JASON ACADEMY

Exploring Data Analysis
SYLLABUS

Course Description

This course helps teachers deepen their understanding of learning and teaching data analysis. It presents a four-step data investigation process (posing a question, collecting data, describing/analyzing data, forming and communicating conclusions) in real-world contexts. The course covers how to analyze data using graphs and summary statistics (i.e., mean, median, and mode), compare groups of data, and develop statistical arguments based on the data. The course uses computer technology to support understanding of key concepts.

Course Objectives

The main goals for this course are for teachers to:

- Investigate the dynamic four-step process of data analysis: pose a question, collect the data, describe and analyze the data, and form and communicate conclusions.
- Learn what data analysis is and how it is used in real-world contexts (i.e., science, engineering, history).
- Compare Exploratory Data Analysis to traditional statistical methods.
- Learn about descriptive and inferential statistics and examine what it means to reason statistically.
- Use technology (i.e., Tabletop and applets) to support and enhance understanding of data analysis concepts.
- Learn about the distinction between categorical and numerical data and examine why it is an important concept.
- Investigate how to use a variety of graphs to describe and analyze data.
- Examine and compare summary statistics (i.e., mean, median, and mode) and learn how to use them as meaningful indicators of center.
- Understand how to use data to support conclusions and how to develop a data-based argument.
- Explore how to compare equal-sized groups of data (i.e., the groups have an equal number of data values).
- Explore how to compare different-sized groups of data (i.e., the groups have a different number of data values).
- Perform an open-ended data analysis project.

Assignments for all participants:

During the course, participants complete a data analysis project of their own choosing. Each week, one or more project tasks will be assigned. Project tasks include: choosing a topic and designing a research question; collecting data; analyzing data; drawing conclusions and communicating those conclusions to others.

Participants keep a Course Journal in which they record mathematical investigations and findings, reflections on their experiences and process, and the potential application of the ideas and materials they have been working with to their own classrooms and curriculum. Participants make several entries in this journal on a weekly basis. The journal will be informal in style.

Each week participants review specific content, solve mathematics problems and post their solutions, and, when appropriate, study instances of students' misconceptions about the content. Each week there are particular topics on which participants contribute to online discussions about mathematical content and teaching and learning.

Participants are expected to create posts in response to each week's assignment and to read and respond to the posts of at least two fellow colleagues. Posts and replies are expected to reflect efforts to understand the content of the course, reflect attempts to understand the ideas and points of view of others, to be based on data and mathematical reasoning, and to engage, build on, productively challenge, support and/or extend the ideas of others

COURSE OUTLINE

WEEK 1 • *Pose the Question and Collect the Data*

During this week, participants will learn about the four-step data investigation process—what it is and why it is used. In particular, participants will examine the first two stages of a data investigation: posing a question and collecting the data. In addition, participants will begin to explore how computer software can support the data analysis process.

Major Ideas: Data analysis is more than just doing calculations or mastering techniques, it is about finding ways to organize and represent the data to reveal information. Data analysis is a process that begins with a question that needs to be answered. Often that general question needs to be transformed into one that can be used as the basis of a data investigation. Once the question is refined, there are a variety of tools that can be used to collect data. Technology can help you organize, describe, and graph the collected data.

Topics & Activities Include:

1. **Why Study Data Analysis?**
   Activity: Statistics in Your World. Choose a real world example of use of data and answer questions about it.
2. **The Data Analysis Investigation Process**
   Activity: Taking Stock. Read NCTM data analysis standard and answer questions.
3. **Your Project**
   Activity: Brainstorming. Choose a data analysis project topic.
4. **Exploring Data**
   Activity: Go Exploring. Explore Cats data set and record your findings and questions.
5. **Exploring Cat Extremes**
   Activity: Action-Oriented Fractions. Investigate extremes in cat data.
6. **Technology and Data Analysis**
   Activity: Tabletop. Install Tabletop and complete *Lab Sheet: Curious About Cats*.
7. **Posing Questions**
   Activity: Shaping a Question for Your Project. Select a purpose for the data investigation project and choose data questions to investigate.
8. **Data Collection Methods**
   Activity: Project Plan. Determine data collection method, answer questions, collect data.
9. **Where to Next?**

Assignments:

Participants create and post a first draft for a data investigation project. They identify a topic and create a list of questions the project will address and describe the comparisons they intend to make. They read and comment on each others' project ideas, using what they have learned about data investigations to provide useful feedback to other course members about their topics and questions.

