The Statistics Teacher Network

www.bio.ri.ccf.org/docs/ASA/stn.html

Number 52 ASA/NCTM Joint Committee on the Curriculum in Statistics and Probability Autumn 1999

Statistics in the Classroom

ASA Advises the NCTM Standards Committee

by Thomas L. Moore
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Mooret@math.grin.edu

The NCTM Standards have been around now for about a decade and for the past several years NCTM has been revising them in a project called Standards 2000. Indeed, NCTM planned for such a revision as they developed the 1989 Curriculum and Evaluation Standards, realizing that their vision of 1989 would be refined as the Standards were implemented and as new ideas and technologies came into mathematics education.

From its inception, the Standards 2000 committee sought input from various professional organizations and asked the professional organizations within the mathematical sciences to appoint what were termed Association Review Groups (ARGs) to help guide the revision process. In December 1996 the American Statistical Association (ASA) appointed the following members to the ASA ARG:

Carol Joyce Blumberg (Winona State University), Christine Franklin (University of Georgia), Jerry Moreno (John Carroll University), Judith O'Fallon (Mayo Clinic), Rosemary Roberts (Bowdoin College), Richard Scheaffer (University of Florida), and myself as chair.

Since that time, the Standards 2000 committee sought our help on five different occasions. The first four occasions were spaced at approximate six-month intervals, each of which asked us to respond to a specific set of questions. Briefly, these four occasions were:

1. In January 1997 the ARGs responded to a set of questions asking our opinions about the current Standards and how well we felt the current Standards captured what we felt to be the central components of K-12 mathematics education.

2. In June 1997 the ARGs responded to more specific questions about algorithmic thinking and about the place and nature of proof in mathematics education.

3. In December 1997 the ARGs responded to questions: (a) about recent changes in the mathematical sciences (including changes in technology) and how these changes should influence K-12 mathematics instruction; (b) about the future role of mathematics both for intelligent citizenry and for careers in the mathematical sciences; and (c) about the kinds of outcomes we would desire for students entering post-secondary education or the workplace.

4. In June 1998 the ARGs responded to a question about teaching students the "nature of mathematics" and to more specific questions about the roles of geometry and discrete mathematics in the K-12 curriculum.

Also In This Issue...

You may read the full responses of the ASA ARG to each round of questions at the following two web sites. The second site contains responses from other ARGs as well as an overview of the Standards 2000 project.

http://www.stat.ncsu.edu/stated/nctm.html
http://www.nctm.org/standards2000/args.html

The fifth and final consultation between the Standards 2000 committee and the ARGs occurred in the fall of 1998 when the "Discussion Draft" of Principles and Standards for School Mathematics was published by NCTM and sent out to each ARG (among a wider dissemination) for thorough comment. ASA's ARG responded on January 25,1999, with a detailed set of comments on the Discussion Draft Standards 2000. These comments may be found at the first of the two web sites listed above.

Throughout its interaction with NCTM, the position of the ASA ARG could be characterized as "pro-Standards"—we have consistently affirmed the essential spirit of the 1989 Standards, while trying hard to give useful and specific suggestions for areas of improvement.

All of the ASA ARG's work was done through e-mail conversations, each of which took us between one and two months in order to produce the final documents that we sent to NCTM. As chair, I really appreciated the responsiveness of the group to my mailings, the caliber of the discussions, and group's commitment to getting NCTM useful and timely input.

The ASA ARG also participated on panel discussions with other ARGs at national conventions. I participated on a panel at the Joint Mathematics Meetings in Baltimore in January of 1998 and Carol Joyce Blumberg represented our ARG on a panel at the NCTM convention this past April in San Francisco.

