analysis), Additional Tools (other statistical tools and resources), SOCR Wiki(collaborative Wiki resource), Educational Materials and Hands-on Activities (varieties of SOCR educational materials), SOCR Statistical Consulting and Statistical Computing Libraries.” (quoted from website)

## **Free or Minimal Cost Copies for Teachers of Statistical Software**

Several publishers have agreed to make a copy of their statistical software free or at minimal cost to K-12 teachers. The list below (in alphabetical order) is given as a convenience to users of this document. No endorsement of these software packages is implied by this listing.

**Fathom** <https://fathom.concord.org/download/>

**JMP** <https://estore.onthehub.com/WebStore/OfferingDetails.aspx?o=2ebffc52-f75f-eb11-8133-000d3af41938>

**NZGrapher** <https://grapher.nz/>

**Python** <https://www.python.org/downloads/>

**RStudio** <https://www.rstudio.com/pricing/academic-pricing/>. The free academic version also includes a limited shiny apps access

**SAS** [https://www.sas.com/en\\_us/learn/academic-programs/software.html](https://www.sas.com/en_us/learn/academic-programs/software.html). They also now have free teaching and learning (for both teachers and students) materials at [https://www.sas.com/en\\_us/learn/academic-programs/educators.html](https://www.sas.com/en_us/learn/academic-programs/educators.html) and [https://www.sas.com/en\\_us/learn/academic-programs.html](https://www.sas.com/en_us/learn/academic-programs.html)

**StatCrunch** Go to <https://www.statcrunch.com/register/instructor> and then click on either instructors or students.

**Tinkerplots** <https://www.tinkerplots.com/get>

## Resources for Teacher Preparation (Both Pre-Service and In-Service)

**Note:** Almost all of the resources given elsewhere in this document may be very useful to those involved in teacher preparation and are not repeated here.

### Preparing Pre-K–12 Teachers of Statistics: A Joint Position Statement of the American Statistical Association (ASA) and the National Council of Teachers of Mathematics (NCTM)

[https://www.nctm.org/uploadedFiles/Standards\\_and\\_Positions/Position\\_Statements/1Statistics%20joint%20ASA%20NCTM%20statement%20021113.pdf](https://www.nctm.org/uploadedFiles/Standards_and_Positions/Position_Statements/1Statistics%20joint%20ASA%20NCTM%20statement%20021113.pdf) (for pdf file)

<https://www.nctm.org/Standards-and-Positions/Position-Statements/Preparing-Pre-K-12-Teachers-of-Statistics/> (homepage that contains the same information as the pdf file)

Note: Some of the links on the homepage and the pdf file do not work because the references they connect to have been deleted from the Internet or the links have changed.

### The Mathematical Education of Teachers II (commonly called MET II)

<http://www.cbmsweb.org/archive/MET2/met2.pdf>

This book was produced by the Conference Board of the Mathematical Sciences. The book is Volume 17 in the CBMS series "Issues in Mathematics Education". "This report is a resource for those who teach mathematics—and statistics—to PreK–12 mathematics teachers, both future teachers and those who already teach in our nation's schools. The report makes recommendations for the mathematics that teachers should know and how they should come to know that mathematics." (quoted from page xi of the book's preface). It also includes numerous recommendations regarding the preparation of teachers to teach statistics.

### The Statistics Education of Teachers

<https://www.amstat.org/asa/files/pdfs/EDU-SET.pdf>

This was developed by ASA as a companion to the MET II report. It gives recommendations on how elementary, middle & high school teachers should be prepared in statistics. It "aims to:

- Clarify and expand MET II's recommendations for the statistical preparation of teachers...
- Address the professional development of teachers of statistics.
- Highlight differences between statistics and mathematics that have important implications for teaching and learning.
- Illustrate the statistical problem-solving process across levels of development.
- Make pedagogical recommendations of particular relevance to statistics, including the use of technology and the role of assessment." (quoted from the preface to the report)

### Teaching Statistical Thinking

<https://www.youtube.com/user/profdstangl/playlists> (location of videos)

Authors/Speakers: Dalene Stangl, Kate Allman, Mine Çetinkaya-Rundel et al.

Through funding from Duke University and the American Statistical Association, the authors have created a set of 52 videos to help teachers understand and teach basic descriptive statistical concepts. The videos are organized into five units. Within each unit there are videos covering core concepts, pedagogy, software use (via JMP, but can be adapted to other software), and applet demonstrations. Unit 1 covers data and explains the structure of the videos. Unit 2 covers one variable descriptive statistics, transforming a variable, and the normal curve. Unit 3 covers description of relationships between two categorical variables (contingency tables) and between one categorical and one numeric (side-by-side boxplots). Unit 4 covers descriptions of relationships between two numeric variables using correlation and regression. Unit 5 pulls all the concepts together in review videos. (adapted from email from the 1<sup>st</sup> author). There are also some additional videos available on this website.

