NCTM NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

American Statistical Association

The Statistics Teacher Network

www.amstat.org/education/stn/index.html

Number 62 ASA/NCTM Joint Committee on the Curriculum in Statistics and Probability Winter 2003

Note from the Editor

The Editor thanks current poster competition chair, Linda Quinn, for providing this article that should encourage teachers and students to participate in the competition.

Feature Article...

The American Statistics Poster Competition

by Linda Quinn, QED Industries
lmq2@po.cwru.edu

A statistical poster is a display containing two or more related graphics that summarize a set of data, that look at the data from different points of view, and that answer some specific questions about the data.

Tukey (*Statistical Science,* 1990, Vol 5, No.3, 327-339) states that "Much of what we want to know about the world is naturally expressed as phenomena, as potentially interesting things that can be described in non-numerical words." We collect data to describe and answer questions about phenomena. We present data to communicate our ideas to others. The purpose of a statistical poster, then, is to visually tell a story, from the data, about some phenomena, revealing to the viewer the conclusions that can be drawn. A poster has one major disadvantage however. Because there is no narrator to tell the story, nor an accompanying report to discuss the data, the poster must be able to stand alone; it should not have to be explained. For this reason, special care must be taken to present ideas clearly. Not only must the viewers understand the individual graphics, but they must also understand the relationships among the graphics, and how the graphics address the question(s) being studied.

The idea for a poster competition originated with Lorraine Denby of the Section on Statistical Graphics. On August 1989, Jerry Moreno was asked to be the first chair and to establish an initial framework and structure for the competition. A committee of five teachers and statisticians was formed, and using information that Lorraine provided about the Japanese competition (in existence since 1955), they developed the purpose, rules and regulations, and awards structure for the competition. Our country's first poster competition took place in the spring of 1990. A few years ago the poster competition was placed under the direction of the ASA/NCTM Joint Committee on Curriculum in Probability and Statistics for Grades k-12.

Judges base their decisions on overall impact, clarity of the poster message, appropriateness of the graphics, originality and creativity, along with technical details. In each of four categories (grades k-3, 4-6, 7-9, and 10-12), first place winners receive $200, a certificate and a trophy, second place winners received $100, a certificate, and a ribbon, third place winners receive $50, a certificate and a ribbon, and honorable mention receives a certificate and a ribbon. The schools represented receive a plaque. Through generous support of Texas Instruments, first place winners, their schools, and advisors also receive calculators and other teaching aids. ASA members make all award presentations. On occasion the presentations are made in a school honors assembly. Posters are created by individuals or groups of up to four students. The exception is k-3 in which the entire class may submit a poster.

For more general information on the competition, including an entry form, visit *www.amstat.org/education/postrcmp.html.* Images of winning entries can be found at, *www.amstat.org/education/postwin01.html* or *www.amstat.org/education/postwin02.html.*

Winners Of the 13th Annual American Statistics Poster Competition, 2002

There were 1,852 entries in the 13th annual American Statistics Poster Competition in 2002. Many were entered through regional competitions in Connecticut, Pennsylvania, Nebraska, Michigan, and Northeast Ohio. The Washington Statistical Society, one of the ASA Chapters, also awarded prizes to the best posters entered in the national competition that were from their area.

The distribution of poster entries for 2002 is as follows:

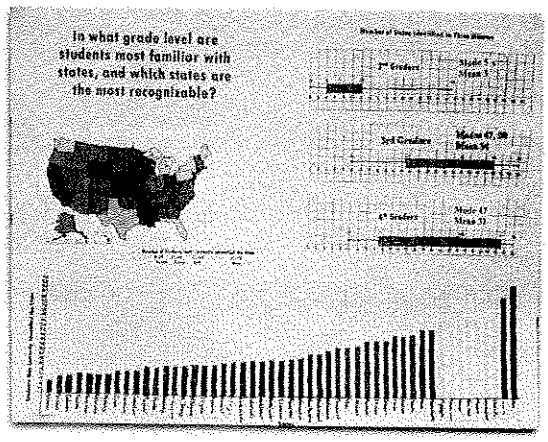
STATE	K-3	4-6	7-9	10-12	TOTAL
CT	9	78	78	76	241
MI	24	174	234	88	520
NE	5	57	21		83
OH	16	140	51	103	310
PA	88	252	89	188	617
Other	5	5	34	37	81
TOTAL	147	706	507	492	1852

National judging was held in Cleveland and the results of the competition are as follows.