COURSE OUTLINE

WEEK 2· *Describe and Analyze the Data with Graphs*

During the second week, participants will move to the third stage of a data investigation by learning how to describe and analyze graphs. In particular, participants will examine a variety of graphs and learn how to organize and summarize data using them.

Major Ideas: Graphs are important tools in a data investigation. They can help you organize your data and detect patterns and trends and to identify relationships. Graphs stimulate ideas that lead to new questions and can help you to make conclusions about your data. There are a variety of graphs available, all which display data in a different way. Different views of the data provide different information. Choosing the appropriate display(s) to represent your data is an important part of a data investigation.

Topics & Activities Include:

1. **Storytelling with Graphs**
   Activity: What's the Story? Interpret graphs using: *Lab Sheet: What's the Story?*
2. **Line Plots**
   Activity: Build Your Graph Sense. Record results of *Lab Sheet: Build Your Graph Sense* in course journal.
3. **Graph Sense**
4. **Why Are There Different Types of Graphs?**
   Activity: Create Some Displays. Make different graphs of cat data and compare.
5. **Displaying Categorical Data**
6. **Displaying Numerical Data with Histograms**
   Activity: Introducing Histograms. Constructing and comparing line plots and histograms.
7. **Graphs that Group Data**
   Activity: Compare Peanut Butters. Compare data on peanut butter quality using a back-to-back stem plot.
8. **Reasoning about Displaying Data**
   Activity: Your Project: Display and Describe Data. Choosing, developing, and analyzing graphs for Data Analysis project.

Assignments:

After reading Topic 4, Why Are There Different Types of Graphs?, participants post two different graphs from the activity, *Create Some Displays,* to answer the question "What color fur does the typical cat have?". If they use TableTop, they post a screen capture of their two data displays. If they create paper graphs, they attach a digital photo or a scan of their displays. Then they answer several questions from the activity and comment on their colleagues' postings.

COURSE OUTLINE

WEEK 3· *Describe and Analyze the Data with Numbers*

This week participants will explore how to analyze and describe data using numbers. In particular, participants will learn how to represent the center and the spread of the data using summary statistics such as the mean, median, mode, and range.

Major ideas: Statistical summaries (i.e., mean, median, and mode) are useful tools to describe a group of data. Using these statistics appropriately is a challenge. Not only do you need to understand the difference between each statistic, but you need to understand what each statistic represents and which one is more appropriate given the type and distribution of the data. [For example, the mean is sensitive to outliers while the median is not. The mode is the only statistic that can be used for categorical data.]

Topics & Activities Include:

1. **What Is Average?**
   Activity: Explore Average. Investigate salary data and determine an average salary value.
2. **The Mode**
   Activity: More Modes. Use Tabletop to determine modes of various cat characteristics, evaluate the typicality of the mode value.
3. **The Median**
   Activity: Constructing a Data Set. Create alternate data sets given a median. Compare modes and median values as measures of typicality for given data sets.
4. **Box Plots**
   Activity: Make Your Own Box Plot. Use the cats data set to explore distribution and center using box plots and summary statistics.
5. **The Mean**
   Activity: Explore the Mean. Using mercury contamination data, explore the significance of the mean as a descriptor. Compare mean, median, and mode as measures of typicality.
6. **Comparing the Mean and the Median**
   Activity: Take Flight! Using flight data and a data applet compare mean and median as measures of typicality. Construct data sets for which mean and median are best measures of typicality.
7. **Measures of Spread**
   Activity: Take Me Out to the Ball Game. Compare data sets with different shaped spreads and the impact of spread on measures of typicality.
8. **Graphs and Numbers**
   Activity: Your Project: Summary. Considering the shape of your data project data and calculating and interpreting summary statistics for the Data Project.
9. **In Summary**

COURSE OUTLINE

WEEK 3· *Describe and Analyze the Data with Numbers*

Assignment:

After doing the *Take Flight Activity* (Topic 6: Comparing the Mean and the Median) participants create a post in which they answer the following questions from the activity.

