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The Editor's Corner

Welcome to Issue 79 of the *Statistics Teacher Network*. Since the last issue, there have been several changes to the editorial staff. Derek Webb, editor for the past several years, has assumed the role of associate editor, and I have assumed the role of editor. Angela Walmsley is continuing as an associate editor. We are pleased to have both Derek and Angie continuing to provide guidance. In addition, we welcome two new associate editors: Jessica Cohen, who teaches at Western Washington, and David Theil, who teaches in Nevada's Clark County School District.

We hope you enjoy this issue containing four articles that span grade levels from K–12 and present timely topics. *The Common Core State Standards: Where Do Probability and Statistics Fit In?*, by Jessica Cohen, discusses the probability and statistics topics found in the Common Core for grades K–6 and includes examples of how to implement those standards. *What's So Significant About Statistical Significance?*, by Douglas K. Rush, gives a down-to-earth explanation of statistical significance. *The Consortium for the Advancement of Undergraduate Statistics Education*, by Leigh Slauson, describes the CAUSE website and useful resources you can use in your classrooms. Finally, *Why Are Polls So Often Reported with a ±3% Caveat? A Statistics & Civics Curriculum Unit for the 2012 National Election,* by Sharon Hessney, discusses a unit that would be perfect to include in your class this fall.

As readers and users of *STN*, I would love to hear from you. Please let me know if you find these articles of interest and/or helpful to your teaching. As always, readers are encouraged to submit articles for publication. Please email me directly at *rpierce@bsu.edu.*

Best Regards,

Rebecca Pierce, Editor
Ball State University

Associate Editors

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The Common Core State Standards: Where Do Probability and Statistics Fit In?

by Jessica Cohen, Western Washington University

With forty-five states and the District of Columbia adopting the Common Core State Standards in Mathematics (CCSSM), the majority of teachers in the United States will be expected to incorporate these new standards into their practice. The CCSSM include both Standards for Mathematical Practice and Standards for Mathematical Content. The Standards for Mathematical Practice prescribe activities and habits of thinking in which students should engage while learning mathematics; the Standards for Mathematical Content prescribe what students should understand and be able to do in content domains. Considering the Content Standards in conjunction with the Standards for Practice create new and exciting opportunities for teaching and learning probability and statistics in the elementary grades.

The CCSSM set forth the following eight Standards for Mathematical Practice, describing the content-neutral experiences students should have while engaging in mathematics:

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

A specific task would likely not focus on all eight mathematical practices simultaneously. However, at every grade level and within every content domain, tasks can be implemented to create opportunities for students to engage in a broad spectrum of the practices.

The Content Standards for elementary grades (K–6) detail the conceptual and procedural knowledge students should develop in mathematics. The K–5 standards include a measurement and data strand, for which some of the standards are directly connected to probability and statistics. The sixth-grade standards include a statistics and probability strand, for which all the standards are relevant to probability and statistics content. Identifying the content standards that include content in data and chance; the opportunities to incorporate the mathematical practices in those standards; and rich, meaningful tasks to expose the content and practices is an important facet of transitioning to CCSSM-compatible practice. Here, we identify the elementary content standards relevant to probability and statistics, and, for selected standards, suggest tasks and classroom practices to facilitate incorporation of the mathematical practices.

Kindergarten

The Kindergarten Measurement and Data standards include two standards relevant to data analysis. Kindergarten students should be able to describe and compare the measurable attributes of objects (K.MD.1, 2) and classify objects into categories and sort the categories by count (K.MD.3).

Students can build understanding of classifying into categories and sorting by count and engage with some of the mathematical practices through a sequence of related tasks. For example, students may begin by classifying and arranging cubes, such as Unifix, by color. The cubes can be physically connected in stacks, creating a concrete bar graph, and the relative heights of the stacks are easily comparable visual representations of the counts of each color of cube. Students may just organize objects, like small colored chips, into groups by color, and if the counts of each color are sufficiently different, students will be able to make statements regarding which color of chips occur with greatest frequency and which occur with the least frequency.

Next, students may use cubes or other small counters to represent counts of real characteristics or objects—such as the colors of students' shirts—sort the cubes into colors, and arrange them so they can make statements about which color shirt is most or least common.

In each of these tasks, students will engage with at least two of the mathematical practices. Students will be required to reason quantitatively (MP.2) as they use counts or compare sizes of stacks to organize their representations and make decisions about relative quantities. When students use cubes or other models to represent real quantities, like the colors of students' shirts, and make statements about relative quantities, they are "attending to the meaning of quantities" (CCSSM), an aspect of reasoning quantitatively.

Students also will model with mathematics (MP.4) when using the cubes to create bar graph–type models of data. Using cubes or other models to represent real quantities is an early step in understanding how to model mathematical ideas. In addition to the two primary mathematical practices inherent in the tasks, teachers may choose to have students engage in constructing arguments (MP.3) through classroom discussions in which students explain their choices in arranging representations or deciding least and greatest counts.

First Grade

The Grade 1 standards include one that is particularly relevant to probability and statistics. First-graders should be able to represent and interpret data, with interpretations focused on the size of the data set and the relative sizes of categories (1.MD.4). Students may build this understanding by collecting, representing, and analyzing data about their classmates. A teacher may guide a class in collecting data by posing a question with a limited number of responses and counting the responses to each category. For example, students may be asked which ice cream flavor they would choose—vanilla, chocolate, or strawberry—and, with help from the class, the teacher could take an accurate count of the number of students choosing each flavor. Students could then represent the counts using physical objects, like colored chips, or by coloring in graph paper appropriately.

Carefully chosen questions can create opportunities for students to interpret the ice cream data and make statements about the class. First-grade students can respond to more specific comparison questions than kindergarteners, extending beyond comparing relative sizes. For example, first-graders may be asked to determine how many more students prefer vanilla ice cream than prefer chocolate. Students' quantitative skills and number sense in first grade make it possible to provide precise answers to "more than" or "less than" questions.

When representing data, students engage in mathematical modeling (MP.4), and when students are encouraged to make decisions about the representations they will choose, they develop meaningful understanding of appropriate modeling. The interpretation of data requires students to reason quantitatively (MP.2), but when first-grade students decide exactly how many more students prefer one flavor of ice cream over another, they are practicing attending to precision (MP.6). Finally, as with most tasks, if the teacher chooses to facilitate a whole class discussion during which students explain what their representations indicate or how they determined how many more students like chocolate than strawberry ice cream, opportunities to construct arguments and critique the arguments of other students (MP.3) develop.

Second Grade

The Grade 2 content standards emphasize students' experiences with more formal and organized representations of data. Students are expected to create frequency graphs of measured lengths of objects (2.MD.9) and picture and bar graphs to answer comparative questions about the data represented (2.MD.10). Second-grade students can consider more categories of data than first-grade students and make a wider range of statements about the data and their representations.

The second grade standards prescribe that students will create frequency graphs using data generated from measuring lengths. A teacher may choose to provide a variety of objects for students to measure, carefully choosing the objects so the lengths are very close to unit lengths and that the range of unit lengths represented is limited. Students could represent these data using dot plots, representing the frequency of each measurement.

When creating picture or bar graphs, the standards suggest that, at most, four categories of data should be represented. Students could collect class data with possible responses limited to four categories. For example, students may choose a favorite color from red, blue, green, and purple. Favorite color data is useful because of the variety of representations possible. Students may choose to model the data using appropriately colored cubes, carefully arranging the cubes in stacks. This enables an easy transition to graph paper, where students can translate the physical representation to a graphical one by coloring in a square on the graph to represent every cube in the physical representation. Students may have access to colored stickers that they can arrange on paper in a representation of a dot plot, similar to the one generated with measured lengths. However, it is critical that any stickers used are of the same size so the representation is not distorted. An in-class discussion in which different representations are discussed can help students draw connections between graphical representations and begin to develop ideas of scale and the importance of consistency in representations.

The variety of questions second-grade students can answer from their representations is broader than in first grade. For example, students may be asked how many of their classmates choose blue or green as their favorite color, how many more students choose blue than choose green, or how many students did not choose red.

Once again, the second-grade data standards provide opportunities for students to model mathematics (MP.4) and reason quantitatively (MP.2). Attending to precision (MP.6) becomes significantly more important in the second-grade standards, as students begin to work with precise graphical representation requiring attention to scale and consistency. As students build frequency plots, picture graphs, and bar graphs, opportunities exist to look for and make use of structure (MP.7). Students may observe that they can count the number of data points in a category and build a bar whose height corresponds to that number, rather than creating a bar one square at a time.

