

Sources of Lesson Plans and Other Resources for Teaching Common Core Statistics and Probability Topics

Please send suggestions for additional entries and comments to carol@amstat.org.

The Joint Committee of the American Statistical Association (ASA) and National Council of Teachers of Mathematics (NCTM) is committed to supporting the work of K-12 teachers. Carol Joyce Blumberg, with some assistance from Roxy Peck and Adam Molnar, and oversight by the ASA/NCTM Joint Committee, created a new resource that provides sources of lesson plans and learning activities to support the teaching of statistics and probability as covered by the Common Core State Standards (<http://corestandards.org> (in general) and at <http://www.corestandards.org/Math/> (for mathematics/statistics)). Except for resources developed by ASA or NCTM, the resources listed here are available at no or minimal cost.

We encourage K-12 users of this document to sign up for a free one-year trial ASA membership at <http://www2.amstat.org/membership/k12teachers/>. In addition, ASA has a special reduced annual membership price of \$54 (70% off regular price) for K-12 teachers. For details go to <http://www.amstat.org/ASA/JoinRenew/JoinMemberType.aspx> and scroll about 2/3 of the way down the page to K-12 Teacher Membership.

Those using this document are encouraged to read the Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K-12 Curriculum Framework at <http://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx> and try to adapt their classroom instruction and activities to fit these guidelines. The GAISE guidelines were developed by the ASA and the GAISE Pre-K-12 Report was published by ASA 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 other parts of this document are 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 <http://www.amstat.org/asa/files/pdfs/EDU-CommonCoreResources.pdf>

American Statistical Association (ASA) Resources

Education Homepage of the American Statistical Association

<http://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 on this Common Core website, the central portal contains additional statistics education resources covering Pre-K through graduate school and continuing education.

Bridging the Gap between Common Core State Standards and Teaching Statistics

<http://ww2.amstat.org/education/btg/index.cfm>

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.

Census at School (USA)

<http://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 Census at 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 random samples from other students around the country and with random samples of responses from the international database.” (quoted from <http://ww2.amstat.org/censusatschool/about.cfm>). For details of how to use this project (including its random sampler) with students, see <http://ww2.amstat.org/censusatschool/participantinstructions.cfm>. For resources, including webinars, for using Census at School information as part of statistics lessons, see <http://ww2.amstat.org/censusatschool/resources.cfm>.

Census at School International

<http://new.censusatschool.org.nz/>

The USA Census at School is part of an international project hosted presently by the government of New Zealand and University of Auckland. The main webpage has links to additional excellent teaching materials. It also has a Random Sampler (<http://new.censusatschool.org.nz/tools/random-sampler/>), where samples can be taken of student responses to a questionnaire that is common across the nations of Australia, Canada, New Zealand, United Kingdom, and the USA or for a single nation of the user’s choice.

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

<http://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 original purpose of the 108-page Grades K-12 report by Franklin, Kader, Mewborn, Moreno, Peck, Perry and Scheaffer (http://www.amstat.org/asa/files/pdfs/GAISE/GAISEPreK-12_Full.pdf) was to supplement the “NCTM Principles and Standards...” (quoted from website). However, it is very relevant to the Common Core Statistics standards. It emphasizes the important ideas (such as variability) that the NCTM Principles and Standards (see <http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/>) and Common Core 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 and interpretation of the results.

Making Sense of Statistical Studies

<http://ww2.amstat.org/education/msss/>

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 teacher 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 going to <http://www.statisticsteacher.org/statistics-teacher-publications/> and scrolling down to “Making Sense of Statistical Studies” on the left hand side of the page.

Journal of Statistics Education

<http://tandfonline.com/toc/ujse20/current> (for issues beginning March 2016)

<https://ww2.amstat.org/publications/jse/> (for issues through 2015)

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). In addition, there is an extensive JSE Data Archive at https://ww2.amstat.org/publications/jse/jse_data_archive.htm that contains many of the data sets from the Data Sets and Stories articles plus many other useful data sets from 2015 and earlier.

Statistics Teacher (online journal)

<http://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 to subscribe to receive email notification when the journal is updated.

The Statistics Teacher Network Newsletters

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

These newsletters were published 2 times per year. 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 content (including detailed lesson plans) and renamed as Statistics Teacher (see above for details) online journal.

StatisticsEducationWeb (STEW)

<http://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 the Common Core standards. Starting in 2017, as new lessons are developed they will appear instead in the Statistics Teacher (see above for details) online journal.

K-12 Statistics Listserv

This service has announcements from ASA of interest to K-12 statistics education. Members can also communicate and share resources. It is only available to ASA’s K-12 Teacher members through the online ASA community. A form for a free K-12 Teacher one-year trial ASA membership at <http://ww2.amstat.org/membership/k12teachers/>. In addition, ASA has a special reduced membership price of \$54 (70% off regular price) for K-12 teachers. For details go to <http://www.amstat.org/ASA/JoinRenew/JoinMemberType.aspx> and scroll about 2/3 of the way down the page to K-12 Teacher Membership.