1. Given the original data set (list them) does the mean or the median best represent a typical flight? Explain your answer.
2. Share the data set you created for which the mean clearly best represents a typical flight. Explain why.
3. Share the data set you created for which the median clearly best represents a typical flight. Explain why.
4. If you had a couple of very poor flights and you wanted to report the longest typical flight, which summary statistic would you use? Explain your reasoning.
5. Does it matter whether you use the mean or the median?

Project Update:

Participants should have collected most of the data for their data investigation projects by now. They organize and sort the data by displaying them graphically, creating at least two different representations. They analyze their graphs and explore measures of central tendency to begin making sense of the data. They post their graphs, computations and comments and respond to colleagues' postings. They answer the following questions.

1. Analyze your graphs. What story do the data tell? Describe any special features of the shape such as: Where are the humps, clumps, gaps, outliers? Are the data clustered or spread out
2. Find the measures of central tendency for your data. Which one(s) best represent the average or typical value in your data set? On what did you base your decision?
3. Describe how the data are distributed. What does this distribution indicate about the variability of the data? How does the distribution of your data influence the type(s) of summaries you chose to represent your data?
4. Once you have organized and displayed and described the data and determined measures of central tendency, what interpretations can you make? Do you have any theories or experiences that might account for how the data are distributed? Do the displays and computations lead to additional questions? If so, list them and describe how you might go about answering those questions in another project.

COURSE OUTLINE

WEEK 4: Using Data to Support Conclusions: Comparing Groups of Equal Size

This week participants will investigate the fourth and final step in a data investigation: forming and communicating conclusions. In particular, participants will learn how to form conclusions by comparing groups of data that are equal in size (i.e., groups that have an equal number of data values). Participants will also learn how to develop data-based arguments.

Major ideas: Forming conclusions about data and communicating those conclusions is the final step of a data investigation—it is the time when you try to answer the original question that kicked off the data investigation to begin with. Comparing groups of data can help you to form conclusions about data and develop data-based arguments. Although comparing groups of data can be challenging, it can encourage you to reason logically about data rather than simply apply rules and algorithms. It can also help you look at the data as a whole and encourage you to explore data in creative ways.

Topics & Activities Include:

1. **Data and Decisions**
   Activity: Comparing Bubbles. Comparing and analyzing data sets to determine the "best" soap for generating bubbles.
2. **Comparing Individual Data Values**
   Activity: Compare Contact Lenses. Compare data about two types of contact lenses and make conclusions about which material is better.
3. **Comparing Counts**
   Activity: Comparing Gas Mileage. Compare individual data values; and using a cut-count compare approach.
4. **Comparing Data Using Summary Statistics**
   Activity: Comparing Brands of Batteries. Try three ways to compare: using (1) individual data values; (2) cut-count method; (3) summary statistics. Which battery and which method is best?
5. **Making a Statistical Argument**
   Activity: Your Project: Comparisons and Conclusions. Can comparing data sets help you answer your data question?

Assignment:

Participants post their results for the *Comparing Batteries* activity from Topic 4. They compare the data using three techniques: (1) individual data values; (2) cut-count method; (3) summary statistics. They post their conclusions about which battery they would pick for a camping trip and explain the method(s) of comparison they used to reach their conclusion.

COURSE OUTLINE

WEEK 5· Using Data to Support Conclusions: Comparing Groups of Unequal Size

During this week of the course, participants will continue to compare data sets in order to form conclusions about data. This time, however, participants will compare groups of data that do not have the same number of data values.

Major ideas: Comparing groups of data that are not equal in size requires more advanced techniques and reasoning skills than those needed to compare equal-sized data sets in Week 4. Instead of simply comparing absolute frequencies (or actual counts), comparing different-sized groups of data requires you to compare relative frequencies (or percents). Comparing relative frequencies requires a more sophisticated level of thinking called multiplicative reasoning. Some graphical displays (i.e., box plots and relative-frequency histograms) encourage multiplicative reasoning and make comparing relative frequencies easier to understand.