Guided classroom discussions during which students explain, justify, and draw conclusions from their representations allow students to build arguments and critique other students' arguments (MP. 3).

Third, Fourth, and Fifth Grade

The grades 3, 4, and 5 standards extend the Grade 2 standards through precision. Students continue to create similar plots, but focus on scales, more categories of data, finer-grain measurement data, and the more meaningful data analyses students can perform as their computational skills improve. Third-grade students create bar graphs with horizontal and vertical scales, where a single box in the bar might represent more than one data point (3.MD.4) and build dot plots from measurement data that include measurements in increments of half and quarter inches (3.MD.5). Fourth-grade students represent measurement data in increments of eighth inches in dot plots and answer questions about these data requiring fraction computation skills, such as determining the range of measurements in the data set (4.MD.4). Fifth-grade students make dot plots of the same types of measurement data represented in the fourth-grade standard, but can perform more complex analysis of these data (5.MD.2). For example, fifth-graders might be guided to consider the total length the data represent, or conjecture about the median length of the data (although they would not use the precise terminology).

The third-, fourth-, and fifth-grade standards require students to attend to precision (MP.6) as they encounter and represent finer-grain data and use more detailed computations to analyze those data. Modeling (MP.4) and reasoning quantitatively (MP.2) continue to be at the forefront of students' experiences with data, and classroom structure allows opportunities for students to create and critique arguments (MP.3). As the analysis of data becomes more meaningful, students have opportunities to make sense of problems and persevere in solving them (MP.1). For example, if students are learning to use a scale in which a unit represents a quantity greater than one, determining how to represent data and quantitatively comparing the data represented may be a problemsolving task. For students who have not yet learned about measures of central tendency, drawing conclusions about the center of a data set from a graphical representation requires problemsolving skills.

Sixth Grade

The Grade 6 standards in statistics and probability emphasize variability and distributions of data. Students' understanding of variability should include knowing when a question is a statistical question (6.SP.1), recognizing variability in a visual representation of a data set (6.SP.2), and knowing how to represent the variability of data with a numerical value (6.SP.3). Students should be able to create visual representations of data that represent the distribution (6.SP.4). They should be able to analyze numerical data for number of data points, type of data being measured, and measures of center, including choosing the appropriate measure for the data (6.SP.5).

All these standards could be combined into a single project, enabling students to deeply and meaningfully consider data. Students could begin by choosing an appropriate question to survey classmates or schoolmates, with attention to the fact that the question must provide for a range of possible responses. Students could collect and decide how to represent the data, with representations like box plots, dot plots, and bar graphs. Requiring students to represent the data in two different graphs would allow for comparisons and reflections about observing variability and center. Students could write a brief report about their data, describing the data collection and representation and quantifying the variability and center of the data.

Once again, students are modeling mathematics (MP.4) and reasoning quantitatively (MP.2). More detailed data representations and analyses require students to attend to precision (MP.6). Furthermore, as students develop a broader range of graphical representations of data from which to choose, choosing the most meaningful representation or the suitable measure of central tendency requires students to use appropriate tools strategically (MP.5). As students make more choices about how to represent and analyze data, they are engaging in more meaningful problemsolving (MP.1) and creating opportunities for rich classroom discussions as they defend their choices and consider the choices of other students (MP.3).

Where Is Probability?

Much of what is contained in the CCSSM related to probability and statistics is similar to what previously appeared in the NCTM standards; however, the CCSSM for K–6 represents a paring down of the NCTM standards (NCTM, 2000). The CCSSM are highly data focused, with emphasis on representing and interpreting data. Data interpretation involves comparing quantities and considering variability and central tendency. There is no discussion in the K–6 standards of likelihood, calculating experimental probabilities from a data set (e.g., What is the probability that a student in our class prefers chocolate ice cream?), extrapolating from a data set (e.g., How likely do you think it would be that a student in Mrs. Bentley's class prefers chocolate ice cream?), or calculating theoretical probabilities (e.g., If we have six gallons of chocolate ice cream and four gallons of vanilla and I take a scoop from a container without looking, how likely is it that the scoop will be chocolate?).

Students as early as kindergarten can begin thinking about likelihood by considering events in their everyday lives (Van de Walle, Karp, and Bay-Williams, 2010). Doing so sets a powerful and important foundation for future understanding of probability.

The CCSSM in Measurement and Data and Probability and Statistics consider data content in connection with the computational skills and number sense students are learning in each grade. For example, students in grades 3 and above begin representing data sets that include fractional measurements. As they develop skills with and understanding of fractions, they explore data sets using analyses that require those new skills. At the same time, students in grades 3 and above begin considering the meanings and representations of fractions, decimals, and percents. It seems teachers may have opportunities to use probabilistic situations as one of the many contexts in which they develop meanings for these numbers. For example, in third grade, students should understand the unit fraction 1/b as one piece out of b equally sized parts of the whole (3.NF.1).

Of the many models and contexts teachers use to represent unit fractions, it may be valuable to future understanding to use a probabilistic example, like equally sized segments in a spinner, and even connect the size of the fraction to likelihood.

Without finding ways to incorporate ideas of probability and likelihood into the CCSSM in other areas, students will not encounter probability until Grade 7. Under the NCTM standards, students would consider likelihood informally as early as kindergarten and more formally as early as third grade. However, teachers can incorporate probability concepts into the CCSSM without including an additional unit, or even lessons, to their instruction. Rather, incorporating probabilistic ideas into instruction in other areas can help expose students to those ideas earlier and prepare students to consider likelihood more deeply when they officially encounter it in Grade 7.

Implementing the CCSSM will require teachers to address both the new content standards and the mathematical practices. Choosing rich tasks with an emphasis on sense-making to address the content and engaging in meaningful classroom discourse around the tasks will naturally provide opportunities for students to engage in the mathematical practices. Teachers will certainly have to make some modifications to their practice to address the new standards, but rich problemsolving tasks focused on statistical topics paired with a focus on conceptual understanding and reasoning will still be a good foundation for student learning.

Further Reading

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Van de Walle, J., A. Karen Karp, and J. M. Bay-Williams. 2010. *Elementary and middle school mathematics: Teaching developmentally*. 7th ed. Boston: Pearson Education.

We invite your school to join in an international collaboration among schools, colleges, societies, and other organizations around the globe to celebrate 2013 as the International Year of Statistics (*www.statistics2013.org*).

The purpose of this International Year of Statistics (Statistics2013) is to promote the importance of statistics through the combined energies of societies and organizations worldwide to the broader scientific community, business and government data users, the media, policymakers, employers, students, and the general public. As noted below, there is a specific emphasis on promoting the importance of statistics to young people.

The goals of Statistics2013 include:

- 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

To register your interest in participating, go to *www.statistics2013.org/join.cfm*. When you register, you will provide the name of a contact person who will serve as a liaison for your school. The liaison will help the International Year of Statistics Steering Committee know what kinds of activities you might be considering that relate to the goals of Statistics2013, and the steering committee will keep your liaison informed of activities being planned elsewhere.

There is no charge or obligation to register or participate in the International Year of Statistics.

There are numerous ways a school might participate: bringing in local experts to speak about statistics at the high school, entering statistics poster and project competitions, participating in the international Census at School classroom project, using information from the website in lessons, etc. The flyer available at *www.amstat.org/education/pdfs/EducationResources.pdf* describes additional free K–12 statistics education resources. We hope to build a network of schools that can share information about how such activities can help meet the objectives of the Common Core State Standards for Mathematics.