Statistics in the Classroom

Relationships between Two Variables: A K-12 Instructional Emphasis

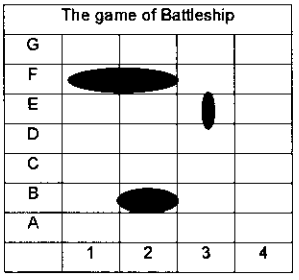
by James F. Bohan
K-12 Mathematics Program Coordinator
Lancaster, Pennsylvania

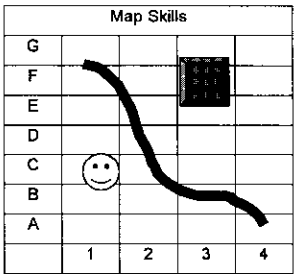
As we approach the end of the "decade of implementation" of the 1989 National Council of Teachers of Mathematics *Curriculum and Evaluation Standards of School Mathematics* (NCTM, 1989), an important fact has become clear to those who study the K-12 mathematics progression. We can identify several unifying themes that can and should be spiraled throughout the grades for all students. One such theme is the "Relationship between Two Variables." This paper details how this theme can be implemented in K-12 classrooms and encourages the further development and recognition of this and other similar themes.

Beginnings (K-2)

The mathematics that is generally discussed in these grades provides excellent opportunities for the inclusion of data-oriented experiences. Univariate data sets should be organized and displayed in a number of different ways. These include topics of ordering the data, finding the "middle" of an ordered set, identification of minimums and maximums and the calculation of ranges of data. Visual displays can include pictographs and bar graphs.

The recognition, study and use of relationships between two variables begin with very elementary ideas of comparison. In the early grades, students have a desire to compare sets of data, for example, girls vs. boys. In addition, students use concepts of plotting two variable systems in a variety of settings. Consider these images representing a popular board game, "Battleship," and a first introduction to map skills.





Graphical displays at the K-2 level focus primarily on using grid systems for the purpose of location. These experiences lay the foundation for further evolution of the concept of graphical displays of relationships between variables.

Middle Grades (3-7)

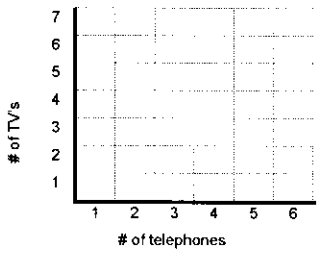
The middle grades offer teachers enormous opportunities to extend the experiences from K-2 and to connect a great deal of middle grades mathematics curriculum to the "real" world. Plots of univariate data including dot plots, stem plots, and histograms can be effectively introduced as tools to understand the nature of data sets. In addition, as an application of arithmetic emphasis in this period, students can be instructed to calculate and interpret summary statistics for univariate sets of data, including the mean, median, and quartiles.

The intuitive sense of relationships between variables by location can be developed into the search for association via the inspection of scatterplots. Students are most interested in themselves and their peers. We can capitalize on that interest by surveying a variety of discrete variables of interest to the students and moving from univariate displays of a single set of data to a scatterplot to investigate the possibility of association. For example, data could be collected from a class and organized into a table so that the responses for a single student are listed in each row:

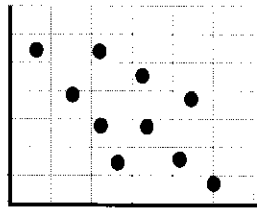
Gender	Number of books in your locker	Number of telephones	Number of Televisions	Hours of sleep per night

Students are instructed to provide different displays for each variable and to calculate summary statistics for each as well. For example, one group could create a dot plot of the number of books, a histogram of the number of telephones, etc. Notice that each display and set of statistics can and should be interpreted in the context of examining the distributions for center, spread and shape. In addition, separate displays by gender provide an interesting environment to challenge students with the idea of differences in data sets of the same variable.

It is most natural now to move to the search for association by asking questions like, "Do you think that families that have more telephones have more TV's? A scatterplot can then be introduced as a visual tool for investigation into these types of questions.

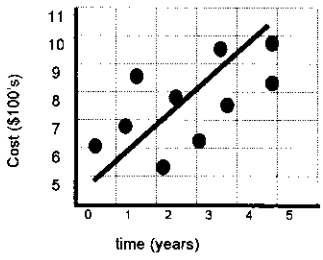


The concept of correlation as a measure of the strength and direction of association is a logical next step in the pursuit of quantifying relationship. Concepts of correlation, at this level, should be developed by the inspection of scatterplots and the corresponding values of the correlation coefficient that exhibit different strengths and directions of association. Words like weak, moderate, strong, positive and negative are introduced for the purpose of interpreting the visual and numerical description of the association in the context of the situation of interest. No calculation of the correlation coefficient should occur at this level. In addition, I recommend that technology be used only to explore and confirm estimates of association.