To give the reader some idea of why these posters of the 2002 poster competition were judged the winners, the posters will be shown along with a summary of comments from the judges.

Grade Category K-3:

First Place: *In What Grade Level Are Students Most Familiar with States, and Which States Are Most Recognizable?* by Sarah Kaeppel, Sienna Zeilinger, Dana Mitchell, Kylie Kaufman, Carolyn Vekstein, Saja Chodosh, Stephanie Wong, Caroline Aronoff, Andrea Seifert, third graders at Hathaway Brown in Shaker Heights, Ohio. Their advisor was Mrs. Sandy Lieberman. The students gave a blank map of the U.S. to fellow students and asked them to name as many states as possible in 3 minutes. The students used three different types of graphs to display their results. The first graph used the outline of the U.S. and color coded the states by the number identified correctly. The second graph was a Pareto bar graph showing the states identified by the least recognizable to the most recognizable. Finally, a set of box and whisker plots was constructed to compare 2nd, 3rd, and 4th grades as to the number of states correctly identified. They used color to tie the map graph and the Pareto graph together. Some viewers might prefer to see the colors in shades from lightest (least recognizable) to darkest (most recognizable). The boxplots are lined up to make the comparisons across the grades easy. However, the median line in the boxplot is a little obscured due to the coloring in the box. Some types of boxplots would have identified the outlier in the second grade boxplot.



In What Grade Level Are Students Most Familiar with States, and Which States Are Most Recognizable? by Sarah Kaeppel, Sienna Zeilinger, Dana Mitchell, Kylie Kaufman, Carolyn Vekstein, Saja Chodosh, Stephanie Wong, Caroline Aronoff and Andrea Seifert

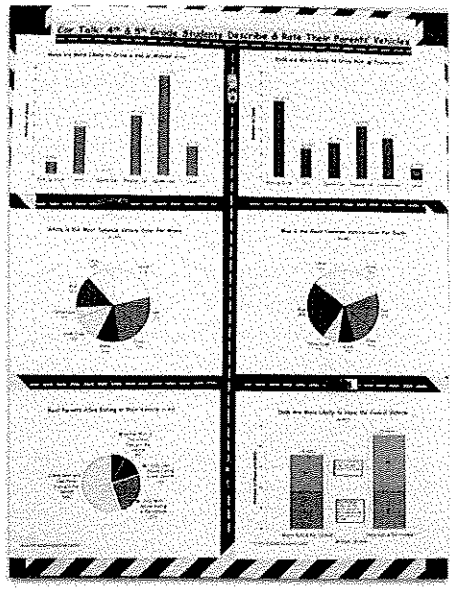
Second Place: *What Card Will You Flip?* by third graders Anna Reighart, Isabel Lane, Alex Cotton, Chase Healey, Mary Beth Musser, Katie Raber, Jennifer Huang, Sarah Lambert, Christine Schubert, Nell Patterson at Hathaway Brown in Shaker Heights, Ohio. Their advisor was Mrs. Sandy Lieberman. These students compared actual probabilities for a deck of cards to estimates from simulations. They examined the suit of the card and used pie charts to compare actuals to estimates. While it is clear to see that the distributions are almost identical, percentages would help to highlight the small differences found. Also, changing the alignment of the actual pie chart makes the reader wonder if there are differences or if there is

an optical illusion. They presented the card values using bar charts. Since they based both calculations on 400, the graphs are directly comparable. The graphs show similarities between estimated and actual. Finally, assigning face cards a value of 10, boxplots were presented that showed the value of randomly chosen cards. The boxplots were lined up for easy comparison. The students used red for estimated and black for actual in all three sets of graphs.