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

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

This workshop is held yearly (usually in connection with the Joint Statistical Meetings) in late July or early August. It is aimed at middle and secondary school teachers. The objective is to “Enhance understanding and teaching of statistics within the mathematics/science curriculum through conceptual understanding, active learning, real-world data applications, and appropriate technology.... Teachers...explore problems that require them to formulate questions, collect, organize, analyze, and draw conclusions from data...Content is consistent with Common Core standards, *GAISE* recommendations, and *NCTM Principles and Standards for School Mathematics*.” (quoted from website)

K-12 Statistics Education Webinars

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

These are past webinars sponsored by ASA. All are available in Windows Media Format, with some also in WebEx format. 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 above) and to previous participants of the ASA MWM Statistics Workshops (see above).

College Majors Requiring Statistics

<http://ww2.amstat.org/misc/CollegeMajors.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.

Stats 101: A Resource for Teaching Introductory Statistics

<http://community.amstat.org/stats101/home>

Richard D. De Veaux, Deborah Nolan, Jasjeet Sekhon, Nicholas Horton, Ben Baumer, Daniel Kaplan, Julie Legler, Carrie Grimes, and David Bock

This repository is a toolkit and contains 5 case studies and associated materials, such as the data sets. “Each case starts with a real world problem and leads the reader through the steps

taken to explore the problem, highlighting the techniques used in introductory or AP statistics classes.... Available case studies include: How Much is a Fireplace Worth?[,], How Much Does a Diamond Cost?[,], Keeping a Web Cache Fresh[,], Better Flight Experiences with Data[,], and Election 2000” (quoted from website). Although parts of each case study go beyond the Common Core and the computer packages used in the studies are R and JMP®, they can be easily be adapted into very useful and interesting Common Core lesson plans.

Data-Driven Mathematics

This is a series of textbook modules funded initially by the National Science Foundation 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 before the Common Core was created, they are very consistent with 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.

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

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

Exploring Centers, by Kranendonk and Witmer

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

Exploring Linear Relations, by Burrill and Hopfensperger

<http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringLinearRelations.pdf> for Student Edition and <http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringLinearRelations.pdf> for the Teacher’s Edition

Exploring Projects, by Errthum, Mastromatteo, O’Connor, and Scheaffer

<http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringProjects.pdf> for Student Edition and <http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringProjects--TeachersEdition.pdf> for Teacher’s Edition

Exploring Regression, by Burrill, Burrill, Hopfensperger, and Landwehr

<http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringRegression.pdf> for Student Edition and <http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringRegression--TeachersEdition.pdf> for the Teacher’s Edition.

Exploring Symbols, by Burrill, Clifford, and Scheaffer

<http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSymbols.pdf> for Student Edition and <http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSymbols--TeachersEdition.pdf> for the Teacher’s Edition

Exploring Systems of Inequalities, by Burrill and Hopfensperger

<http://www.amstat.org/asa/files/pdfs/ddmseries/ExploringSystemsofInequalities.pdf> for Student Edition and <http://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

<http://www.amstat.org/asa/files/pdfs/ddmseries/MathematicsinaWorldofData.pdf> for Student Edition and <http://www.amstat.org/asa/files/pdfs/ddmseries/MathematicsinaWorldofData--TeachersEdition.pdf> for the Teacher’s Edition

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

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

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

CHANCE <http://chance.amstat.org/>

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 teacher members have online access to all *CHANCE* issues. For information on a one-year free trial membership see page 1 of this document.

CHANCE Special Issues on Nurturing Statistical Thinking Before College

This two part special issues are available on the web at <http://chance.amstat.org/2015/09/28-3-editors-letter/> (Part 1) and <http://chance.amstat.org/2015/11/28-4-editors-letter/> (Part 2). While all articles are available to subscribers of *CHANCE* (see just above), articles relevant to the Common Core that are free access are:

The Relationships Between Statistics and Other Subjects in the K-12 Curriculum by Zalman Usiskin at <http://chance.amstat.org/2015/09/k-12-curriculum/> (webinar discussing this article at http://magazine.amstat.org/videos/education_webinars/Usiskin-StatisticsandotherSubjects.wmv)

Data Surfing by Kay Endriss at <http://chance.amstat.org/2015/09/datasurfing/> (webinar related to the article is at http://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 <http://chance.amstat.org/2015/11/math-modeling/>.

Preparing Students for a Data-centric World by Nicole Lazar and Christine Franklin at <http://chance.amstat.org/2015/11/preparing-students/>.

Modeling Statistical Thinking by Daniel Kaplan at <http://chance.amstat.org/2015/11/statistical-thinking/>.

This is Statistics

<http://thisisstatistics.org/>

This is a new 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 <http://thisisstatistics.org/educators/>.

The World of Statistics

<http://www.worldofstatistics.org/>

"The World of Statistics—the successor to the highly successful International Year of Statistics (Statistics2013) campaign celebrated in 2013—is a global network of more 2,350 organizations worldwide committed to:

- Increasing public awareness of the power and impact of statistics on all aspects of society
- Nurturing statistics as a profession, especially among young people
- Promoting creativity and development in the sciences of probability and statistics” (quoted from <http://www.worldofstatistics.org/about-us/>)

Curriculum Guidelines for Undergraduate Programs in Statistical Science

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

<http://www.amstat.org/education/pdfs/quidelines2014-11-15.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 <http://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 <http://www.amstat.org/asa/files/pdfs/EDU-ResamplingUndergradCurriculum.pdf> (this article is also available at <http://arxiv.org/format/1411.5279v1>). A closely related article by T. Hesterberg is at <http://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1089789>.

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

<http://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1094283>

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 Common Core 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 <http://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 <http://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1089789>

There are also several non-free access in this issue that are relevant to Common Core.