Upper Grades (8-12)

The typical mathematics curriculum in the upper grades makes relationships between variables the focus of most of the function experience for students. Beginning with the study of linear equations in two variables and systems of linear equations in two variables, we develop techniques that allow us to fit lines to bivariate data sets for the purpose of prediction. This motivates the connection of relationships between meaningful variables. For example, for this graph, students in Algebra 1 should be required to create equations in the form of Cost = 1.65(time) + 4.35. In addition, students should interpret the parameters of their equations saying statements such as:



1. The slope of 1.65 indicates that the Cost will increase by $165 each year.
2. The y-intercept indicates that the Cost is approximately $435 in year 0.

Examination of the goodness of fit of a linear model is accomplished via the inspection of the corresponding residual plot. Again, criteria involving the residual plot can be introduced intuitively and visually. This modeling approach can be extended in later courses to the analysis of bivariate data that is best modeled by exponential, logarithmic, polynomial and periodic functions.

Technology can support this progression. However, the development of concepts demands many hands-on experiences with the manipulation of data and resultant expressions of relationship. For example, consider the process of using the data transformation of $(x,y) \rightarrow (x, \ln y)$ to "linearize" an exponential and then using linear regression to generate an equation that fits the observed relationship. Using technology to accomplish the linear regression on (x, ln y) provides the support to make the transformation of the equation to exponential form a reasonable and useful task in the context of the original set of data. With the proper progression of experiences, *all* high school students can become empowered to do these types of transformations.

$$\ln y = 1.43 + 6.2x \Rightarrow y = e^{1.43+6.2x}$$
$$\Rightarrow y = e^{1.43} \cdot e^{6.2x}$$
$$\Rightarrow y = 4.179 \cdot 492.749^{x}$$

The theme of mathematical modeling real data, quantifying and specifying relationships between two variables begins with the elementary playing "Battleship" and can lead to the development of a library of algebraic functions that fit important sets of data. In addition, the infusion of Quantitative Literacy experiences in the normal progression of K-12 mathematics instruction enriches and connects the curriculum to the real world in activities that are meaningful and relevant to students.

A Class Activity: The Spread of Disease

The purpose of this activity is to track and analyze the spread of a disease within the classroom. I like to tell students that this disease is the LOVE OF MATHEMATICS. The disease has two important properties:

1. Once you get it, you have it for life.
2. Once you have it, you are obsessed with the idea of spreading the disease to all other students in your class.

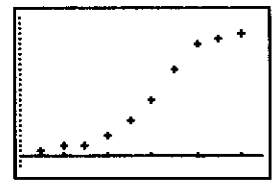
Materials: Chart (see below) and a TI-83 Graphing Calculator

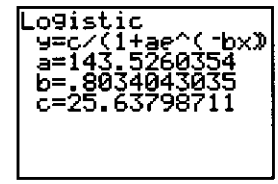
Instructions:

Day	Total Cases

1. Number each student consecutively.
2. Use the random number generator on the TI-83, *randInt*, to select the first victim. Have this student stand. Note that we have one diseased student in the class on Day 1 on the chart.
3. Announce that this student is doing everything that he/she can to spread the disease to another. Select another random number and have that student join the first in standing. Note on the chart that on Day 2, we have a total of 2 diseased students. If the second random number duplicates the first, the total for Day 2 remains one.
4. Continue this process until all students are standing. On each subsequent day, select another random number (and therefore, potentially another victim) *for each student who is already diseased.* That is if 10 students are standing, then for the next day, you select 10 random numbers. In all cases, you are to note the *total* number of cases for the specific day.
5. Enter your time series into the TI-83 and produce a scatterplot. Discuss the shape (it will be a logistic curve - an s-shape curve). Probe to see if the students can describe in words the apparent existence of a horizontal asymptote at the upper bound of the population.
6. Do a logistic regression on the TI-83 and graph it.
7. Conclude with the discussion of the usefulness of this type of curve. For example, population studies in restricted ecosystems, inventory control predictions (at Walmart, for example), and most importantly, the actual spread of diseases such as AIDS.

Example displays from the activity in a class of 24 ninth graders:





Who would have thought that this all begins with playing "Battleship?"