Topics & Activities Include:

1. **New Strategies**
   Activity: Compare Different-sized Groups of Data. Compare groups with unequal numbers of data elements.
2. **Reasoning Skills: Comparing Percents versus Comparing Counts**
   Activity: Men versus Women: Body Temperature. Compare male and female body temperatures; make an argument to support which sex has a warmer body temperature.
3. **Tools to Compare Relative Frequencies: Histograms**
   Activity: Water Usage. Construct absolute frequency graphs and relative-frequency graphs for the same set of data.
4. **Tools to Compare Relative Frequencies: Box Plots**
   Activity: Weight Loss. Compare unequal data sets for different weight loss products and determine which is most effective.
5. **Comparing Summary Statistics**
   Activity: Your Project: Wrap Up. Wrap-up of the Course Project and reflect on the experience.
6. **Where to Next?**
   Activity: Reflect on the Course. Reflect on how to use what you have learned in the course in the classroom.

Assignment:

At this point participants should be well along in their Data Investigation Projects. This week they write a brief executive summary of their project, methods, and findings. They include any questions that they are still grappling with and a sentence or two about what they have learned from carrying out this project. They offer feedback by commenting on each other's projects.

Reflection on the Course:

Participants comment on the course, what they've learned, how they will use it in their teaching, and make comments or suggestions on the content and instruction.

GRADING & CREDITS

Successful completion of the course for graduate credit is determined by:
Course Moderator/Course Instructor

Grading Overview

1. **(35 points)** Quality and completeness of weekly assignments, as reflected in the posts on discussion board.
2. **(25 points)** Quality of collaborative participation in course discussion.
3. **(40 points)** Quality and completeness of the Course Journal, due at the end of the course, which includes work on all non-optional activities in the Course Documents.

Letter grades are determined by adding the points earned (100 points possible for one graduate credit): 90-100 points = A, 80-89 points = B, 70-79 points= C.

Criteria and Descriptions

Weekly Assignments (35 points = 7 points per weekly assignment)
Posts with participant's responses to the weekly assignment should be well-focused on the questions asked, clear, well-organized, and complete (all assignments and activities are worked through to conclusion).

Because assignments are intended for learning, initial posts will not necessarily show complete understanding of the topic or include full and accurate solutions, but should show increasing understanding over the week.

Collaborative Participation (25 points = 5 points per weeklydiscussion)
Interactivity (4 points per week) - Challenges or questions other posts; stimulates further discussion; makes multiple, quality replies

Netiquette and Presentation (1 point per week)
Regards most rules of netiquette; includes appropriate grammar, spelling, and punctuation.

Course Journal (35 points for content; 5 points for presentation)

- The Course Journal includes all work on all non-optional activities presented in Course Documents, including one's reasoning or steps in solving mathematical activities.
- Journal entries should include evidence of understanding (or growing understanding) of mathematical concepts in Course Documents.
- Where applicable, final entries on any specific mathematics activities are reasonable and present accurate solutions. (N.B.: Initial entries may include errors in computation or strategy, but subsequent entries should show evidence of mathematical growth and understanding.)
- Where applicable, shows reflection or analysis of teaching practice, application of ideas to student learning, and understanding of standards.

Journal Presentation: Journal should be well organized and legible, with entries clearly labeled with dates and assignment titles. Tone and style can be informal, but correct grammar, spelling, and punctuation should be used.

Bibliography

Bohan, H., Irby, B., & Vogel, D. (2000, January). Problem Solving: Dealing with Data in the Elementary School. Teaching Children Mathematics, 1, 256-60.

Bright, G. W., Brewer, W., McClain, K., & Mooney, E. (2003). Making and Using Histograms. In Navigating through Data Analysis in Grades 6-8. Reston, Virginia: National Council of Teachers of Mathematics.