National Council of Teachers of Mathematics (NCTM) Resources

Principles and Standards for School Mathematics

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

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

<http://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. 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.

Illuminations

<http://illuminations.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 <http://illuminations.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)

[http://www.nctm.org/store/Products/Thinking-and-Reasoning-with-Data-and-Chance,-68th-Yearbook-\(2006\)/](http://www.nctm.org/store/Products/Thinking-and-Reasoning-with-Data-and-Chance,-68th-Yearbook-(2006)/)

ISBN: 9780873535885

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 website)

Learning and Teaching Measurement, 65th Yearbook (2003)

[http://www.nctm.org/store/Products/Learning-and-Teaching-Measurement,-65th-Yearbook-\(2003\)/](http://www.nctm.org/store/Products/Learning-and-Teaching-Measurement,-65th-Yearbook-(2003)/)

ISBN: 9780873535397

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 website)

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

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

ISBN: 9780873536424

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

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)

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)

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

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

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

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

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

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

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

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

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

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

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

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

Statistical Questions from the Classroom

<http://www.nctm.org/store/Products/Statistical-Questions-from-the-Classroom/>

ISBN: 9780873535823

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

NCTM publishes journals aimed teachers at various grade levels. Almost every issue of these journals has articles related to statistics and probability. In order of grade levels covered they are:

“Teaching Children Mathematics”

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

“Mathematics Teaching in the Middle School”

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

“Mathematics Teacher”

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

“Mathematics Teacher Educator”

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

Making Sense of Data

<http://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

<http://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.

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

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

ISBN: 9780873536721

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

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

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

ISBN: 9780873536769

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

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

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

ISBN: 9780873537377

(As an e-book: [http://www.nctm.org/Store/Products/\(eBook\)-Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-\(PDF-Downloads\)/](http://www.nctm.org/Store/Products/(eBook)-Putting-Essential-Understanding-into-Practice-Statistics,-9%E2%80%9312-(PDF-Downloads)/) 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 (3rd Edition)

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

ISBN: 9780873536516

(As an e-book) [http://www.nctm.org/store/Products/\(eBook\)-Developing-Data-Graph-Comprehension-in-Grades-K-8,-third-edition-\(PDF\)/](http://www.nctm.org/store/Products/(eBook)-Developing-Data-Graph-Comprehension-in-Grades-K-8,-third-edition-(PDF)/) 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)

Resources Developed By ASA Committees and Published Elsewhere

Exploring Data (Second Edition)

ISBN-10: 0866516131 ISBN-13: 9780866516136

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

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 Common Core existed, it covers probability in the manner advocated by the Common Core. 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. However, 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

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 Common Core existed, it covers much of the material on analyzing the results from surveys in the manner advocated by the Common Core. 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

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. 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 7 to 12.

Statistics: A Guide to the Unknown, 4th Edition

<http://www.cengage.com/c/statistics-a-guide-to-the-unknown-4e-peck>

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 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. The 3rd 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 4th 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.

Other Sources of Lesson Plans

Illustrative Mathematics

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

Comprehensive and easy to navigate website. 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.

EngageNY

<https://www.engageny.org/common-core-curriculum>

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)

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>

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/prec calculus-and-advanced-topics-module-5>

LearnZillion

<https://learnzillion.com/math> (General website for mathematics)

<https://learnzillion.com/search?m=LessonPlan&category=Data%2C+statistics%2C+and+probability> (Direct link to data, statistics and probability lessons)

This website has a full set of Common Core lesson plans for Grades K-8 mathematics and statistics. “Included in each lesson are presentations, videos, downloadables, and interactive materials that help you introduce, demonstrate, and assess key concepts.” (quoted from an email from LearnZillion). In addition, there are teacher guides and assessment materials for Grades K-8. There are also videos for Grades K-12 that can be easily used in classrooms.

Mathematics Vision Project

<http://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 website). 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 level and the honors level. The most appropriate modules for Common Core statistics are:

Secondary I—Module 9: Modeling Data at <http://www.mathematicsvisionproject.org/secondary-mathematics-i-2016.html>

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

Secondary III—Module 8: Statistics at <https://www.mathematicsvisionproject.org/secondary-mathematics-iii.html>

Mathematics Georgia Standards of Excellence (GSE)

The State of Georgia has developed frameworks and lesson plans for implementing the Common Core standards. Below, for each grade band, the general URL is listed, followed by the most relevant ones for each particular grade.

Grades K-5 <https://www.georgiastandards.org/Georgia-Standards/Pages/Math-K-5.aspx>

Grade K—Unit 4 at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/K-Math-Unit-4.pdf>

Grade 1—Unit 4 at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/1st-Math-Unit-4.pdf>

Grade 2—Unit 3 at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/2nd-Math-Unit-3.pdf>

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

Grade 4—Unit 7 at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/4th-Math-Unit-7.pdf>

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

Grades 6-8 <https://www.georgiastandards.org/Georgia-Standards/Pages/Math-6-8.aspx>

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

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

Grade 8—Unit 6 at <https://www.georgiastandards.org/Georgia-Standards/Frameworks/8th-Math-Unit-6.pdf>

OpenIntro Statistics

<http://www.openintro.org/stat/index.php>

Authors: David M Diez, Christopher D Barr and Mine Çetinkaya-Rundel

This is several comprehensive introductory statistics courses with all materials on the same website. All materials are free. The text of **Intro Stat with Randomization and Simulation** at https://www.openintro.org/stat/index.php?stat_book=isrs is the most appropriate one for teaching the Common Core, although some of it goes beyond the Common Core. The main text at the college level is OpenIntro Statistics at

https://www.openintro.org/stat/index.php?stat_book=os, but much of it is appropriate for Common Core standards in Grades 9 to 12. There is also a textbook aimed at Advanced Placement statistics called Advanced High School Statistics at

https://www.openintro.org/stat/index.php?stat_book=aps. For each textbook the website includes the textbook itself, labs (using R), videos, lecture slides, data sets, forums, and more.