Statistics in the Classroom

Umbrella Handles and Significant Differences

by Robert S. Butler
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In April 1997 I taught a six-part statistics course to a self-selected group of third and fourth grade students at the Onaway School in the Shaker Heights, Ohio public school system. A detailed discussion of the course and the methods that I employed in teaching these students about the proper methods for comparing two averages was detailed in STN newsletters 49-51.

In my concluding remarks I mentioned that I had had difficulty in teaching the differences in the concepts of numeric vs significant differences and that, if given another chance, I would try to use a different approach to teach this concept. In April 1999 I was given that second chance. The new coordinator of the Enrichment Clusters, Jacqueline Douglass, asked me to teach the statistics course a second time. The method that I used to teach the concept of significant differences worked very well. Indeed, the speed with which the students grasped the concept of significant difference was such that I ran out of material for the session before the session had ended.

The purpose of this article is to describe the method that I used. The method employed visuals of my design and copies of those visuals are included in this article.

Umbrellas

I began by talking about umbrellas. I had a real one in the classroom and I opened it up and asked the students what I was holding in my hand. They, of course, responded that it was an umbrella. I asked them why they had said "umbrella" and not "umbrella handle?" The key to this discussion was the eventual recognition on their part that they were focusing on the entire object and not just a single part of the object. To re-emphasize this I put up a slide (Figure 1) with three individuals holding umbrella handles. The first person looks happy, the second looks somewhat concerned and the third looks unhappy. The question that I asked was-who worries about handles? With just handles there is no reason for the range of personal reactions shown in the slide.

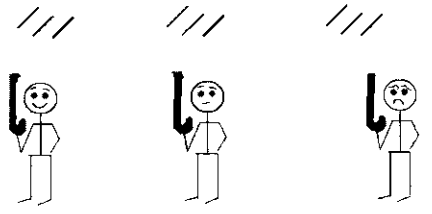

Figure 1

After some discussion about the nonsense nature of the slide I put up a slide with the umbrellas attached to the various handles (Figure 2). With the umbrellas in place, the explanation for the expressions on the faces of the three umbrella holders is obvious—BUT ONLY IF YOU LOOK AT THE ENTIRE UMBRELLA!

Figure 2

This led directly to the concept of comparing distributions. On the next slide I made the following points:

1. Distributions are like umbrellas.
2. The average is like the umbrella handle.
3. The standard deviation is like the width of the actual umbrella.
4. So, one MUST look at the average and the standard deviation together in order to understand anything about the average itself.

Next, I presented the students with a drawing of an umbrella with multiple handles, one of which was displaced from the rest (Figure 3) and I asked the students which umbrella handle was really in a different location when com-

pared to the others. Their choice was obvious. I asked the students how they made their choice. Their answers all involved the location of the one handle relative to the umbrella.

This slide allowed me to introduce the idea of significant differences. I put up a slide with the following bullet points.

Figure 3

- When something is REALLY DIFFERENT, we say that it is SIGNIFICANTLY DIFFERENT.
- How did you decide which handle was different? (You looked at the handles and compared them to the umbrella!)

These points were discussed in light of the umbrella with multiple handles.

After some discussion I tied the concepts of umbrellas and handles to that of distribution and averages (Figure 4).

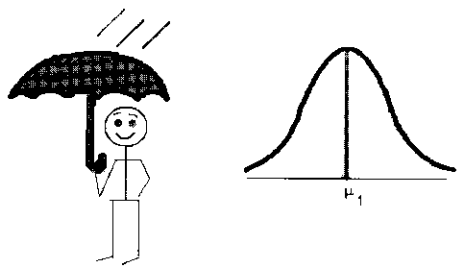

Figure 4

From this point the class did the same exercises for the fifth session that were outlined in STN #51. The difference this time was that the students flew through the exercise, concluded with very little difficulty that there were no significant differences in the averages of our repeat samplings of a normal distribution, and sat at their desks waiting for me to teach them something else.