Third Place: *Are You Getting Enough Z's?* by Samantha Bradley of Rydal Elementary in Huntingdon Valley, Pennsylvania. Her advisor was Ellen Brown. This student surveyed classmates from ages 6-11, boys and girls, about how many hours they sleep each night. She plotted the mean response by age and gender using a bar chart. It was very good to coordinate colors so that pink represented girls and blue represented boys. The graph itself is very neat and legible. The judges liked that the recommendation is denoted with a green background. It allows the reader to see how well the mean response fits the recommendation. It is impossible to determine how many responses go into each mean. When examining how well students meet the recommendation, it would also be nice to see how many students meet the recommendation as opposed to how the average falls. There is plenty of room to reorganize and possibly present another graph or more information. The conclusion on the poster ensures that the reader understands what the intent of the poster was.

Grade Category 4-6:

First Place: *Car Talk: 4th and 5th Graders Describe and Rate Their Parents' Vehicles* by Rachel Morlock of St. Stephen's Lutheran School in Waterford, Michigan. Her advisors were Mr. Dunsmore and Mr. Robert Morlock. This poster shows many aspects of how students think about their parents' cars. In two bar charts, the student shows which vehicles mothers or fathers are more likely to drive. Mothers are shown in red and fathers in blue. The next set of graphs has comparative pie charts that contrast the colors of vehicles driven by mothers and fathers. The final two graphs discuss whether eating is allowed and which parent has the coolest car. The student does many things well. The student uses the titles of each graph to convey the conclusions of each graph. She uses space very effectively. She keeps the order of the pie colors similar in both charts so that comparisons can be made easily. She also recognizes in

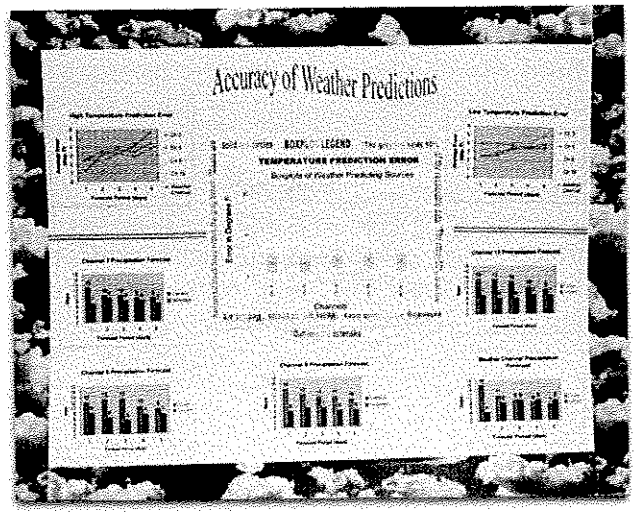


Car Talk: 4th and 5th Graders Describe and Rate Their Parents' Vehicles by Rachel Morlock

her graphics that there were some no-responses. Some improvements that could be considered are that the pie charts, especially for color, could be larger without altering the overall format. The judges did note that the title mentions 4th and 5th graders, but that distinction is not made in any graphs. Also, it is important to not attach 3-D objects to the posters. While the small cars attached to the poster were innovative, they can easily become detached when transporting and reviewing posters and may detract from the overall impact.

Second Place: *Who Makes Up the 2002 U.S. Winter Olympic Team?* by fourth graders Elizabeth Martin, Amanda Dillon, and Georgette Baliga of Hathaway Brown in Shaker Heights, Ohio. Their advisor was Mrs. Sandy Lieberman. These students obtained demographic information from the Internet on the 211 athletes that comprised the U.S. Olympic team. They presented a pie chart that broke down the team by sport. They used boxplots to show the distribution of ages by sport. They used a bar chart to show the heights of the athletes. Finally they used a color coded map of the U.S. to show what states the athletes were from. They used space effectively. In the color coded map, blue and purple were a little hard to distinguish. Ohio stands out even among the other reds. Since the countries listed were in red, it might be assumed that they each had from 1-6 athletes born there.