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>

Online Statistics Education: An Interactive Multimedia Course of Study

<http://onlinestatbook.com>

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 common core or as a source for teachers to improve their own knowledge of statistics.

Probability and Statistics of the Math Forum

<http://mathforum.org/probstat/probstat.html>

This is a very comprehensive website on its own, even though it is part of the bigger website of Teacher’s Place website (<http://mathforum.org/teachers/>). The website is divided into four portions: Classroom materials for teachers and students (sorted by grade level); Software links (but mostly for college level and beyond); Internet projects; and Public forums. These materials were formerly known as The Math Forum @ Drexel and are now under the auspices of NCTM.

Gapminder

<http://www.gapminder.org/>

“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 Gapminder’s mission statement). Although most of the content is concerned 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, and labs. The data and videos parts are described further in the “Applets/Videos” and “Sources of Data” sections below.

MAA (Mathematical Association of America) Notes

Even though these notes are aimed at the post-secondary level, some are very appropriate for secondary schools. The most relevant ones for statistics and probability are:

“Teaching Statistics: Resources for Undergraduate Instructors” ISBN: 9780883851623

<http://www.maa.org/press/maa-reviews/teaching-statistics-resources-for-undergraduate-instructors>

“Current Practices in Quantitative Literacy” ISBN: 9780883851807

<http://www.maa.org/press/maa-reviews/current-practices-in-quantitative-literacy>

“Innovations in Teaching Statistics” ISBN: 9780883851753

<http://www.maa.org/publications/maa-reviews/innovations-in-teaching-statistics>

Statistics New Zealand Lesson Plans

<http://new.censusatschool.org.nz/resources/>

Even though the extensive collection of lesson plans for Grades 4 to 12 were developed for New Zealand’s schools, they fit well into the Common Core Standards and are easily adaptable to U.S. students.

About Statistics: Power from Data!

<http://www.statcan.gc.ca/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.

Statistics: A Powerful Edge! (2nd 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 20 years old, it has a wide variety of resources applicable to the Common Core.

Puzzling Statistics/Playful Statistics: Ideas for Creating Student-Generated Data

<https://www.dropbox.com/sh/e5i8m4t0fn44q26/AAAtdBDozouwOD5uKeanNZYqa?n=106531208>

Author: André Michelle Lubecke

Once at this webpage, scroll down to the Puzzling Stats JSM 2014.pptx file. It is the PowerPoint slides from a talk by the author at the Joint Statistical Meetings in 2014. It demonstrates a variety of activities that can quickly produce student-generated data using free or very inexpensive ‘props’ (objects). The remainder of the webpage gives the instructions for the various activities and worksheets for student use. Many of these activities can be used as early as Grade 5. A webinar on this same topic is at <https://www.causeweb.org/cause/webinar/activity/2015-03/>

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 below). It “draws on current scientific research—including research on the ways students learn science effectively” (quoted from website).

Next Generation Science Standards

<http://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

[http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1467-9639](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-9639)

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

http://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

The resources included in this section are those that are compatible with the Common Core. This section is still under development. Additional resources will be added in the future.

Workshops in Statistical Literacy (Talleres de Alfabetización Estadística)

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

The objectives of this project were to develop and disseminate through workshops 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.

Visual Understanding Applets

<http://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 are highly recommended by several Common Core statistics teachers and can be used in Grades 7 to 12. Also available in Spanish, German, Turkish, Dutch, Polish, Swedish, French, Russian, Italian, Portuguese, Chinese and Japanese.

Applets

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&feature=youtu.be&hd=1 (for Macs).

Visual Understanding Applets

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Rossman/Chance Applet Collection

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

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

Statkey

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

This website contains many applets. There are also very nice data visualization tools in the “Descriptive Statistics and Graphs” section. The website 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.

Stat-Attic

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.

Rice Virtual Lab in Statistics Simulations/Demonstrations

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

This website has 34 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 subset of 21 of these simulations is at http://onlinestatbook.com/stat_sim/index.html

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 knowledge of statistics and probability.

Statistical Applets

<http://www.stapplet.com/SPA/>

This website has applets for both analyzing data and for helping students understand important statistical concepts. The applets are easy-to-use and adaptable in terms of the format of the output.

Videos

LearnZillion

<https://learnzillion.com/resources/73936-math-video-lesson-library>

These are short videos that are part of the bigger LearnZillion project (see <https://learnzillion.com/math>) already aligned directly with the Common Core standards. There are separate portions for teachers and students. For Grades K to 5, the statistics-related materials are under Measurement and Data. For Grades 6 to 12, the statistics-related materials are under Statistics and Probability.