Bright, G. W., & Friel, S. N. (1998). Graphical representations: Helping students interpret data. In S. P. Lajoie (Ed.), Reflections on statistics: Learning, teaching, and assessment in grades K-12. Hillsdale, NJ: Lawrence Erlbaum.

http://Baseballhistorian.com (Babe Ruth's lifetime batting average).

Chance, B. (2002). Components of Statistical Thinking and Implications for Instruction and Assessment. Journal of Statistics Education, 10(3). Reprinted at www.amstat.org/publications/jse/v10n3/chance.html.

Cobb, P. (1999). Individual and collective mathematical development: The case of statistical data analysis. Mathematical Thinking and Learning, 1(1), 5-43.

Contact Lens Council 2000 statistics http://www.contactlenscouncil.org/stats.htm.

Cuevas, G. (Ed.). (2002). Navigating through Data Analysis and Probability in Grades 3-5. Reston, VA: National Council of Teachers of Mathematics.

Dartmouth's Chance News (Vol. 3.11; 23 July to 10 Aug 1994) http://www.dartmouth.edu/~chance/chance_news/recent_news/chance_news_3.11.html.

Dartmouth's Chance News (Vol. 3.08; 21 May to 10 June 1994) http://www.dartmouth.edu/~chance/chance_news/recent_news/chance_news_3.08.html#Grade%20inflation.

Everyday Mathematics Student Reference Book. (1998). The University of Chicago School Mathematics Project. Chicago, IL: pp 241-246.

Erickson, T. (2002). Technology, statistics, and subtleties of measurement: bridging the gap between science and mathematics. In B. Phillips (Ed.) Developing a statistically literate society: Proceedings of the sixth international conference on teaching statistics. Voorburg, The Netherlands: International Statistical Institute.

Feicht, L. (1999, September). Making Charts: Do Your Students Really Understand the Data? Mathematics Teaching in the Middle School, 5, 16-18.

Flint, A. (1994, June 4). Grade Inflation Losing Air at Some Colleges. The Boston Globe, City Edition.

Friel, S. N. (1998). Teaching Statistics: What's average? In L. J. Morrow and M. Kenney (Eds.), The Teaching and Learning Algorithms in School Mathematics (pp. 208-217). Reston, VA: National Council of Teachers of Mathematics.

Friel, S. N. (Ed.). (2003). Navigating through Data Analysis in Grades 6-8. Reston, VA: National Council of Teachers of Mathematics, 2003.

Friel, S. (In Press). The Research Frontier: Where Technology Interacts with the Teaching and Learning of Data Analysis and Statistics. In M.K. Heid & G.W. Blume (Eds.), Research on technology and the teaching and learning of mathematics: Syntheses and perspectives, Volume 1. Greenwich, CT: Information Age Publishing, Inc.

Friel, S. N., Bright, G.W., & Curcio, F.R. (1997, November-December). Understanding Students' Understanding of Graphs. Mathematics Teaching in the Middle School, 3, 224-27.

Friel, S N., Curcio, F.R., & Bright, G.W. (1997). Making Sense of Graphs: Theory Development for Instruction. Unpublished paper. As cited in Friel, Bright, and Curcio (1997) above. Chapel Hill, N.C.: University of North Carolina—Chapel Hill School of Education.

Friel, S. N., & O'Connor, W.T. (March 1999). Sticks to the Roof of Your Mouth? Mathematics Teaching in the Middle School, 4, 404-11.

Feldman, A., Konold, C., & Coulter, R., with Conroy B., Hutchinson, C. and London, N. (2000). Network science, a decade later: The Internet and classroom learning. Hillsdale, NJ: Lawrence Erlbaum.

Garfield, J. (2002). The Challenge of Developing Statistical Reasoning. Journal of Statistics Education, 10(3). Reprinted at www.amstat.org/publications/jse/v10n3/garfield.html.

Gelman, A., Pasarica, C., & Dodhia, R. (2002, May). Let's practice what we preach: turning tables into graphs. The American Statistician, v56 i2:121(10).

Gelman, A., Nolan, D., Men, A., Warmerdam, S., & Bautista, M. (1998, May). Student projects on statistical literacy and the media. The American Statistician, 52(2), 160-167.