### **Statistics and Data Science for Teachers**

Authors: Anna Bargagliotti and Christine Franklin

This book is “a resource to guide entire courses and professional development, or portions of courses and professional development when preparing teachers ... to teach the foundations of statistics and data science in their classrooms....[It] presents statistical ideas through investigations and engagement with the statistical problem-solving process of formulating statistical investigative questions, collecting/considering data, analyzing data, and interpreting results.”

Free low-resolution download: <https://www.amstat.org/docs/default-source/amstat-documents/SDSTeacherBook.pdf>

Free high-resolution download: <https://www.amstat.org/docs/default-source/amstat-documents/SDSTeacherBook-highres.pdf>

Hardcopy: [https://www.amazon.com/dp/1734223545?ref =pe\\_3052080\\_397514860](https://www.amazon.com/dp/1734223545?ref =pe_3052080_397514860) . Note:

This book is an ASA publication that is being sold via Amazon and other websites.

### **Mathematics Teacher Educator**

[https://pubs.nctm.org/view/journals/mte/mte-overview.xml?tab\\_body=About](https://pubs.nctm.org/view/journals/mte/mte-overview.xml?tab_body=About)

This is a journal of the National Council of Teachers of Mathematics (NCTM) and the Association of Mathematics Teacher Educators. Its mission is to “contribute to building a professional knowledge base for mathematics teacher educators that stems from, develops, and strengthens practitioner knowledge” (quoted from old website for the journal).

### **GeorgiaStandards.org Statistics Videos for Teacher Training**

<https://www.georgiastandards.org/Georgia-Standards/Pages/CCGPS-Statistics-Video-Training.aspx>

There are 4 videos in this series: [Introduction](#); [Association of two quantitative variables](#), [Association of two categorical variables](#), and [Collection of data and study design](#)

### **What is a Survey?**

<http://courses.washington.edu/thesis/what%20is%20a%20survey.pdf>

Author is Fritz Scheuren. This booklet is aimed at non-specialists in doing surveys. It is very appropriate for students in teacher education programs and for a general audience.

### **Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 6-8**

<https://www.nctm.org/store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8/>

ISBN: 9780873536721

As an e-book) [https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8-\(Download\)/](https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-6-8-(Download)/)

ISBN: 9780873538534

Authors: Gary Kadar, Tim Jacobbe, Patricia Wilson and Rose Mary Zbiek

This book is part of the NCTM Essential Understanding Series. “This book focuses on essential knowledge for mathematics teachers about statistics. It is organized around four big ideas, supported by multiple smaller, interconnected ideas *essential understandings*... [Going] beyond a simple introduction to statistics, the book will broaden and deepen ... understanding of one of the most challenging topics for students and teachers. It will help ... engage...students, anticipate their perplexities, avoid pitfalls, and dispel misconceptions... [Users] also learn to develop appropriate tasks, techniques, and tools for assessing students’ understanding of the topic.” (quoted from website)



## **Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 9-12**

<https://www.nctm.org/store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12/>

ISBN: 9780873536769

As an e-book: [https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12-\(Download\)/](https://www.nctm.org/Store/Products/Developing-Essential-Understanding-of-Statistics-for-Teaching-Mathematics-in-Grades-9-12-(Download)/)

ISBN: 9780873538527

Authors: Roxy Peck, Rob Gould, Stephen Miller and Rose Mary Zbiek

This book is part of the NCTM Essential Understanding Series). "... [It] examines five big ideas and twenty-four related essential understandings for teaching statistics in grades 9–12. The authors distinguish mathematical and statistical models, explore distributions as descriptions of variability in data, focus on the fundamentals of testing hypotheses to draw conclusions from data, highlight the importance of the data collection method, and recognize the need to examine bias, precision, and sampling method in evaluating statistical estimators ... [The] authors discuss the growth of students' ideas about statistics and examine challenges to teaching, learning, and assessment. They intersperse their discussion with questions for teachers' reflection." (quoted from website).