ASA Poster and Project Competition Winners

The winners of the American Statistical Association's 10th Annual National Poster and 13th Annual National Project Competitions are included as an insert in this issue. Poster competition winners came from among four K-12 grade-level categories; project winners came from three grade-level categories.Winners were chosen from over 2,000 entries from 22 states, Canada, and Turkey. Judges for the poster competition based their decisions on overall impact, clear demonstration of important relationships and patterns, appropriateness of the graphics relationship to the data, and creativity. First prize winners received $300 and a plaque, second prize winners received $100, and third prize winners received $50. Through generous support provided by Texas Instruments, first place winners, their schools, and advisors received calculators and teaching aids. Poster and project entries were judged by a team of K-12 teachers and professional statisticians. ASA would like to recognize the outstanding contributions of its volunteer poster and project competition coordinators—Linda Quinn of QED Industries, Brunswick, Ohio, for her assistance in organizing and judging the Poster Competition and Linda Young, of the University of Nebraska, for coordination and judging of the Project Competition. For more information on entering ASA poster and project competitions, see www.amstat.org/education/poster1.html.

Letter to the Editor...

A little suggestion for the *Stats Teacher Network*. I thought that you could insert a possible hint for teachers to keep their eyes out for appropriate boxes for posters to be sent in for the poster contest. It may seem like a goofy comment, but when it is time to send in posters to the competition in April, finding a box can be a real problem. Before and at the time school starts each year, supplies arrive and there are boxes of every size and shape readily available. In my case, someone in my department had ordered large math posters, so I latched onto the box!

Renetta Deremer
Hollidaysburg Area Senior High School
Hollidaysburg, PA

Workshop Report...

Science Education and Quantitative Literacy

Wesleyan University, Summer 1999

General Information

A SEAQL workshop was held for three weeks from July 12 to July 30, 1999 on the campus of Wesleyan University in Middletown Connecticut. Thirty-six participants attended, namely sixteen math teachers, nine middle school science teachers, and eleven high school science teachers. Almost all participants were teamed with one or two other participants from the same school district. A team of one math teacher and one science teacher was most common. I would characterize the group as very professional, academically able, generally skilled in the use of the TI-83, and extremely cooperative. They enjoyed sharing ideas with each other, and pushed us instructors further in the use of quantitative analysis than ever before.

QL Content

We covered all the general skills including line plots, stemplots, boxplots, and scatterplots. We returned several times to look at a line plot of data to check the distribution of data before summarizing using the boxplot. The stemplot was very popular for taking a quick look at class data and for simple back-to-back comparisons. The boxplot was also very popular, especially stacking them and using them to represent matched pairs of data. This year we presented the scatter plot from a variety of grade-level perspectives. We discussed scatter plots in a quantitative and semi-quantitative way as might be done in a 6th or 7th grade class. Then we looked at it with simple curve fitting by guessing an equation and testing the fit using the calculators. This is something that algebra I students can do. We used manipulation of data on the x- or y-axis to produce a straight line, and we used regression options found on the calculator. Teachers at all grade levels were interested in seeing how the data would be dealt with in grades other than those they taught. High school teachers role playing as middle school students made for some very interesting discussions.

Technology

There is no getting away from it, technology sells workshops. We found ourselves doing more and more data collection through the use of the CBL. An increasing number of participants in our SEAQL workshops are familiar with it, and they are eager to try some clever experiments and look at the data collected. We have been purchasing for the participants the TI-83 that can be used with the viewscreen. This allows them to make their presentations easily. Overall, we try to be careful however in not allowing the technology to overshadow the learning of QL. Without careful attention, the workshop can turn into a calculator one very easily.

Activities

Activities this year included measuring the height of the flagpole, scavenging for data, measuring the length of peanuts, density of a solid, specific heat, absorbency of a paper towel, percent water in popcorn, speed of sound, chromatography, diffusion, Galileo's experiment, projectile motion, rate of dissolving for Alka-Seltzer, knots in a rope, reaction time, mixing hot and cold water, reflectivity of light, respiration of yeast, radioactive decay, Rutherford scattering, and stickiness of tape. Projects included the radish riddle, stomata, CBL madness, a CBL project, preparation of lessons. We also brought in a math teacher, Matt Bornstein, to present data collection activities for math teachers.

Comments

We are working with the American Statistical Association in trying to get some of the activities published in a booklet for future workshop use. Unfortunately, funding has run out to continue SEAQL at Wesleyan, so searching for new funding sources is underway. I would like to find some connections in locations closer to home in New York and New Jersey as well. I hope that the SEAQL workshop in Cleveland Ohio went as well as ours did.