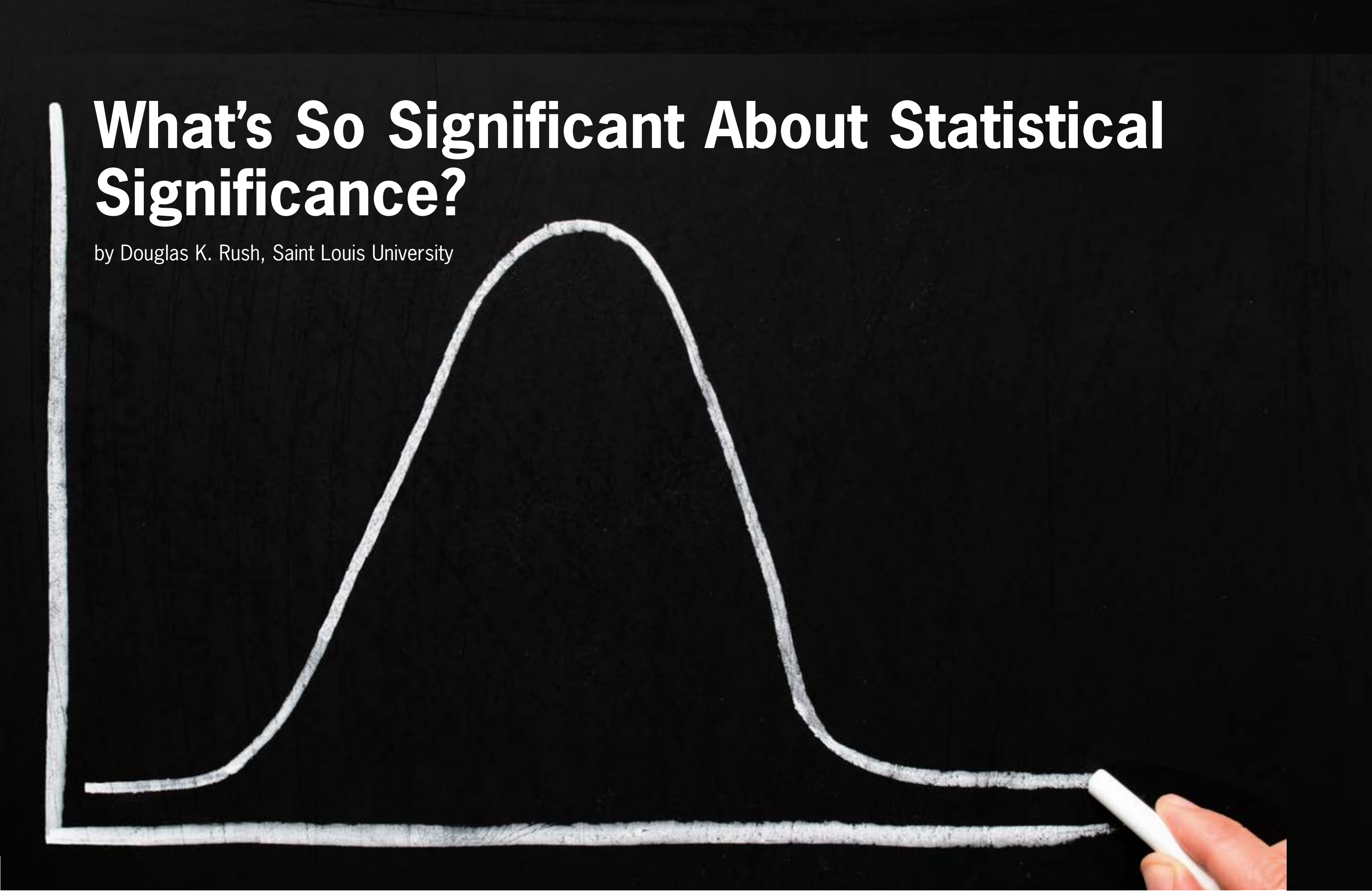
Thank you.

Ron Wasserstein, Executive Director, American Statistical Association

International Year of Statistics Steering Committee: Richard Emsley, University of Manchester; Adam Jakubowski, Nicolaus Copernicus University; Denise Lievesley, Kings College London; David Madigan, Columbia University; Vijay Nair, University of Michigan; Sastry Pantula, North Carolina State University; Ada van Krimpen, International Statistical Institute

What's So Significant About Statistical Significance?

by Douglas K. Rush, Saint Louis University



Have you ever attended a professional development meeting at which one of your colleagues or a presenter referred to a recent article containing "statistically significant" findings about a new curriculum? Did you wonder what statistical significance means, or did you assume the new curriculum must have been better? C. J. Torgerson, in "Publication Bias: The Achilles' Heel of Systematic Reviews?," cautions that there may be a social science journal publication bias in favor of research articles that report statistically significant findings. Some authors suggest that social science researchers are similar to big game hunters. Where hunters seek animal quarry, the social science researcher is hunting for the elusive asterisk. When a social science researcher's findings yield a statistically significant relationship, difference, or association, the researcher can affix one or more asterisks to the results and thus improve the odds of her study being published or the new curriculum being adopted.

This leads me to ask the question posed in the title of this article: What's so significant about statistical significance? What does statistical significance really mean? Does a finding of statistical significance provide justification to make policy changes based on the statistically significant results of the study? Before I answer these questions, consider the following hypothetical education policy issue.

Suppose a large suburban school district is approached by a salesperson for a computer software program that is targeted at improving mathematics achievement scores for third-graders. The salesperson assures the district's administration that other school districts using the software have shown statistically significant gains in third-grade math achievement scores as measured on national standardized tests.

Our hypothetical district's administration understands that many factors may affect third-grade math achievement scores. The administration also believes the cost of implementing a new third-grade math curriculum based on the computer-assisted math software would require purchasing additional computers and the software, as well as necessitate retraining the teachers and staff to use the software. The cost of such a change in curriculum would be approximately $1 million in the first year of implementation. The costs would be much greater if the district expands the computer-assisted math curriculum to all elementary grades. On the other hand, the district is under pressure to improve math achievement scores to meet statewide assessment criteria. Should the district implement the computer-assisted math instruction curriculum?

The district proposes to conduct a pilot test to help evaluate the software and aid in making the decision about implementing the new curriculum. It selects six of its 12 elementary schools at random to participate in the study. Each of the selected schools has six third-grade classrooms. Three of each of the selected school's classrooms are randomly assigned to the "computer-assisted" math instruction group and three are assigned at random to the "traditional" math instruction group. Each classroom has 20 third-graders. Thus, we have a quasi-experimental study in which there are 360 total students in the 18 classrooms in the control group (traditional math instruction) and 360 total students in the 18 classrooms in the treatment group (computer-assisted math). The software vendor lends the school district sufficient computers to conduct the study and trains the teachers in the use of the math instruction software.

The district pre-tests each third-grader's math achievement prior to the beginning of the semester and post-tests each student's math achievement at the end of the semester. Analyzing the results using ANCOVA (analysis of covariance), the district finds the group of students who received computer-assisted math instruction using the vendor's software has, in fact, demonstrated statistically significant mean gain in math achievement when compared to the mean math achievement gains of the students who received instruction based on the district's traditional math curriculum.

Do the results of the pilot study justify the district's purchase of the computers and software? Do the results justify the implementation of the new computer-assisted math curriculum? Maybe, maybe not. Let's return to the question posed earlier: What's so significant about statistical significance? The answer might surprise you.

Statistical significance means the findings are "not likely due to chance." A finding of statistical significance tells a researcher little or nothing about the "practical significance" of the findings. J. Wilkinson and the American Psychological Association, in "Statistical Methods in Psychological Journals: Guidelines and Explanations," caution that every finding is statistically significant if the sample size is large enough. Practical significance, on the other hand, is determined by the "effect size" of the results. Effect sizes can be stated in "raw" score differences, "percentage" differences, or in "standardized" score differences based on standard deviation units.

In *SPSS Survival Manual*, J. Pallant points out that effect sizes are sometimes called "strength of association." In our example above, the raw effect size can be expressed as the actual difference in scores on the math achievement tests when comparing the two groups. It also may be expressed in terms of the difference in percentile gains or the difference in the adequate yearly progress (AYP) when comparing the two groups.

Let's now add another bit of information about the results of our pilot study. We know there was a statistically significant increase in the mean gain on math achievement scores in our computer-assisted treatment group when compared to the mean gain in math achievement scores in the traditional math instruction control group. The difference detected, the effect size of the study, was only one-twentieth of the district's AYP target gain on math achievement scores. While the finding was statistically significant due to the large number of students in the study, the practical significance, or effect size, of only a small percentile gain in math achievement scores may not justify the $1 million cost of implementing the computer-assisted math curriculum.

Another way to think about practical significance is to think in terms of what is doable, manageable, or affordable. It is a policy- and budgetary-based decision. As shown in the previous example, the school district may see a small rise in mathematic achievement scores if it purchases and implements the new computer-based mathematics instruction curriculum. However, from a policy and budgetary standpoint, the small gain in achievement scores probably does not justify the expense associated with implementing the new curriculum.