Bibliography

Graham, A. (1987). Statistical Investigations in the Secondary School. London: Cambridge University Press.

Guinness Book of World Records online. http://www.guinnessworldrecords.com/

Halvorsen, K. T., & Moore, T. L. (2002). Motivating, Monitoring, and Evaluating Student Projects. In Teaching Statistics Resources for Undergraduate Instructors (pp. 27-34). Washington, D.C.: Mathematical Association of America.

Hitch, C., & Armstrong, G. (1994, January). Daily Activities for Data Analysis. Arithmetic Teacher, 41, 242-45.

International Food Council
http://ific.org/nutrition/kids/index.cfm
Isaacs, A. Konold, C. McFadden, E. Mokros , J. Rasala, S. Rubin A. Sconiers, S. Tierney, C. (2001) Bridges to Classroom Mathematics Staff Developer's Guide: Mathematics for Elementary Teachers. Sconiers, S. (Director). Lexington, MA: Comap.

The JASON Project online and print curricular material. www.jasonproject.org.

The JASON Project Yellowstone data http://www.jason.org/expeditions/jason8/yellowstone/oldfait2.html.

Kader, G., & Perry, M. (1994, September-October). Learning Statistics with Technology. Mathematics Teaching in the Middle School, 1, 130-36.

Konold, C. (1995). Issues in Assessing Conceptual Understanding in Probability and Statistics. Journal of Statistics Education, 3(1). Reprinted at www.amstat.org/publications/jse/v3n1/konold.html.

Konold, C. (In Press). Teaching Concepts Rather than Conventions. New England Journal of Mathematics. Draft: January 16, 2002.

Konold, C. & Pollatsek, A. (2002). Data analysis as the search for signals in noisy processes. Journal for Research in Mathematics Education, 33, 259-289. Reprinted at: http://www.umass.edu/srri/serg/papers/KonoldPollatsek2002128.pdf

Konold, C., Pollatsek, A., Well, A., & Gagnon, A. (1996). Students analyzing data: Research of critical barriers. In J.B. Garfield and G. Burrill (Eds.), Research on the role of technology in teaching and learning statistics: 1996 Proceedings of the 1996 IASE Round Table Conference (pp. 151-167). Voorburg, The Netherlands: International Statistical Institute.

Lappan, G., Fey, J., Fitzgerald, W., Friel, S., & Phillips, E. (1998). Samples and Populations. Menlo Park, California: Dale Seymour Publications.

Lock, R., Moore, T., & Roberts, R. (2000). Evaluating Statistical Analysis Packages for Introductory Statistics Teaching (p. 121). In Resources for Undergraduate Instructors Teaching Statistics.

Mackisack, M. (1994). What Is the Use of Experiments Conducted By Statistics Students? Journal of Statistics Education, 2 (1). Reprinted at www.amstat.org/publications/jse/v2n1/mackisack.html.

Mackowiak, P.A., Wasserman, S.S., and Levine, M.M. (1992). A Critical Appraisal of 98.6 Degrees F, the Upper Limit of the Normal Body Temperature, and Other Legacies of Carl Reinhold August Wunderlich. Journal of the American Medical Association, 268, pp. 1578-1580.

Mander, J., Dippel, G., & Gossage, H. (1971). The Great International Paper Airplane Book. Simon and Schuster Publishing.

Mathemagica Course on Data Analysis, 2003. The JASON Foundation for Education. Online text and teachers postings.

McClain, Kay. (1999, March). Reflecting on Students' Understanding of Data. Mathematics Teaching in the Middle School, 4, 374-80.

McClain, K., Cobb, P., & Gravemeijer, K. (2000). Supporting Students' Ways of Reasoning about Data. In M. Burke & C. Frances (Eds.), Learning Mathematics for a New Century, 2000 Yearbook. Reston, VA: National Council of Teachers of Mathematics.

McClain, K., McGatha, M. & Hodge, L. (2000, April). Improving Data Analysis. Mathematics Teaching in the Middle School. 5 (8), 548-553.