Art Christensen
Mahwah High School
Mahwah, New Jersey
Ajchris61@aol.com

Editor's Note: Art is the NSTA representative to the ASA Advisory Committee on Quantitative Literacy. The Editor has assisted in SEAQL workshops. They are terrific in analyzing real laboratory data using simple statistical graphing techniques. Write to Art or the Editor in helping you organize a SEAQL workshop for the science teachers of your school district.

From the Editor

Please accept my sincerest apologies for the delay in publishing this autumn 1999 issue of *STN*. Let's just say that "Murphy" was working overtime on this one, and let it go at that.

Last year, I suggested to the ASA/NCTM Joint Committee on Curriculum in Probability and Statistics for grades K–12, to whom *STN* is responsible, that I needed help in keeping *STN* fresh. In particular, I felt that more should be provided for grades K–8. Our solution has been to add three associate editors. Cyrilla Bolster has agreed to gather articles appropriate for grades K–5, Susan Bates for grades 6–8, and Tom Short on grades 9–12. I look forward to working with them as we try to serve your statistics needs in *STN*.

Keep Us Informed...

The Statistics Teacher Network is a newsletter published three times a year by the American Statistical Association—National Council of Teachers of Mathematics Joint Committee on Curriculum in Statistics and Probability Grades K–12.

We need your letters, announcements, articles, and information about what is happening in statistics education! Please send hard copy, and, if possible, a disk written in standard ASCII text to:

Jerry L. Moreno
Department of Mathematics
John Carroll University
University Heights, OH 44118

or **moreno@jcu.edu**

or **Fax: (216) 397-3033**

To be added to the mailing list or make an address change, please send your name and address to: *Statistics Teacher Network*, c/o American Statistical Association, 1429 Duke St., Alexandria, VA 22314-3415; (703) 684-1221; Fax: (703) 684-2037; E-mail: **judy@amstat.org**.

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1999 American Statistics Project Competition Awards

Grades 4–6 Winners

First Place Award
Stop the Noise: Investigation of Sound Levels
Carrie Guiney, Meredith Higgins, Andy Pavlina, Michael Spires, Alex Turvy
Advised by Anna Marie Stoudenmaier
Ida Weller Elementary School
Centerville, Ohio

Second Place Award
Survey Says!
Alison Cannon
Advised by Larry Scartz
Mattawoman Middle School
Waldorf Maryland

Honorable Mention
Cafeteria Food
Molly Dendas, Leigh Anne Does
Advised by Sherie Stump and Heather Kalbach
Shafer Elementary School
Nazareth, Pennsylvania

Honorable Mention
Candy Bar Economics
Nick Johansen, Tyler Pedersen, Jim Molokken, Emily Heying, and John Steffens
Advised by Pat Hunsberger
West Union Elementary School
West Union, Iowa

Grades 7–9 Winners

First Place Award
Seeing Colors in a New Light
Rachel Kut, Tiffany Ju, Lindsey Pujanauski, and Lauren McCain
Advised by Lisa Breidenbach
Rachel Carson Middle School
Herndon, Virginia

Second Place Award
A Good Look on Books
Lien-Than Kratzke, Timothy Whalen
Advised by Lisa Breidenbach
Rachel Carson Middle School
Herndon, Virginia

Third Place Award
What's New After School?
Michele Oliver, Keely Phillips, and Kevin Swain
Advised by Melissa Souter
Northeast Middle School
Tifton, Georgia

Honorable Mention
Does Music Affect Your Academic Performance?
Michael Clarke and Paul Johnson
Advised by Melissa Souter
Northeast Middle School
Tifton, Georgia

Grades 10–12 Winners

First Place Award
The Effects of Color and Gender on Short Term Memory
Dominique Shelton
Advised by Joe H. Ward, Jr.
Health Careers High School
San Antonio, Texas

Second Place Award
New Techniques, Better Scores?
Steven Schmoll and Kathryn Nikolai
Advised by G. T. Brown
Henry Sibley High School
Mendota Hts., Minnesota

Honorable Mention
Which Radio Station Plays the Most Music?
Mary Lassey and Brigitte Martindale
Advised by G. T. Brown
Henry Sibley High School
Mendota Hts., Minnesota