BetterLesson

http://betterlesson.com/common_core

This website has thousands of video-based lessons along with written commentary for teachers and worksheets for students. The lessons are broken down by grade level and by particular common core standards. Many of the lessons cover more than one standard. There are also lessons listed under Next Gen Science (which stands for Next Generation science standards) which are appropriate for teaching statistics and probability.

Against All Odds

<http://www.learner.org/courses/againstallodds/index.html>

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, a glossary, teacher guides and student guides.

Gapminder (Videos)

http://www.gapminder.org/videos/#.U_uOA_IdWSp

There are 47 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.

OpenIntro Statistics

<http://www.openintro.org/stat/index.php>

Authors: David M Diez, Christopher D Barr and Mine Çetinkaya-Rundel

This is several comprehensive introductory statistics courses with all materials on the same website. All materials are free. The text of **Intro Stat with Randomization and Simulation** at https://www.openintro.org/stat/index.php?stat_book=isrs is the most appropriate one for teaching the Common Core, although some of it goes beyond the Common Core. The main text at the college level is OpenIntro Statistics at

https://www.openintro.org/stat/index.php?stat_book=os, but much of it is appropriate for Common Core standards in Grades 9 to 12. There is also a textbook aimed at Advanced Placement statistics called Advanced High School Statistics at

https://www.openintro.org/stat/index.php?stat_book=aps.

For each textbook the website includes the textbook itself, labs (using R), videos, lecture slides, data sets, forums, and more. The videos are under the "Videos" tab.

Khan Academy (Grades 6 to 12)

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

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

These are the links to its materials (mostly videos) for statistics and probability. While the two webpages have substantial overlap, there is enough different on each to make it worthwhile looking at both of them. They can be used in Grades 6 to 12. 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.

Khan Academy (Grades K to 8)

<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.

American Public University System

<http://www.apus.edu/media/mathWV/statistics.htm>

This is a very traditional approach to introductory statistics using 100 videos done in a very simple format. They can be used in Grades 9 to 12.

Sources of Data (Including Case Studies)

Journal of Statistics Education

<http://tandfonline.com/toc/ujse20/current> (for issues beginning March 2016)

<http://ww2.amstat.org/publications/jse/> (for issues through 2015)

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). In addition, there is an extensive JSE Data Archive at http://ww2.amstat.org/publications/jse/jse_data_archive.htm that contains many of the data sets from the Data Sets and Stories articles (with links to the articles—many of which contain lesson plans) plus many more useful data sets.

DASL—The Data and Story Library (new version)

<http://dasl.datadesk.com/>

The original DASL of Carnegie-Mellon University is no longer being updated, although it is still accessible (see below). The website here is a replacement, which contains much of the original content and some new content. “DASL is designed to help teachers locate and identify datafiles for teaching. DASL also serves as an archive for datasets from statistics literature. The DASL archive contains stories and datafiles. Each story applies a particular statistical method to a set of data. Each datafile has one or more associated stories. The data can be downloaded as a tab-delimited table of text, easily read by most statistics programs, or viewed in your browser.” (quoted from website)

DASL—The Data and Story Library (old version)

<http://lib.stat.cmu.edu/DASL/>

This website, while operational, is not being fully maintained. “DASL (pronounced "dazzle") is an online library of [datafiles](#) and [stories](#) that illustrate the use of basic statistics methods. We hope to provide data from a wide variety of topics so that statistics teachers can find real-world examples that will be interesting to their students. Use DASL's powerful search engine to locate the story or datafile of interest.” (quoted from the website)

A Little Stats

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

This list of data sets was created by a high school teacher and is designed specifically for those involved in teaching Common Core statistics.

Data.Gov

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

This website has over 194,000 data sets from over 225 organizations at the State and Federal government levels. However, it is deficient in certain areas (e.g., energy statistics from the U.S. Energy Information Administration (see below))

U.S. Census Bureau

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

This website contains links to a huge variety of data sets. It also contains tools (see <https://www.census.gov/data/data-tools.html> for details) including articles, data visualizations, mobile apps, software, maps and more in the context of surveys and of the national Census.

American FactFinder

<https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

This website contains some of the most popular datasets available from the U.S. Census Bureau. It is easier to use than the general website discussed above.

Virtual Laboratories in Probability and Statistics

<http://www.math.uah.edu/stat/data/index.html>

Each of the data sets here has one or more explanatory paragraphs with historical details, sources of the data and links to references for more in-depth explanations.

DataFerrett

<https://dataferrett.census.gov/>

This is part of the Census Bureau's TheDataWeb (<https://thedataweb.rm.census.gov/index.html>) and contains a variety of datasets that can be used in classrooms. "DataFerrett is a data analysis and extraction tool to customize federal, state, and local data to suit your requirements. Using DataFerrett, you can develop an unlimited array of customized spreadsheets that are as versatile and complex as your usage demands then turn those spreadsheets into graphs and maps without any additional software." (quoted from website).

U.S. Energy Information Administration

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

To get started, click on the "Sources and Uses" phrase near the top of the page. Then, click on the area of energy for which you want data sets. On each type of energy page, click on "Data" to get a list of available data sets. Many are available as Excel or CSV files.

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)

FRED (of the Federal Reserve Bank system)

<https://research.stlouisfed.org/fred2/>

"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 <https://research.stlouisfed.org/about.html>). Many of the over 492,000 datasets 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/data/search>

Has 43,000 datasets from a variety of UK government sources that are available in a variety of downloadable formats.