Keep this in mind the next time you hear a presentation or read an article. A finding of statistical significance tells you little beyond the fact that the finding is not likely due to chance or error. It is the effect size that lets you know whether the statistically significant findings have any practical significance.

Further Reading

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The Consortium for the Advancement of Undergraduate Statistics Education

by Leigh Slauson, Capital University

CAUSE, the Consortium for the Advancement of Undergraduate Statistics Education, is a national organization whose mission is to support and advance undergraduate statistics education. While it is an organization officially dedicated to the undergraduate teacher and student, the overlap in content of the AP Statistics course and many other high-school courses with the content of the introductory college statistics course make many of the resources available through CAUSE useful to the high-school statistics teacher.

One of the most important services CAUSE provides is their website: *www.causeweb.org*. In 2006, when CAUSE was founded, there was no centralized location for undergraduate statistical education resources. The website was conceived as a one-stop shopping site for lecture ideas, labs, data sets, activities, cartoons, and research. The website now also houses announcements about professional development opportunities; workshops and recordings of a bimonthly webinar series; and information about USCOTS, the biennial United States Conference on Teaching Statistics, and eCOTS, the inaugural Electronic Conference on Teaching Statistics. It is possible, but not necessary, to register an account on the website. Some of the benefits of creating an account include saved searches that can email an instructor updates when new matching resources are added; access to un-watermarked cartoons; and the ability to add comments, rate resources, and receive recommendations (similar to *Amazon.com* or *Netflix.com*).

Resources

At first, the vast amount of resources contained on the website may seem daunting. Fortunately, there are a few tools to help. You can browse the resources by statistical topic (e.g., *p*-value), pedagogical method (e.g., cooperative learning), or material type (e.g., laboratories). An example search under "Browse by Statistical Topic: Data Presentation" yields the following as the first three resources:

Chance Teaching Aids

This is a site that contains many types of material that can be used in teaching about chance and probability. Lesson plans, syllabi, suggested activities, and data sets are available. *www.dartmouth.edu/~chance/teaching_aids/teaching_aids*

David C. Howell's Statistical Homepage

This set of pages contains statistical material compiled by David C. Howell that may be of interest to faculty and students. Some of it goes along with his textbooks. *www.uvm.edu/~dhowell/StatPages/StatHomePage.html*

Histogram Explorer

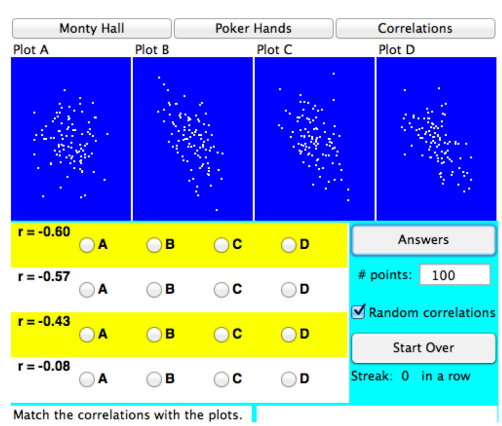
This applet is designed to allow users to explore the relationship between histograms and the most typical summary statistics. The user may choose from several types of histograms. A complete list is at *www.ratrat.com/histogram_explorer/he.html*.

Clicking on the title of a resource leads to the appearance of a new page with a more complete description of the resource, including the resource type (e.g., collection, lesson plan, applet, etc.), the other statistical topics the resource might address, and the intended audience. Resources marked with ** have been peer reviewed by statistics educators on *www.merlot.org* and generally are listed first. This website hosts online resources for all subjects, not just statistics, but partners with CAUSE to host the peer reviews of statistics resources. All statistics resources reviewed and catalogued by MERLOT are indexed on CAUSE.

Applets

Some of the most useful resources on CAUSE are the applets that provide visual demonstrations of statistical concepts. For example, the Guess the Correlations game, submitted by the statistics department at the University of Illinois, randomly generates four scatter plots and four correlation coefficients. Students must then match the plots to the coefficients. The game provides a fun way for students to connect the concept of r to a scatter plot. The website also keeps track of how many answers in a row a user gets correct, so the instructor can turn the activity into a competition among students.

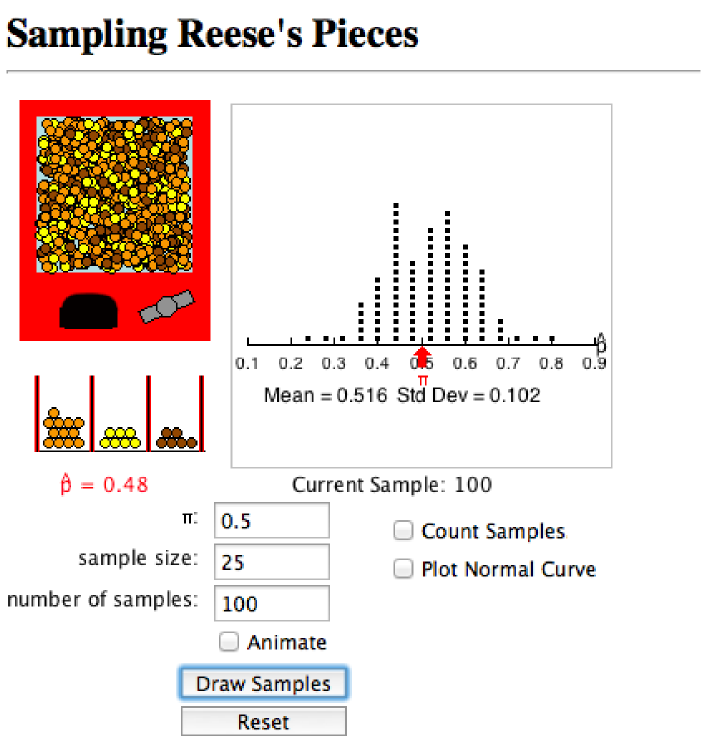
Another great set of applets, developed by Allan Rossman and Beth Chance from Cal Poly, are indexed on CAUSE, along with much of their other work in statistics education. These applets cover topics from data presentation to randomization tests. For an introduction of the sampling distribution of a sample proportion, one of my favorite applets to use is the Reese's Pieces applet. An instructor can bring real Reese's Pieces into class for



a hands-on introduction to the idea of repeated samples. Then, the applet allows the instructor to repeat the process many, many more times with animation. This allows students to watch the sampling distribution as it is being constructed.

Tagged Resources

As each resource is added to the CAUSE database, it is tagged with helpful information such as material type, statistical topic(s), and intended user role. When an instructor conducts a search, he/she can click on the more info button and look for Audience. Many resources are specifically tagged High School. An instructor can then click on that High School tag and it will bring up a list of resources that have been identified as



potentially appropriate for the high-school level. However, there are many more resources beyond these in the CAUSE database that could be useful to high-school teachers, so do not hesitate to search beyond the High School tag. The database and website are undergoing revisions behind the scenes, and there is a new resource editor who is working to update the resource tagging.

Fun

If you search under material type, one of more unique categories is the Fun section. Here you will find jokes, poems, song lyrics, videos, cartoons, and more—all related to statistics in some way. Every two years, CAUSE hosts an A-Mu-sing contest in conjunction with the U.S. conference on teaching statistics to add to this database. Certainly these resources can provide enjoyment and levity to your classroom, but they "can also yield deeper engagement when accompanied by thoughtful questions," according to Lawrence Lesser and Dennis Pearl in their *Journal of Statistics Education* paper, "Functional Fun in Statistics Teaching: Resources, Research, and Recommendations."

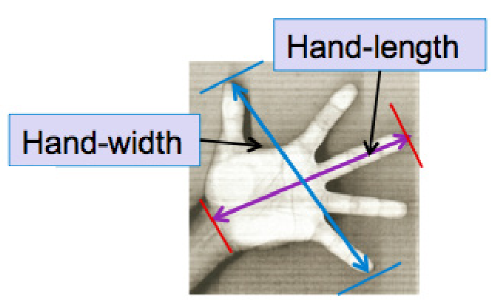
Activity Webinars

Each month, CAUSE hosts two webinars. The activity series hosts a statistical educator talking about an activity that he/she has developed and used in his or her own classroom. The live webinar happens on the fourth Tuesday of every month at 2:30 p.m. EST; however, every webinar is recorded and can be downloaded and watched at a later date. By attending the live webinar, participants have the chance to converse with the author of the activity.