McDonald's online nutritional guide http://www.mcdonalds.com/countries/usa/food/nutrition/categories/nutrition/index.html

Mokros, J., & Russell, S. (1995, January). Children's Concepts of Average and Representativeness. Journal for Research in mathematics Education 26, 20-39.

NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/.

Bibliography

National Council of Teachers of Mathematics (2000). Principles and Standards for School Mathematics. Reston, VA: NCTM.

Parker, J., & Widmer, C. (Eds.). (1992, April). Teaching Mathematics with Technology: Statistics and Graphing. Arithmetic Teacher, 48-52.

Rothstein, R. (2001, November 28). LESSONS; Statistics, a Tool for Life, Is Getting Short Shrift. The New York Times.

Rubin, A., Mokros, J., & Friel, S. (1996). Data: Kids, Cats, and Ads. Palo Alto, CA: Dale Seymour Publications.

Russell, S. & Mokros, J. (1996, February). What Do Children Understand about Average? Teaching Children Mathematics, 360-64.

Russell, S., Schifter, D., & Bastable, V., (principle investigators) with Konold, C. & Higgins, T. (2002). Working with Data Casebook. Parsippany, NJ: Dale Seymour Publications.

Scheaffer, R. (2000). Statistics for a New Century. In Burke, M. and F. R. Curcio (Eds.), Learning Mathematics for a New Century, NCTM 2000 Yearbook, (pp. 158-73). Reston, VA: National council of Teachers of Mathematics.

Shoemaker, A. (1996). What's Normal? – Temperature, Gender, and Heart Rate. Journal of Statistics Education, 4(2). Reprinted at www.amstat.org/publications/jse/v4n2/datasets.shoemaker.html

Short, T. & Pigeon, J. (1988). Protocols and Pilot Studies: Taking Data Collection Projects Seriously. Journal of Statistics Education 6(1). Reprinted at www.amstat.org/publications/jse/v6n1/short.html.

Social Security Administration Popular Names: May 2003 http://www.ssa.gov/OACT/babynames/.

Tabletop Software and Curriculum Materials (Teacher's Guide). Published by TERC, 1995: Cambridge, MA.

Teaching Statistics, Resources for Undergraduate Instructors. Edited by Thomas L. Moore. 2000 by the Mathematical Association of America (Inc.).

Thompson (forthcoming) as cited in the NCTM Standards website: http://standards.nctm.org/document/chapter5/.

Toby, J. (1994, August 9). In War Against Grade Inflation, Dartmouth Scores a Hit. The Wall Street Journal.

Triola, M. (2004). Elementary Statistics (9th ed.). Addison-Wesley.

The UCLA School of Public Health: John Snow http://www.ph.ucla.edu/epi/snow.html.

The U.S. Environmental Protection Agency's Global Warming site: http://yosemite.epa.gov/oar/globalwarming.nsf/content/EmissionsIndividualOntheRoad.html.

The U.S. Environmental Protection Agency Fact Sheet. Mercury Update: Impact on Fish Advisories: http://www.epa.gov/ost/fishadvice/mercupd.pdf.

The United States Department of Energy's Fuel Economy Website: http://www.fueleconomy.gov/index.htm.

The U.S. Geological Survey's Water Use at Home: http://ga.water.usgs.gov/edu/qahome.html
The U.S. Department of Labor Bureau of Labor Statistics. 1998 National Occupational Employment and Wage Estimates: http://stats.bls.gov/oes/1998/oesnat98.htm.

Yellowstone National Park: http://www.nps.gov/yell/nature/geothermal/ycr/index.htm

The Weather Channel's Monthly Average Temperatures for Honolulu, Hawaii: http://beta.weather.com/outlook/driving/climatology/monthly/USHI0026.

Zawojewski, J. & Shaughnessy, J.M. (2000, March). Mean and Median: Are They Really So Easy? Mathematics Teaching in the Middle School, 436-40.

Zawojewski, J. et al. (1991). Data Gathering by Students. In Dealing with Data and Chance, Curriculum and Evaluation Standards for School Mathematics Addenda Series, Grades 5-8, pp. 4-19. Reston, Virginia: National Council of Teachers of Mathematics.