The World Factbook (of the CIA)

<https://www.cia.gov/library/publications/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 267 world entities.” (quoted from website)

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 2011. All are backed with extensive support, training and guidance to meet the needs of data users, owners and creators.” (quoted from <https://www.ukdataservice.ac.uk/about-us>). The website includes user guides, teacher resources at <https://www.ukdataservice.ac.uk/use-data/teaching>, student resources at <https://www.ukdataservice.ac.uk/use-data/student-resources> and a “Discover” interface for exploring datasets at <http://discover.ukdataservice.ac.uk/>.

IPUMS (Integrated Public Use Microdata Series)

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

This group of websites is sponsored by the Minnesota Population Center. It has a wide variety of population and sample data from the US and over 80 other countries. A short description of the two largest websites are given here. They also have a classroom registration system (see https://international.ipums.org/international/classroom_accounts.shtml for details).

IPUMS International

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

This website has census data from 301 censuses from 85 countries. They have taken the data supplied by the countries and have harmonized (made them comparable across countries) the data. They have also collected and preserved relevant documentation

IPUMS-USA

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

This website has data on people from the U.S. censuses from 1790 to the present and for the American Community Survey from 2000 to the present. They have been harmonized for comparison across time and relevant documentation has been preserved on the website.

OpenIntro Statistics

<http://www.openintro.org/stat/index.php>

Authors: David M Diez, Christopher D Barr and Mine Çetinkaya-Rundel

This is several comprehensive introductory statistics courses with all materials on the same website. All materials are free. The text of **Intro Stat with Randomization and Simulation** at https://www.openintro.org/stat/index.php?stat_book=isrs is the most appropriate one for teaching the Common Core, although some of it goes beyond the Common Core. The main text at the college level is OpenIntro Statistics at

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https://www.openintro.org/stat/index.php?stat_book=aps. For each textbook the website includes the textbook itself, labs (using R), videos, lecture slides, data sets, forums, and more. The data sets are under the “Extras” tab on the overview page for each textbook.

Baseball Prospectus

<http://www.baseballprospectus.com/sortable/>

As the name implies all of the data sets here are about baseball. The link given here goes to an index of its wealth of data sets. Much of the website can be used without paying a fee.

baseballsavant

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

This site has lots of information about baseball statistics

Baseball Reference and Pro Football Reference

<http://www.baseball-reference.com/> and <http://www.pro-football-reference.com/>

Have easy-to-access datasets about professional baseball and football including a variety of historical datasets. Main overall website is <http://www.sports-reference.com/> which also contains websites for professional basketball and for college football and basketball. The main website and the separate websites are set up so one can easily jump from one to another.

Advanced Football Analytics

<http://www.advancedfootballanalytics.com/>

This website is focused on more advanced statistical techniques. It includes built-in visualization tools. However, many of the data sets are very useful for teaching.

Gapminder (Data Portion)

<http://www.gapminder.org/data/>

There are over 500 indicators here. Each can be downloaded as an Excel data file. Within the Excel file are the data (usually over time and by country) and a separate worksheet with more information about the data (including definitions and sources).

StatLine

<http://statline.cbs.nl/StatWeb/?LA=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 here is for the version in English.

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

<https://www.icpsr.umich.edu/icpsrweb/ICPSR/index.jsp>

This website has a wide variety of data sets. In addition, there are materials for teaching using their data at <https://www.icpsr.umich.edu/icpsrweb/instructors/index.jsp>

Rice Virtual Lab in Statistics Case Studies

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.

Seelt

<https://sites.google.com/a/cbst.ucdavis.edu/sbcepublic/seeit>

“Seelt is a data visualization and manipulation tool that was developed by the SBCE [Science, Biostatistics & Cancer Education] project team. The basic program is divided into three major forms – distributions, correlations, and resampling... [It can] run on Google Chrome and Mozilla Firefox browsers and most tablets.” (quoted from website). The data sets are available by clicking on one of the tabs related to the statistical techniques being covered.

Statistics and the Media (including graphical displays)

Chance News

https://www.causeweb.org/wiki/chance/index.php/Main_Page

“Chance News reviews current stories in the news that involve probability or statistical concepts...The latest version is always under construction, with the results consolidated into (approximately) monthly issues.” (quoted from website). The reviews give direct links to the relevant articles and related materials. Some even contain questions for discussion.

FiveThirtyEight

<http://fivethirtyeight.com/>

This is the website of the FiveThirtyEight group that covers news, sports and features from a statistical viewpoint using correct methods and write-ups that are extremely easy to follow. The head of the group is Nate Silver, who is famous for his 2012 election predictions.

Science and News: A Marriage of Convenience

<http://ww2.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 <http://ww2.amstat.org/meetings/jsm/2016/onlineprogram/AbstractDetails.cfm?abstractid=321845>)

Work of Alan Schwarz of the New York Times

http://en.wikipedia.org/wiki/Alan_Schwarz

This website gives links to his work using statistics to do unbiased reporting on the topics of concussions in football and the prevalence rates for ADHD, as well as his work on the use of statistics in baseball. He was the winner of the 2013 ASA Excellence in Statistical Reporting Award.

The New York Times 2013: The Year in Interactive Storytelling

<http://www.nytimes.com/newsgraphics/2013/12/30/year-in-interactive-storytelling/#visualfeat>

This website has portions on multimedia stories, data visualization, exploratory graphics, breaking news, and visual and interactive features.