Many of these webinars feature activities that can be implemented in either a high-school or college classroom. One of my favorites , "Teaching Statistics with Chocolate Chip Cookies" with Herbert Lee of the University of California at Santa Cruz, describes a fun way to introduce concepts of sampling distributions and hypothesis tests by taking samples of a national brand of cookies and counting the average number of chips per cookie. Even the method of counting the chips leads to interesting discussions, since not all chips are visible from the outside of the cookie. The presenter of this activity noted, based on his own classroom experience, that some students carefully break their cookies apart, while others "pulverize" their cookies. *www.causeweb.org/webinar/activity/2009-04*

Carl Lee, from Central Michigan University, presented another great activity for the webinar series dealing with bivariate data. Students are asked whether they think hand size can predict a person's height. After a discussion of how to measure hand size, students can collect their class data and add it to a real-time online database hosted by Central Michigan. From there, a teacher can introduce the topics of scatter plots, correlation, linear regression, and residual plots.

This investigation allows students to deal with some of the issues related to data collection and data entry. It was specifically designed to meet recommendations for active learning set forth in the GAISE (Guidelines for Assessment and Instruction in Statistics Education) report. The website also lists several activities that cover topics from distribution shapes to estimation. *http://www.causeweb.org/webinar/activity/2009-11/*



Each activity webinar hosted by CAUSE brings together all the information in one place that a teacher might need to implement the activity themselves. This includes handouts or assessment questions and links to websites when it is appropriate.

The second webinar series that CAUSE hosts, the teaching and learning series, deals with bigger picture ideas such as how to teach statistical concepts in an inverted classroom (The inverted classroom is the currently popular educational model that entails students listening to podcasts of lectures at home and doing homework or problemsolving in class.) or how to implement more reading and writing in an introductory statistics course. These webinars also focus on issues of course design and research topics. Some of these webinars also may address a topic of interest to an AP or high-school teacher.

Subscribing to CAUSEweb.org

If you would like to subscribe to updates from CAUSE, there are several ways to do so. First, CAUSE has a twitter account (*@causeweb*). All newly added resources and webinar announcements are posted there. You also can subscribe to the RSS feed for webinars (*www.causeweb.org/webinar*) or find them in the iTunes store. Last, you can be added to the email listserv by emailing your name and email address to *jscott@causeweb.org*.

Statistics instructors have traditionally been very willing to work collaboratively, and CAUSE aims to help facilitate that collaboration through our website and other professional development activities. We encourage all involved in the teaching of high school/college-level statistics to explore the resources the website has to offer and sign up for updates.

Further Reading

Lesser, L., and D. Pearl. 2008. Functional fun in statistics teaching: Resources, research, and recommendations. *Journal of Statistics Education* 16(3). *www.amstat.org/publications/jse/v16n3/lesser.html*

Parry, M. 2012. Debating the 'Flipped Classroom at Stanford.' *The Chronicle of Higher Education. http://chronicle.com/blogs/wiredcampus/debating-the-flipped-classroom-at-stanford/34811?sid=wc&utm_source=wc&utm_medium=en*

Teaching Statistics with Chocolate Chip Cookies, with Herbert Lee, University of California at Santa Cruz. *www.causeweb.org/webinar/activity/2009-04*

Hand Size Versus Height: A Real-Time Activity, with Carl Lee, Central Michigan University. *www.causeweb.org/webinar/activity/2009-11*

Guess the Correlations Game. *www.causeweb.org/cwis/index.php?P=FullRecord&ID=363*

Rossman Chance Applet Collection

www.causeweb.org/cwis/index.php?P=FullRecord&ID=779

GAISE report*, www.amstat.org/education/gaise*

Why Are Polls So Often Reported with a ±3% Caveat?

A statistics and civics curriculum unit for the 2012 national election

by Sharon Hessney, John D. O'Bryant School of Mathematics and Science

If you have time to teach a unit on the statistics of polling, the upcoming 2012 national election should not be neglected in a high-school math class. Based on the author's previous experience teaching such a unit for the 2008 national election, this article can provide the basis for your unit.

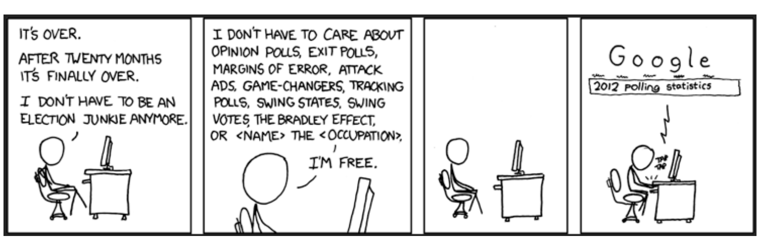
During the weeks leading up to the election, we will hear statistical terminology over and over again that goes something like the following:

> *The Serious Poll announced today that Candidate Green is leading Candidate Purple. The poll shows that likely voters favor Green 43% to 41%, plus or minus 3%. There are still a large number of undecided voters that could swing the election.*

If you ask most anyone, few would be able to explain what the ±3% means, let alone describe how the poll was taken. Most would just conclude that Green is ahead. Statisticians know how nuanced polling information can be and the importance of having everyone understand these nuances.

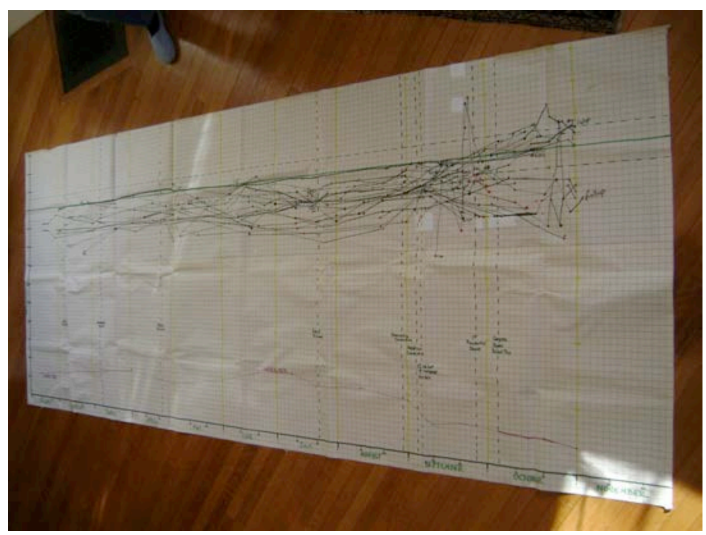
First, statisticians know that unbiased polling strategies need to be employed for valid conclusions to be drawn. They also know that the sample size is usually about 1,000. They also are 95% confident that the true proportion of voters that favor Candidate Green is captured in the interval (40%, 46%)—Green is statistically leading in the poll, but has not captured the election. Thus, the candidates are in a statistical dead heat given the poll's margin of error of 3 percentage points.

In the fall of 2008, I used the presidential election as the basis of a two-month unit on statistics and polling in my discrete math class. The class consisted of seniors who were not taking Advanced Placement math. Some were even eligible to vote in the November election. Daily news events were used to supplement class discussions. Following my lead, students were motivated to listen to the news about the election and also saw how it was incorporated into our learning. By November 4, the day of the election, they were fully engaged and, on election night, they were ticking off the electoral votes needed to top 270.