## **Putting Essential Understanding into Practice: Statistics, 9-12**

<https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice--Statistics,-9-12/>

ISBN: 9780873537377

As an e-book: [https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-\(Download\)/](https://www.nctm.org/Store/Products/Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-(Download)/)

ISBN: 9780873539159

Authors: Terry Crites and Roy St. Laurent

This is a companion to the book Developing Essential Understanding... of the previous entry. "The authors demonstrate how to use this multifaceted knowledge to address the big ideas and essential understandings that students must develop for success with statistics—not only in their current work, but also in higher-level mathematics and a myriad of real-world contexts. Explore rich, research-based strategies and tasks that show how students are reasoning about and making sense of statistics. Use ... these ... to build on their understanding while identifying and correcting misunderstandings..." (quoted from website)

## **Enhancing Statistics Teacher Education with E-Modules [ESTEEM]**

<https://www.fi.ncsu.edu/projects/esteem/>

"The ESTEEM materials are designed to be used with preservice middle and secondary mathematics teachers in online environments, though instructors may adapt these for use in face-to-face or hybrid courses, or with other teacher audiences. The diagram shows our modular approach. There are 3 modules available. Module 1 (Foundations in Statistics Teaching) should always be used first (1.1 and 1.2). After Module 1, you can implement the Teaching Statistical Association (B.1 and B.2) and/or the Teaching Inferential Reasoning (A.1 and A.2) Modules in any order." (quoted from an earlier version of the website). For related materials & free courses go to <https://place.fi.ncsu.edu/> and click on the statistics and/or mathematics related courses.

## Supports for Improving Practice

<https://www.fi.ncsu.edu/pages/tsdi-resources/>

This website “is a collection of resources (videos, articles, activities, and websites) [for teachers. They]...can assist teachers in strengthening their approaches to teaching statistics through data investigations. In particular these resources focus on the use of real data and technology, developing good lessons and tasks, and supporting students’ statistical reasoning.” (quoted from website). Some of the major webpages within this website are:

**Big Issues in Teaching Statistics in Schools** at <https://www.fi.ncsu.edu/pages/teaching-statistics-in-schools/>

**Using Real Data and Technology in the Classroom** at

<https://www.fi.ncsu.edu/pages/resources-for-using-real-data-and-technology-in-the-classroom/>

**Support for Designing Statistics Lessons** at <https://www.fi.ncsu.edu/pages/support-for-designing-good-statistics-lessons/>

**Supporting Students’ Statistical Investigations** at <https://www.fi.ncsu.edu/pages/supporting-students-statistical-investigations/>

**Amplifying Statistics and Data Science in Classrooms** at

<https://place.fi.ncsu.edu/local/catalog/course.php?id=33&ref=1>.

## Primarily Statistics: Developing an Introductory Statistics Course for Pre-service Elementary Teachers

<https://www.tandfonline.com/doi/abs/10.1080/10691898.2013.11889683>

(Journal of Statistics Education, Volume 21, Issue 3, 2013)

Authors: Jennifer L. Green and Erin E. Blankenship  
and

## The Development and Evolution of an Introductory Statistics Course for in In-Service Middle-Level Mathematics Teachers

<https://www.tandfonline.com/doi/abs/10.1080/10691898.2014.11889715>

(Journal of Statistics Education, Volume 22, Issue 3, 2014)

Authors: Kendra K. Schmid, Erin E. Blankenship, April T. Kerby, Jennifer L. Green, and Wendy M. Smith

These two articles deal, as their names imply, with teaching statistics to teachers. Besides describing the course, each has an extensive section of references.

Webinar and materials related to the second article are at

<https://www.causeweb.org/cause/webinar/jse/2015-02>

## Wild About Statistics

<https://www.youtube.com/c/WildAboutStatistics/featured>

This is a series of videos that were originally developed for a MOOC (Massive Open Online Course) and then released publicly.

*Week 1 Videos: Getting Started:* Introduction, data analysis and data organization

*Week 2 Videos: Boot Camp:* Basic statistical concepts

*Week 3 Videos: Relationships:* Discusses relationships between categorical and numeric variables and changes across subgroups

*Week 4 Videos: More Relationships:* Diving deeper into relationships

*Week 5 Videos: Why what we see is never quite the way it really is:* Biases, confounding and random errors

*Week 6 Videos: Estimation with Confidence:* Confidence intervals and bootstrapping

*Week 7 Videos: Randomised Experiments and Statistical Tests (including "significance" and randomisation tests)*

*Week 8 Videos: Time Series:* Basic ideas, seasonal decomposition and forecasting

### **ABCs of EDA (Full name is: Applications, Basics, and Computing of Exploratory Data Analysis)**

[https://ecommons.cornell.edu/bitstream/handle/1813/78/A-B-C\\_of\\_EDA\\_040127.pdf;jsessionid=EE350E49918B787B2A92497E5B3DCD6D?sequence=2](https://ecommons.cornell.edu/bitstream/handle/1813/78/A-B-C_of_EDA_040127.pdf;jsessionid=EE350E49918B787B2A92497E5B3DCD6D?sequence=2)

Authors: Paul F. Velleman and David C. Hoaglin

This is a pdf file (publicly available through the library of the first author's university) of a book that is now out-of-print. It was the only textbook on exploratory data analysis (EDA) that was developed for use by undergraduates. It goes one step beyond the exploratory data analysis (EDA) topics taught as part of the Common Core and includes very useful variations on topics such as stem-and-leaf displays and boxplots. It also has some more EDA topics that are worth knowing such as resistant lines, median polish, and rootograms.