The New York Times 2012: The Year in Graphics

http://www.nytimes.com/interactive/2012/12/30/multimedia/2012-the-year-in-graphics.html?_r=0

“Graphics and interactives from a year that included an election, the Olympics and a devastating hurricane. A selection of the graphics presented here include information about how they were created.” (quoted from website)

Work of Amanda Cox of the New York Times

<https://www.nytimes.com/by/amanda-cox>

Amanda Cox is a statistician who specializes in graphical displays. She was the winner of the 2012 ASA Excellence in Statistical Reporting Award.

Football Perspective by Chase Stuart

<http://www.footballperspective.com/>

This is a series of daily articles about football. Each contains a background story and then continues on to a statistical analysis that is at the level easily understandable to secondary school students.

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

<http://www.cas.miamioh.edu/statsandstories/index.html>

This is a series of oral “podcasts”. In each one “quantitative ideas encountered in our daily lives and journalism are explored. Each program will feature a guest who will share a story with a strong statistical flavor.” (quoted from <http://www.cas.miamioh.edu/statsandstories/about.html>). Each podcast is accompanied by a complete script that can be downloaded.

Stats.org

<http://www.senseaboutscienceusa.org/stats/>

“...a collaboration between the American Statistical Association and the non partisan, non profit Sense About Science USA. [It] provide[s] guidance and practical help ... to more complex problems in analysis and research integrity...” (quoted from website).

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.

Visual Understanding Applets

<http://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 Grades 7 to 12. Also available in Spanish, German, Turkish, Dutch, Polish, Swedish, French, Russian, Italian, Portuguese, Chinese and Japanese.

Stat-Attic

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

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.

Teaching the Common Core: Making Inferences and Justifying Conclusions (Webinar)

http://magazine.amstat.org/videos/education_webinars/TeachingCommonCore-KariLockMorgan.wmv

This is a webinar that was presented by Kari Lock Morgan of Penn State University as part of the ASA webinar series for K-12 teachers (see <http://www.amstat.org/asa/education/K-12-Statistics-Education-Webinars.aspx>) It explains how to integrate simulation tools into the teaching of Common Core statistics. It uses Statkey (see above), but is also very useful for simulations using other tools.

Teaching Simulation-Based Inference

http://magazine.amstat.org/videos/education_webinars/KariLockMorganWebinar4-16.wmv

Covers how to integrate bootstrap confidence intervals and randomization tests into the teaching of Common Core statistics and other introductory statistics courses using free online tools. Talk is from a Washington Statistical Society (WSS) Statistics Education Seminar by Kari Lock Morgan. Overlaps with the above webinar, but has some different coverage.

Random Number Generators and Random Samplers

Excel (2013 Version)

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/RandomGen/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.

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

Computing Technology for Math Excellence

<http://www.ct4me.net/index.html> (home page)

<http://www.ct4me.net/Common-Core/hsmath-intro.htm#statistics-probability> (direct link to high school statistics resources)

This website “is devoted to resources for teaching and learning mathematics (K-12 and calculus), technology integration, and the standards movement in education. CT4ME's major ongoing project is to identify Common Core math resources...[The]resources include...basic skills mastery, specific upper level subject resources, problem solving and critical thinking, using data, homework assistance, games, simulations, virtual math manipulatives, project-based learning, field trips for math, standardized testing, and more. Resources for teaching mathematics to learners with special needs are provided...An extensive list of software products with potential to raise student achievement is included.” (quoted from http://www.ct4me.net/about_this_site.htm). This website contains both non-commercial free resources and commercial resources. No endorsement of the commercial resources is implied by this listing.

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)

iNZight

<https://www.stat.auckland.ac.nz/~wild/iNZight/index.php>

This software is heavily used in secondary schools in New Zealand. There are downloadable versions for Windows and Macintosh on the website. It does all of the statistical procedures that are part of the Common Core. See the next entry for an online version of the software.


inzight lite

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

“inzight 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. inzicht 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)

NZGrapher

<http://www.jake4maths.com/grapher/>

NZGrapher has been developed by Jake Wills, a mathematics teacher in New Zealand specifically for supporting the teaching of the NCEA Statistics Standards. The idea behind NZGrapher was to be able to run on **any device**, without an install. NZGrapher was developed to run on anything with a browser, computers, iPads, ChromeBooks, Microsoft Surface, Android, even iPhones. On the iPad the best way to make it work is to click on the  button and add it to your home screen.

Seelt

<https://sites.google.com/a/cbst.ucdavis.edu/sbcepublic/seeit>

“Seelt is a data visualization and manipulation tool that was developed by the SBCE [Science, Biostatistics & Cancer Education] project team. The basic program is divided into three major forms – distributions [including boxplots], correlations, and resampling... [It can] run on Google Chrome and Mozilla Firefox browsers and most tablets. All data can either be imported from tab or comma delimited files or can be read directly from Google spreadsheets, allowing data to be easily created and shared between students and teachers. Data can be edited through drag and drop procedures. All statistical and graphical representations are modified in real time... [It also has] a [Quick Guide](#) and [Tutorial Videos](#).” (quoted from website).