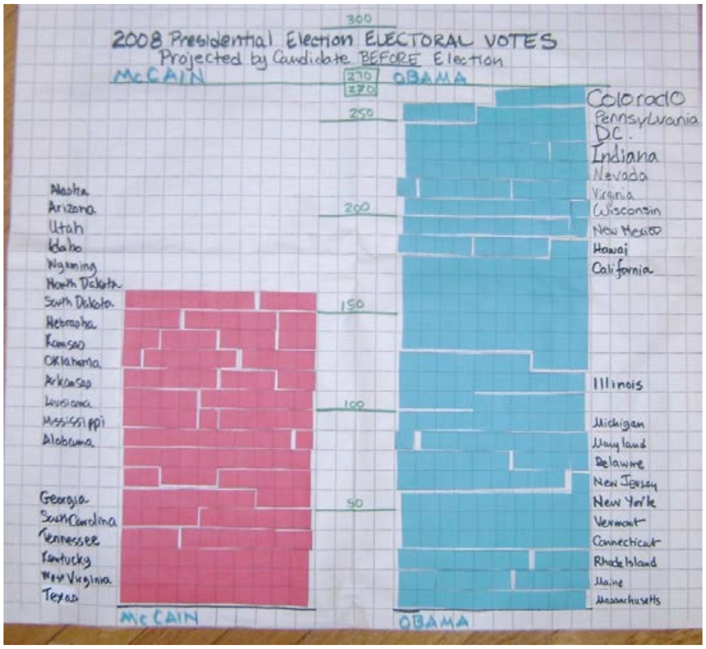


Permanent link to this comic: *http://xkcd.com/500/*

The main class product was a 5-foot by 10-foot graph of pollster numbers for the 10 months that led up to the election. The dates January 1, 2008, through November 4, 2008, were on the x-axis. The pollsters' proportions of voters for Barack Obama, John McCain, and those undecided were on the y-axis with bold, horizontal lines at 50% as well as at 47% and 53% (i.e., 50% ± 3%). Pairs of students were assigned to different pollsters, including ABC, Pew, and Zogby. Weekly, they marked the proportions for McCain in red and Obama in blue. Throughout the 10-month period including Super Tuesday, debates, and the mortgage bailout, significant events were marked by vertical lines through the date. The students saw how polling proportions changed over time, but as the election approached, eventually converged toward 50%. This visual display was a constant reminder of how the measurement of public opinion varied from pollster to pollster and from week to week. It also allowed students to reflect on what we were learning and how it related to the selection of our next president.



Another class product was a bar graph of projected electoral votes for each candidate. Students were assigned to follow polling in each state. When there was a consensus based on polling that a state would fall for a candidate, the student glued the number of electoral votes, represented by squares, to the candidate's bar. Slowly, the bars edged toward the needed 270 electoral votes to capture the presidency. However, the bars did not reach 270 before the election. With neither candidate at 270, there was suspense in the classroom on election night as the returns came in. Each student had a map of the country with the number of electoral votes given each state. As the winners were announced by state, they colored in the state—red for McCain and blue for Obama—and kept a cumulative total of votes.



The following is a brief explanation of what our class studied in order to master the concepts of variability, margin of error, sample size, and confidence interval. Understanding these concepts is necessary to explaining why polls say "± 3%" and why a sample size of about 1,000 is sufficient to estimate the population's preference. Typically, these topics would be spread over a full year of high-school statistics; however, we had to complete the unit by early November. To do this, I relied on basic data collection with analysis, simulations, and explanations from news articles. Though the students did not have a strong mathematical understanding of these concepts, they grew comfortable with how polls should be properly conducted and how to interpret the results.

Why Are We Learning These Topics?

We had a class discussion at the beginning of fall about the upcoming election on November 4. I asked the class the following questions: What is a poll? Why are polls taken? How are polls carried out? Together, we read the *New York Times* article, "How the Poll Was Conducted," that accompanies all of the *Times'* polls. (The following explanation is from that year's election and tells how the poll was adjusted for the high usage of cell phones.)

> The latest *New York Times*/CBS News poll is based on telephone interviews conducted March 7 through March 11 with 1,009 adults throughout the United States. Of these, 878 said they were registered to vote.
>
> The sample of land-line telephone exchanges called was randomly selected by computer from a complete list of more than 72,000 active residential exchanges across the country. The exchanges were chosen to ensure that each region of the country was represented in proportion to its share of all telephone numbers. Within each exchange, random digits were added to form a complete telephone number, thus permitting access to listed and unlisted numbers alike. Within each household, one adult was designated by a random procedure to be the respondent for the survey.
>
> To increase coverage, this land-line sample was supplemented by respondents reached through random dialing of cellphones. The two samples were then combined and adjusted to ensure the proper ratio of land-line-only, cellphone-only, and dual phone users. Interviewers made multiple attempts to reach every phone number in the survey, calling back unanswered numbers on different days at different times of both day and evening.
>
> In theory, in 19 cases out of 20, overall results based on such samples will differ by no more than three percentage points in either direction from what would have been obtained by seeking out all American adults. For smaller subgroups, the margin of sampling error is larger. For example, for the 301 self-described Republican primary and caucus voters, the sampling error was plus or minus six points. Shifts in results between polls over time also have a larger sampling error.
>
> In addition to sampling error, the practical difficulties of conducting any survey of public opinion may introduce other sources of error into the poll. Variation in the wording and order of questions, for example, may lead to somewhat different results.
> Complete questions and results are available at *www.nytimes.com/polls*.

How Are Polls Conducted?

There are many questions that can be raised regarding how a poll was conducted. For example, why did this poll ask 1,084 adults, and why was this enough respondents? How do we know enough individuals from different regions, age groups, etc. were selected? What about cell phone polling? (Though the issue of the polling of cell phones was raised in 2008, it was not recognized as important of an issue in the 2008 election as it is now.) Why ask "likely" voters? Where did the "3% points in either direction" come from? What is a "margin of error"? What kind of "practical difficulties" would a pollster have? *Newsweek's* "The Slippery Art of Polling," by Sharon Begley (October 6, 2008), answers these and other questions in depth.

As a class, we compiled a long list of questions. I let them know we would be answering them between now and the election. The students never asked, "When will we ever use this?" The applications were obvious. The gauntlet was down! We needed to find out how to read polls before November 4. The students were ready to be engaged.

Center, Shape, Spread, and Unusual Data

To learn how to describe data, students collected it on themselves. This included quantitative data such as how many siblings they have, how long it took them to get to school that day, and how much money they have in their pockets. They also collected categorical data such as political affiliation (conservative, liberal, or undecided), mode of transportation students used to get to school, and modes of communication they use (cellphone calls, land line, texting, etc.).

The students were very interested in this data because it was about them. We used it over the next two weeks to learn the concepts of center, shape, spread, and unusual data. For categorical data, we learned how to make and interpret frequency tables, contingency tables, bar graphs, segmented bar charts, and pie charts. For quantitative data, we learned how to make and interpret dot plots, histograms, box plots, and stem plots. From the graphs, we learned how to calculate and derive an understanding of median, quartiles, and interquartile range as well as how they related to mean, standard deviation, range, spread, and outliers.

To understand properties of the normal distribution, students generated sums of 100 rolls of two dice, as simulated with a graphing calculator. They then graphed the data and noticed that approximately 68%, 95%, and 99% of the data are within $\mu\pm1\sigma$, $\mu\pm2\sigma$, and $\mu\pm3\sigma$, respectively. Following this, we had an in-depth discussion of the normal distribution. Included was the derivation of the concept that 95% of data is within about 2 standard deviations.

The class then transitioned from student-generated data to polling data. Picking a September poll in which McCain was leading at 61%, each student did a simulation using technology of sampling 100 individuals with a probability of success of 0.61. (Alternatively, this simulation can be done with a bag containing 100 slips of paper—61 red for McCain and 39 blue for Obama. Pick 100 slips with replacement, summing the number of red and then dividing by 100 to determine the proportion for McCain.) Of course, what they discovered was not only did they not all get 61% for McCain, but their answers varied considerably, but were clustered close to 61%. In asking what they thought happened, the students developed the concept that samples vary and, therefore, we cannot exactly determine the percentage for McCain from any particular sample.

How Are Polls Constructed?

With each poll we studied, we asked the following "5 Ws + 1 Hs" questions: WHO is being polled? WHAT is the pollster asking? WHEN was the poll done (and what was happening right before then)? WHERE was the poll taken? WHY did this pollster take the poll (who paid them)? HOW was the poll taken? From the answers, we determined a set of criteria for determining the validity of poll results.

Two excellent resources to share with students are COMAP's "Decisions Through Data" videos on polling and *20 Questions A Journalist Should Ask About Poll Results*, 3rd edition, by Sheldon R. Gawiser and G. Evans Witt. I wanted the students to understand that since, for practical reasons, we are unable to determine how everyone in the country will vote, we take a sample of voters and use this information to make a reasonable estimate of how all will vote. This sample will only be a good representation of all voters if it is a random sample in which every person polled has an equal probability of being selected and, therefore, there is no bias toward one group of voters or another.

ANNOUNCEMENTS

PROJECT-SET

Project-SET is a new NSF-funded project to develop curricular materials that enhance the ability of high-school teachers to foster students' statistical learning regarding sampling variability and regression. All materials will be geared toward helping high-school teachers implement the Common Core State Standards for statistics and are closely aligned with the learning goals outlined in *Guidelines for Assessment and Instruction in Statistics Education (GAISE): A Pre-K–12 Curriculum Framework*. Materials will be available in January of 2013. Further information about the project can be found at *http://project-set.com*.