Third Place: *5, 4, 3, 2, 1-Day Forecast Accuracy: When Can You Trust the Weather Forecast?* by George J. Dickson, III of Wallingford Elementary School in Wallingford, Pennsylvania. His advisor was Mr. Larry Miller. This poster has eight graphs all discussing weather forecasts. The first row of graphs deals with the reported low temperature. The next row of graphs are on the high temperature. Each of these rows consists of three graphs. The first is a pie chart that shows the difference between forecast and actual temperature after categorizing the differences. The next shows a bar chart with the average error in temperature with the first bar representing the 5-day away forecast and the last bar representing tomorrow's forecast. As expected, the error rate is highest in the five day forecast. The last shows the accuracy of the reports with 5 days being the first bar and 1 day away being the last bar. A definition of how accuracy is defined was missing. The student did keep the bar colors consistent with yellow always being the 5 day and orange the 1 day forecast. The last two graphs address the accuracy of the description of the weather with 5 days the first bar and 1-day the last bar. The last graph is a stacked bar chart that describes the overall accuracy as the sum of accuracy on the high temperature, low temperature and weather description. This poster used space and color very effectively. A suggestion from the judges was to make the labels a little larger for readability. Much more information could be displayed other than just averages. Another possibility was to use scatterplots to compare actual to predicted values.



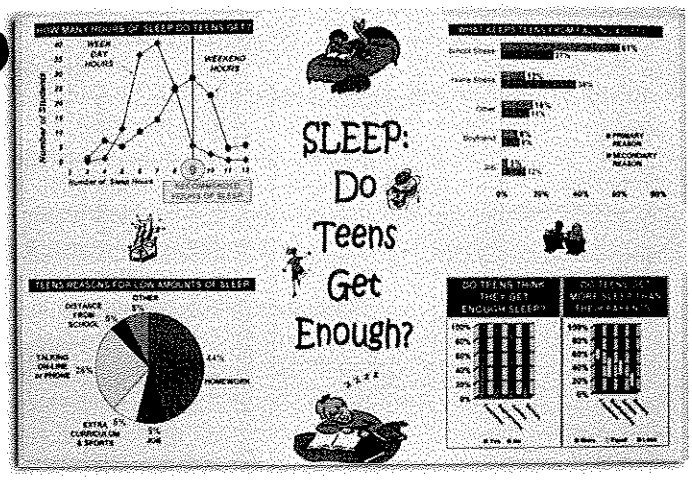
Accuracy of Weather Predictions by Erin Doyle

Grade Category 7-9

First Place: *Accuracy of Weather Predictions* by Erin Doyle, a seventh grader at Incarnate Word Academy in Parma Heights, Ohio. Her advisor was Mrs. Gail Moran. Erin entered a poster based on the work she presented in the Northeast Ohio Science and Engineering Fair, for which the Cleveland Chapter had also recognized her for the use and understanding of statistics. She showed how the different television stations fared in their weather predictions. In the national competition, it would have been better to use network affiliations instead of channel numbers to keep the location of the student blinded from the judges. The student may want to consider creating an overall ranking so that you can determine which station to watch.

Second Place: *The Solar System* by Aliaksei Smaliinchuk of Carson Middle School in Pittsburgh, Pennsylvania. The advisor was Mr. J. P. Prager. This poster presents information on the solar system in different graphs. The student always used the same coloring and order for the planets (the planet closest to the sun to the one farthest away). The labels on these plots are very legible. The judges noted that it would have been interesting if different information was compared, for example—temperature vs. diameter—to see if either affects the other. Also, while the information and graphs were well done graphically, it was not a very exciting topic nor could any conclusions be drawn that might be of further interest.