### **What Teachers Should Know about the Bootstrap: Resampling in the Undergraduate Statistics Curriculum**

<https://arxiv.org/abs/1411.5279v1> and then clicking on the box on the right-hand side of the screen that says "Download:"

or

<https://www.amstat.org/asa/files/pdfs/EDU-ResamplingUndergradCurriculum.pdf>

Author: Tim Hesterberg

This is an 83-page easy-to-follow article on the methods used for resampling and simulation. It is at the level that all secondary teachers should be able to follow. The author has "three goals in this article: (1) To show the enormous potential of bootstrapping and permutation tests to help students understand statistical concepts including sampling distributions, standard errors, bias, confidence intervals, null distributions, and P-values. (2) To dig deeper, understand why these methods work and when they don't, things to watch out for, and how to deal with these issues when teaching. (3) To change statistical practice---by comparing these methods to common t tests and intervals, we see how inaccurate the latter are; we confirm this with asymptotics.  $n \geq 30$  isn't enough---think  $n \geq 5000$ . Resampling provides diagnostics, and more accurate alternatives. Sadly, the common bootstrap percentile interval badly under-covers in small samples; there are better alternatives. The tone is informal, with a few stories and jokes." (quoted from the article abstract)

### **Proceedings of the IASE Round Table on the Joint ICMI/IASE Study: Teaching Statistics in School Mathematics: Challenges for Teaching and Teacher Education**

[https://iase-web.org/Conference\\_Proceedings.php?p=2008\\_Joint\\_ICMI-IASE\\_Study](https://iase-web.org/Conference_Proceedings.php?p=2008_Joint_ICMI-IASE_Study)

This round table was held "to start the process of organising a Joint Study to *analyze the teaching of statistics at school level and make recommendations about how to improve the training of mathematics teachers to better succeed in educating statistically literate students.*" (quoted from page 3 of the Discussion Document).

## Assessment Resources

### **LOCUS (Levels of Conceptual Understanding in Statistics)**

<https://locus.statisticseducation.org>

“LOCUS is ... focused on developing assessments of statistical literacy. The intent of these assessments is to provide teachers, educational leaders, assessment specialists, and researchers with a valid and reliable assessment of statistics consistent with the Common Core State Standards (CCSS).” (quoted from earlier version of the website). Limited to Grades 6-12.

### **PARCC (Partnership for Assessment of Readiness for College and Careers)**

<https://www.lumoslearning.com/llwp/resources/parcc-practice-tests-sample-questions.html>

Free PARCC practice tests and sample questions for Math and Language Arts assessments. Updated for 2021-2022 PARCC assessment practice. Includes standards-aligned tech-enhanced questions that mirror PARCC testing items for Grades 3 to 12.

### **EngageNY Sample Questions for the Mathematics Tests for Grades 3 to 8**

<https://www.engageny.org/resource/released-2021-3-8-mathematics-state-test-questions-translated-editions>

These sample questions are in Arabic, Bengali, Spanish, Chinese, English, Haitian Creole, Korean and Russian. They are matched to the New York State standards (which are close to the Common Core standards) they cover. In addition, there are explanations for the correct answers and even for the wrong answers—which explain for the teacher what the students’ misunderstandings may be. Note: Not all questions are translated into all languages.

### **Khan Academy Assessment Items**

<https://www.khanacademy.org/commoncore/map>

This portion of the Khan Academy website contains a wide variety of both mathematics and statistics assessment items. For example, there are approximately 700 measurement and data items for Grade 3. For the higher grades, the number of statistics and probability items is 594 for Grade 6, 213 for Grade 7, and 249 for Grade 8. There are more than 800 items at the high school level. Hints are available for the students, if needed. These items are applicable to assessing the Common Core standards as well as other State Standards. Also, links to relevant videos are given with the items.

### **PISA (Programme for International Student Assessment) Questions**

<https://www.oecd.org/pisa/test/> (for questions from 2012, 2015 and 2018)

<https://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm> (for questions from 2003, 2006 and 2012)

PISA is the international effort (under the auspices of OECD) in mathematics to compare mathematics knowledge (and knowledge in other areas) across the world. This webpage contains items from past PISA assessments. The items were designed to be administered to 15-year-old students. Many of those shown on the websites directly or indirectly assess statistical literacy. Some of the questions are available in French.