LESSON PLANS AVAILABLE ON STATISTICS EDUCATION WEB FOR K–12 TEACHERS

Statistics Education Web (STEW) is an online resource for peer-reviewed lesson plans for K–12 teachers. The lesson plans identify both the statistical concepts being developed and the age range appropriate for its use. The website resource is organized around the four elements in the GAISE framework: formulate a statistical question, design and implement a plan to collect data, analyze the data by measures and graphs, and interpret the data in the context of the original question. Teachers can navigate the site by grade level and statistical topic.

WHEN STATISTICS EDUCATION AND STATE POLICY MEET

Christine Franklin, Lothar Tresp Honoratus Honors Professor in Statistics at the University of Georgia, shares her advice with those seeking to have more statistics in their state's education curriculum in an article available online at *http://magazine.amstat.org/blog/2012/05/01/statsed/*.

MATHEMATICS OF PLANET EARTH COMPETITION FOR AN OPEN SOURCE EXHIBITION OF VIRTUAL MODULES

This competition is part of the world initiative Mathematics of Planet Earth 2013 (MPE2013). The modules could be reproduced and used by institutions around the world, from science museums to schools. The exhibition will have a virtual part, as well as instructions to realize material parts. The competition will be open until May 15. Prize winners will be selected by an international jury nominated by MPE2013 and announced in August. The winning modules will occupy a prominent place on the website of the exhibition. Moreover, it is planned to show the modules of the overall winners in exhibitions and museums.

A properly conducted poll should control for bias as much as possible. We had a discussion of under- and over-coverage of subgroups, nonresponse bias, and response bias, as well as the possible effects of directing and ambiguous questions. Other interesting *New York Times* articles to share with students include "Precisely False vs. Approximately Right: A Reader's Guide to Polls" (August 27, 2006) and "Do Polls Lie About Race?" (October 12, 2008). Since most of my students were Black, Hispanic, Asian, or Arab, this latter article drew them into the discussion of valid polls.

Variability

From the initial class-wide questions and the Serious Poll, we learned there will always be sampling variability when a sample is taken. To come to a reasonable prediction of who would win the election—McCain or Obama—our job was to make sense of this variability. When sampling with replacement from a distribution with a true proportion of 0.61 for n=10, 50, 100, 500 and 1,000, each student in the class calculated the proportion for McCain. As each student increased sample size, they noticed their sample estimate of the true proportion tended to get closer to 0.61. This is a good hands-on example of the Law of Large Numbers.

The students also noticed that the sampling distribution of all the proportions they estimated from their samples had an approximate normal distribution shape and was centered at approximately 0.61. They noticed that as n increased from 10 to 1,000, the shape of their sampling distributions looked more normal and tended to be centered closer to 0.61. This was a good illustration of the Central Limit Theorem. Additionally, the students noticed the spread of their sampling distributions tended to decrease as n increased. This is a further property of the Central Limit Theorem; the variability of the sampling distribution decreases proportional to the square root of n.

Why 19 Out of 20 Cases? Why ±3%? Why Sample Size of 1,000?

Our next mission was to understand why polls usually have about 1,000 respondents. From discussions of tossing two dice and normal distributions, the students knew that approximately 95% of the outcomes of a normal distribution are within 1.96 standard deviations of the mean. We discussed for understanding and used the following four properties of binomial distributions:

- The formula for calculating the margin of error is $z^*\sqrt{\frac{pq}{n}}$, where z* is the z-score, p is the proportion of "successes" or proportion of voters for the candidate of interest, q is the proportion of "failures," and n is the sample size.
- Since winners are hardest to determine when the candidates are running neck and neck (both close to 50%), we will want a larger sample for these races. The most conservative estimate of the needed sample size results when p = q = 0.5.
- Convention has decided that estimates should be correct about 95% of the time, or 19 out of 20 times. Approximately 95% of data in a normal distribution are within 1.96σ of the mean. Therefore, z* = 1.96.

U.S. Census at School Program Seeks Champions

The ASA and Population Association of America (PAA) launched the U.S. version of Census at School (*www. amstat. org/censusatschool*), a free, international classroom project that engages students in grades 4–12 in statistical problemsolving. Students complete an online survey, analyze their class census results, and compare their class with random samples of students in the United States and other participating countries. The project began in the United Kingdom in 2000 and now includes Australia, Canada, New Zealand, South Africa, Ireland, South Korea, and Japan. The ASA and PAA are seeking champions to expand the U.S. Census at School program nationally. This is a wonderful opportunity for statisticians and statistics educators to perform outreach in their communities. For more information about how you can get involved, see the article online at *http://magazine.amstat.org/blog/2012/02/01/censusatschool-2* or email Rebecca Nichols at *rebecca@amstat.org*.

Free Statistics Education Webinars

The American Statistical Association offers free webinars on K–12 statistics education topics at *www.amstat.org/education/webinars*. This series was developed as part of the follow-up activities for the Meeting Within a Meeting (MWM) Statistics Workshop. The Consortium for the Advancement of Undergraduate Statistics Education also offers free webinars on undergraduate statistics education topics at *www.causeweb.org*.

Inform New Activities, Programs to Support K--16 Mathematics, Statistics Education

The National Science Foundation (NSF) in cooperation with the U.S Department of Education (ED) is interested in input that can inform new activities and programs to support and improve K-16 mathematics education. The working group is viewing mathematics to broadly include pure and applied math, statistics, and the computational sciences. For more information and to provide input regarding K--16 mathematics and statistics education, see the NSF Dear Colleague letter at *www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf12080 and survey link at www.surveymonkey.com/s/k_16_initiative*.

- Convention has decided that estimates for political polls should be within 3% of the true proportion. Therefore, the margin of error equals 0.03.

Solving for n in the equation $z^*\sqrt{\frac{pq}{n}}$ yields a sample size of 1,068. We had an extensive discussion about why we need 1,068 if and only if the sample is random and therefore representative of the whole population.

Now, the students have an explanation and understanding of our initial questions.

- Why ± 3%? This is the margin of error that convention in polling has determined is reasonable. Other margins of error are used in situations, such as medicine or engineering.
- Why 19 out of 20? The ratio of 19 out of 20 can be represented as a percentage as 95%. Polling convention says it is sufficient to estimate the true proportion of voters for a candidate 95% of the time. To be able to identify the correct candidate with a higher frequency would require a much larger sample.
- Why about 1,000 respondents? Using the formula $MOE = z^*\sqrt{\frac{pq}{n}}$, where $MOE = 0.03$, $z^* = 1.96$, and $p = q = 0.5$, as previously discussed, n = 1,068, or about 1,000. This is the sample size required if we want a 3% margin of error and a 95% confidence level.

The Poster of Pollster Results

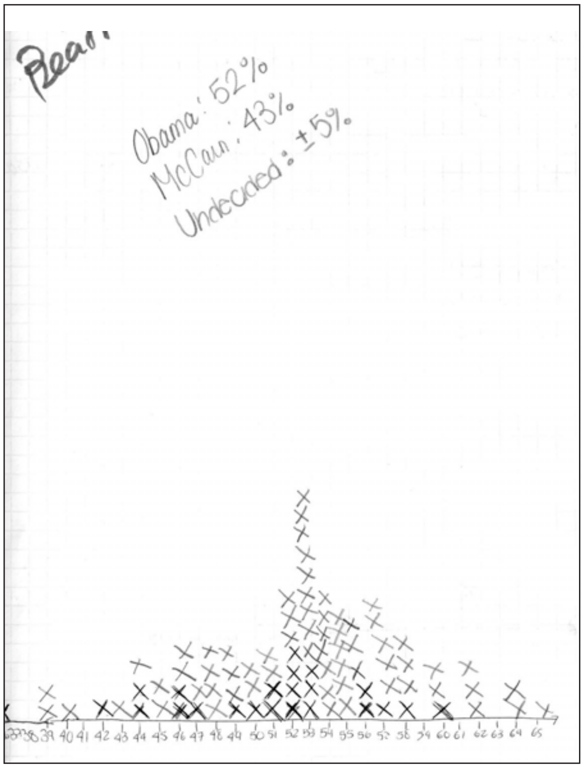
As described above, the students were each assigned a different pollster and frequently marked the results of their pollster's polls on the 5' x 10' poster. For a given time, students saw there was variability of results from pollster to pollster. We discussed the source of this variation. They also saw that as the proportion of undecided voters decreased over time, the polls varied less from one week to another. For this close race, the proportions for McCain and Obama edged toward 50%, with Obama passing McCain in many polls after the debates in October. Even then, there were polls with McCain very close to Obama. A picture is worth a thousand words. We had many more than 1,000 words in our discussions about the polls and how the candidates were doing.