Honorable Mention
Slots Ripping Us Off?
Joe Moody and Chad Sepeda
Advised by Michelle Grunewald
Henry Sibley High School
Mendota Hts., Minnesota

1999 American Statistics Poster Competition Awards

Grades K–3 Winners

First Place Award
Is Seven Really Lucky?
Joe Ashley and Nick Ashley
Advised by Ann Wachs and Debbie Miller
Huntington Elementary School
Brunswick, Ohio

Second Place Award
If I Throw a Casino Die 96 Times...
Hobart Reynolds
Advised by Wendy N. Cohen
Arlington Science Focus School
Arlington, Virginia

Third Place Award
What's In A Bag?
Aaron Kelter
Advised by Karen Horst and Carol Hillhouse
Morley Elementary School
Lincoln, Nebraska

Honorable Mention
First Grade Birthday Months
Kate McElhanney, Cory Gamble, Nolan Rivers, Jillian Comer, Raun Gray, Andrea Clabbers, Allison McGlumphy, Laura Parks, and Katelyn Cooper
Advised by Gwen Ceniviva
Overlook Elementary School
Abington, Pennsylvania

Honorable Mention
How Many Cubes?
Andrew Farias, Jonah McElroy, Christian Noveral, and Jason Stearns
Advised by Katie Calabrese, Helen Naab, Nina Marczyk, Tina Sweeley, and Debra Peters
Russell Elementary School
Broomall, Pennsylvania

Grades 4–6 Winners

First Place Award
Body Temperature and Time of Day
Jordan Mar
Advised by Suzanne Kirby
Clinton Elementary School
Lincoln, Nebraska

Second Place Award
Which Weather to Watch?
Shayleigh Dickson
Advised by Christine Smith
Wallingford Elementary School
Wallingford, Pennsylvania

Third Place Award
Does Weight, Length, and Wingspan Effect a Glider's Flight?
Joey Lucchesi, James O'Keefe, Mike Stavridis, and Bobby Weaver
Advised by Claudette Ohsann
King Street Int. School
Danbury, Connecticut

Honorable Mention
Are You Getting What You're Paying For?
Maya Close, Elena Buzaid, Molly Kluge, and Melinda Brainard
Advised by Denise Meany
Broadview Middle School
Danbury, Connecticut

Honorable Mention
Find a Match!
Nida Intarapanich
Advised by Peter Intarapanich
Hamden, Connecticut

Grades 7–9 Winners

First Place Award
Engine Size Determines Altitude
Michael Ortega
Broadview Middle School
Danbury, Connecticut
Advised by Dolores Kelsey

Second Place Award
Ice Cream vs. Frozen Yogurt: Which One Melts Faster?
Kimberly Carson and Melissa Crespo
Broadview Middle School
Danbury, Connecticut
Advised by Dolores Kelsey

Third Place Award (tie)
Hamburger Serving Temperatures, Do They Meet the Standards?
Paul Brandt, Michael Mason-D'Croz, and Aaron Stubbendieck
Lux Middle School
Lincoln, Nebraska
Advised by Arlene Rea

Third Place Award (tie)
Where Are You on the Political Spectrum?
Thomas van den Berg, Joshua Randazzo, and Brandon Pederson

Lux Middle School
Lincoln, Nebraska
Advised by Arlene Rea

Grades 10–12 Winners

First Place Award
Correlation Between Soil Erosion and Wind Velocity
Pritesh Patel
Spruce Creek High School
Port Orange, Florida
Advised by Sandra J. Tweedy

Second Place Award
How Are the Reading Achievement Levels of Students Affected by Their Location and Income?
Allison Miller
Cuyahoga Valley Christian Academy
Cuyahoga Falls, Ohio
Advised by Cheryl Clason

Third Place Award
How Has Charitable Giving Changed?
Randi Woods
Cuyahoga Valley Christian Academy
Cuyahoga Falls, Ohio
Advised by Cheryl Clason

Honorable Mention
Busiest Days and Hours at Red Lobster, Altoona
Brandie Markley
Hollidaysburg Area Senior High School
Hollidaysburg, Pennsylvania
Advised by Renetta Deremer