CPMP-Tools

<http://www.wmich.edu/cpmp/CPMP-Tools/>

To download the tools, scroll down this webpage until the “Download” button. “*CPMP-Tools* is a suite of both general purpose tools and custom apps designed to support student investigation and problem solving in the [Common Core]...[The] Statistics tools include tools for graphic display and analysis of univariate and bivariate data, simulation of probabilistic situations, and mathematical modeling of quantitative relationships.”

Project MOSAIC Little Books for Learning R Programming Language

<https://github.com/ProjectMOSAIC/LittleBooks/blob/master/README.md>

Authors: Randall Pruim, Nicholas Horton, and Daniel Kaplan

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

“***Start Teaching Statistics Using 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/index.html>. In particular, there is a four page handout called “**Minimal R for Intro Stats**” on the website or directly at <http://cran.r-project.org/web/packages/mosaic/vignettes/MinimalR.pdf>

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 <http://socserv.mcmaster.ca/jfox/Misc/Rcmdr/>

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

<https://dl.dropboxusercontent.com/u/32015088/EN-CNTNT-Whitepaper-Effective-Graphs-with-Microsoft-R-Open.pdf>

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.

Common Online Data Analysis Platform (CODAP)

<https://concord.org/projects/codap> (homepage)

<https://concord.org/stem-resources> (software and other K-12 resources)

“[This is] software that can be used by curriculum developers to get students working with data...[It] is free and runs in a web browser. It’s also open source, which means that ... [anyone] can modify it. CODAP is building on the Data Games project” (quoted from <https://concord.org/publications/newsletter/2014-spring/codap>). It contains many of the features of Fathom and Tinkerplots (see below).

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 <http://fathom.concord.org/download/>

JMP https://www.jmp.com/en_us/academic/jmp-student-edition.html

RStudio <https://www.rstudio.com/pricing/academic-pricing/>

StatCrunch <http://www.statcrunch.com>

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

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

Note: Almost all of the resources given elsewhere on this website may be very useful to those involved in teacher preparation and will not be 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)

<http://www.nctm.org/Standards-and-Positions/Position-Statements/Preparing-Pre-K-12-Teachers-of-Statistics/> (homepage)

http://www.nctm.org/uploadedFiles/Standards_and_Positions/Position_Statements/1Statistics%20joint%20ASA%20NCTM%20statement%20021113.pdf (pdf file of the position statement)

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

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

This document was developed by ASA as a companion to the MET II report. It puts forth recommendations on how elementary, middle, and high school teachers should be prepared in statistics. In particular, it "aims to:

- Clarify and expand MET II's recommendations for the statistical preparation of teachers at all grade levels: elementary, middle, and high school.
- 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, and Mine Çetinkaya-Rundel

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 1st author)

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

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

ISBN: 9780873536721

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

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

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

ISBN: 9780873536769

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

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

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

ISBN: 9780873537377

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

Data Analysis, Statistics, and Probability

<http://www.learner.org/courses/learningmath/data/?pop=yes&pid>

This is a no-cost Annenberg Learner course which uses videos and other materials as the medium of instruction. It “introduces statistics as a problem-solving process... [via] practical examples [and] case studies, divided into grade bands for K-2, 3-5, and 6-8 teachers.... [It] show[s] how to apply what [was]...learned in... [the] classroom.” (quoted from website).

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

<https://www2.amstat.org/publications/jse/v21n3/green.pdf> (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://www2.amstat.org/publications/jse/v22n3/schmid.pdf> (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.

A webinar related to the second article is at <https://www.causeweb.org/webinar/jse/2015-02/index.php>.

Wild About Statistics

<https://www.stat.auckland.ac.nz/~wild/wildaboutstatistics/> (homepage)

https://www.youtube.com/channel/UCEIKp33-h_Yw0o8XATHlICg (YouTube channel)

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

Stat 200: Elementary Statistics

<https://onlinecourses.science.psu.edu/stat200/>

This is a free on-line introductory statistics course developed by faculty in the Eberly College of Science at Penn State University.

What is a Survey?

<https://www.whatisasurvey.info/overview.htm>

“This...booklet is written primarily for non-specialists and is free of charge. Its overall goal is to improve survey literacy among individuals who participate in...surveys or use...survey results.” (quoted from website).

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

http://dspace.library.cornell.edu/bitstream/1813/78/2/A-B-C_of_EDA_040127.pdf

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

<http://arxiv.org/format/1411.5279v1> or

<http://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)

Mathematics Teacher Educator

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

This is a new 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 website-March 2014 issue).

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

http://iase-web.org/Conference_Proceedings.php?p=Joint_ICMI-IASE_Study_2008

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)

<http://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 website)

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

<http://www.parcconline.org/about>

This “is a group of states working together to develop a set of assessments that measure whether students are on track to be successful in college and their careers... PARCC has produced a variety of resources for educators, parents, and the public...” (quoted from webpage). Sample assessment items are at <http://www.parcconline.org/resources/educator-resources>.

EngageNY Sample Questions for the Mathematics Tests

<https://www.engageny.org/resource/new-york-state-common-core-sample-questions>

These sample questions are matched 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. These are presently only for Grades 3 to 8.

Khan Academy Assessment Items

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

This portion of the Khan Academy website contains both mathematics and statistics Common Core 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, 245 for Grade 7, and 237 for Grade 8. There are more than 800 items at the high school level. Hints are available for the students, if needed. Also, links to relevant videos are given with the items.

PISA (Programme for International Student Assessment) Questions

<http://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm>

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.