(On November 1, 2008, *The New York Times* ran an excellent graphic of the final polls for the 1980–2008 elections by Pew, Gallup, and *NYT*/CBS News. The graphic clearly illustrates how much variation there is among polls and can be viewed at *http://www.nytimes.com/imagepages/2008/11/01/opinion/01blow_ready.html*.)

The Polls and the Results: A Historical Perspective

Do polls identify the winner?

On November 3, 2008, the day before the election, I had the students do one more assignment. Using their pollster's numbers for McCain or Obama (whichever they preferred), they ran a simulation of 100 polls. They graphed the results. Based on the distribution, I asked them to predict who would win.



Student graph of simulation on November 3

With this projection in hand, they went home to hear and record on their maps the results of actual electoral votes. I doubt many other citizens had as detailed an understanding of the election as the students.

The final assessment for the unit included questions relating to collecting, displaying, and analyzing data. In addition, they had to explain how valid polls need to be run. There was an opportunity for the students to run a simulation to explain the Law of Large Numbers and the Central Limit Theorem. Finally, there was a take-home assessment that asked them to answer "one of five questions about America" listed in the November 2, 2008, *Boston Globe* so they would think deeply about the content of the election debate. The questions included the following two: Are young people becoming a driving force in American Politics? How much do Americans care about their image in the world?

By focusing on the election for about two months, we learned a lot of statistics, but we also learned much about national issues. I found the national election to be a very teachable moment, and it would have been an awful opportunity to miss!

Sharon Hessney teaches statistics, geometry, and discrete math at Boston's John D. O'Bryant School of Mathematics and Science. She holds National Board Certification in high-school math and is the 2009 Massachusetts Presidential Awardee in Excellence in Mathematics Teaching. For 2011–2012, Hessney was an Einstein Educator Fellow working on a congressional staff. shessney@gmail.com

BAPS

BEYOND AP STATISTICS

Wednesday, August 1, 2012

8:30 a.m. - 4:30 p.m.

San Diego, California

A WORKSHOP FOR EXPERIENCED TEACHERS

Sponsor: ASA-NCTM Joint Committee on Curriculum in Statistics and Probability

The ASA/NCTM Joint Committee is pleased to sponsor a Beyond AP Statistics (BAPS) workshop at the annual Joint Statistical Meetings (JSM)* in San Diego, California, on August 1, 2012. Organized by Roxy Peck, the BAPS workshop is offered for AP statistics teachers and consists of enrichment material just beyond the basic AP syllabus. The course is divided into four sessions led by noted statisticians. Topics in recent years have included experimental design, survey methodology, multiple regression, logistic regression, what to do when assumptions are not met, and randomization tests.

COST:

The course fee for the full day is $50. Attendees do not need to register for JSM to participate in this workshop, although there is discount JSM registration for K–12 teachers available at *www.amstat.org/meetings/jsm/2012*.

LOCATION:

Hilton San Diego Bayfront, located at 1 Park Blvd., San Diego, CA 92101 near the San Diego Convention Center (workshop meeting room location to be announced)

PROVIDED:

Refreshments (lunch on your own)

Handouts

Pass to enter the exhibit hall at the Joint Statistical Meetings

Certificate of participation from the American Statistical Association certifying professional development hours

Optional graduate credit

REGISTRATION:

More information and online registration is available at *www.amstat.org/education/baps*. Registrations will be accepted until the course fills, but should arrive no later than July 12. Space is limited. If interested in attending, please register as soon as possible.

QUESTIONS:

Contact Rebecca Nichols at *rebecca@amstat.org* or (703) 684-1221, Ext. 1877.

*The Joint Statistical Meetings are the largest annual gathering of statisticians, where thousands from around the world meet to share advances in statistical knowledge. JSM activities include statistics and statistics education sessions, poster sessions, and the exhibit hall.

MWM

Meeting Within a Meeting

a statistics workshop for K-12 teachers

Mathematics and Science Teachers

(www.amstat.org/education/mwm)

Sponsored by the American Statistical Association (ASA) 2011 Joint Statistical Meetings (JSM)*

Based on the Common Core State Standards for Mathematics (*corestandards.org*) and *Guidelines for Assessment and Instruction in Statistics Education (GAISE): A Pre-K–12 Curriculum Framework* (*www.amstat.org/education/gaise*)

Dates:	Tuesday, July 31, and Wednesday, August 1, 2012, 8:00 a.m. to 3:30 p.m.
Place:	San Diego Convention Center, located at 111 West Harbor Drive, San Diego, CA 92101 (workshop meeting room location to be announced)
Audience:	Middle- and high-school mathematics and science teachers. Multiple mathematics/science teachers from the same school are especially encouraged to attend. Note: Experienced AP Statistics teachers should register for the Beyond AP Statistics (BAPS) workshop. See *www.amstat.org/education/baps* for more information.
Objectives:	Enhance understanding and teaching of statistics within the mathematics/science curriculum through conceptual understanding, active learning, real-world data applications, and appropriate technology
Content:	Teachers will explore problems that require them to formulate questions; collect, organize, analyze, and draw conclusions from data; and apply basic concepts of probability. The MWM program will include examining what students can be expected to do at the most basic level of understanding and what can be expected of them as their skills develop and their experience broadens. Content is consistent with the Common Core State Standards, GAISE recommendations, and *NCTM Principles and Standards for School Mathematics*.
Presenters:	GAISE report authors and prominent statistics educators
Format:	Middle-school and high-school statistics sessions
	One-day pass to attend activities at JSM* (statistics education sessions, poster sessions, JSM exhibit hall)
	Activity-based sessions, including lesson plan development
Provided:	Refreshments
	One-day pass to attend the Joint Statistical Meetings
	Lodging reimbursement (up to a specified amount) for teachers from outside the San Diego area
	Handouts
	Certificate of participation from the ASA certifying professional development hours
	Optional graduate credit available
Cost:	The course fee for the two days is $50. **Please note: Course attendees do not need to register for the Joint Statistical Meetings to participate in this workshop**.
Follow up:	Follow-up activities and webinars (*www.amstat.org/education/k12webinars*)
	Network with statisticians and teachers to organize learning communities
Registration:	More information and online registration available at *www.amstat.org/education/mwm*. Space is limited. If interested in attending, please register as soon as possible.
Contact:	Rebecca Nichols, *rebecca@amstat.org*, (703) 684-1221, Ext. 1877

*The Joint Statistical Meetings are the largest annual gathering of statisticians, where thousands from around the world meet to share advances in statistical knowledge. The JSM activities include statistics education sessions, posters sessions, and the exhibit hall.

CENSUS at SCHOOL

FREE international classroom project to engage students in statistical problemsolving

Teach statistical concepts, statistical problemsolving, measurement, graphing, and data analysis using your students' own data and data from their peers in the United States and other countries.

Complete a brief online survey (classroom census)

13 questions common to international students, plus additional U.S. questions

15–20-minute computer session

Analyze your class results

Use teacher password to gain immediate access to class data.

Formulate questions of interest that can be answered with Census at School data, collect/select appropriate data, analyze the data—including appropriate graphs and numerical summaries for the corresponding variables of interest—interpret the results, and make appropriate conclusions in context relating to the original questions.

Compare your class census with samples from the United States and other countries

Download a random sample of Census at School data from United States students.

Download a random sample of Census at School data from international students (Australia, Canada, New Zealand, South Africa, and the United Kingdom).

International lesson plans are available, along with instructional webinars and other free resources.

www.amstat.org/censusatschool

For more information about how you can get involved, email Rebecca Nichols at *rebecca@amstat.org*.

STatistics Education Web

The new editor of STEW, Mary Richardson of Grand Valley State University, is accepting submissions of lesson plans for an online bank of peer-reviewed lesson plans for K–12 teachers of mathematics and science. Lesson plans will showcase the use of statistical methods and ideas in science and mathematics based on the framework and levels in the *Guidelines for Assessment and Instruction in Statistics Education* (GAISE). Consider submitting several of your favorite lesson plans according to the STEW template to *steweditor@amstat.org*.

Statistics Education Web (STEW) in Search of Lesson Plans

STEW

STatistics Education Web