Third Place: *Some of My Classmates Are Squares* by Brittany Nejame, Flora Marcelino, Dorian Carey, Alexandra Alvarez of Broadview Middle School in Danbury, Connecticut. The advisor was Dolores Kelsey. This poster has three plots—two bar charts that show height and armspan of students in the class. The bar charts are broken down by gender—red for girls and blue for boys. The middle scatterplot shows height by armspan. Points that fall on the line are squares—students that have an armspan equal to their height. The three drawings of people show that there are wide rectangles (reach larger than height), squares, and tall rectangles (height greater than reach). It would have been nice to be more explicit on the middle scatterplot to show which students are tall versus wide rectangles versus squares. This is a great data collection activity that can tie in with other subjects as well. The color coordination between graphs was good. The same choices were made for grouping of the data. The labeling was legible. It would have been interesting if the armspan vs. height graph could have shown how boys and girls fell onto tha



Sleep: Do Teens Get Enough? by sophomores Regina Wowk and Jacqueline Jamison

chart. This could have been done by highlighting the scatterplot to see how many boys and how many girls were squares or other shapes.

Grade Category 10-12:

First Place: *Sleep: Do Teens Get Enough?* by sophomores Regina Wowk and Jacqueline Jamison at St. Joseph Academy in Cleveland, Ohio. Mrs. Paula Marshall-Schuetz advised them. This poster asked teens several different questions regarding their sleep habits. The poster graphs were computer generated but were extremely legible and neat. The first graph, a frequency polygon, shows a reference line for the actual number of hours that are recommended, which helps to answer the title question. The only flaw was that the horizontal axis should have a zero on it since it is a potential value. The primary and secondary reasons are shown in side-by-side bar charts. An alternative format could be a stacked bar chart which would allow the viewer to focus on the total of the two.

Second Place: *Is There a Relationship Between Time Spent Watching Educational Programming and 1st and 2nd Grade Academic Achievement?* by sophomore Sarah McGuinness at St. Joseph Academy in Cleveland, Ohio. Her advisor was Mrs. Paula Marshall-Schuetz. This poster has two series of pie charts. The first series shows hours of educational TV watched as a 2nd grader. Each pie shows the grade distribution. It is clear to see more "A" students in the most educational TV category and more "F"students in the least amount of educational TV. The second series again shows pie charts for grade distributions. This time each pie represents a degree of struggle. For those students that struggle a lot, there are more "F" students. For students struggling little, more "A" students. The middle stacked bar chart ties the two variables, struggle and educational TV together. The major improvement to be made for this poster is the labeling, which is not readable for a poster. The use of consistent colors, and the interrelatedness of the three graphs is a positive. Interestingly, this poster is based on survey research of high school students who are asked to recall how much educational TV they watched as a second grader. This could raise some memory recall issues when trying to draw inferences from it.

Third Place: Does Where You Live Affect How You Will Die? by Kirsti Kraus at Neshaminy High School in Langhorne, Pennsylvania. Her advisor was Diane McCollick. This poster consists of computer generated graphs that show incidence rates of death and death by specific factors from several countries. While the order of the countries is the same in each of the graphs, it might be good to organize them either alphabetically or smallest to largest in terms of total deaths. While the labeling is clear and legible, there is too much narrative information provided. The graphs should be able to tell the whole story. The pie charts compare deaths in Russia to deaths in the U.S., except that the same pie piece is not pulled out in both. This poster was also recognized this year as the third place poster in the Pennsylvania Statistics poster competition.

Some Advice from the Judges

There is a working rubric for judging that is undergoing modifications each year. We hope that providing a judging rubric would be helpful to teachers in guiding poster construction. An example of the most recent working version of the one used for the national competition is on the following page. It focuses on the aspects we have always stressed: overall impact, clarity of the message, statistical appropriateness, and creativity. It will be revised at the national statistics meeting in collaboration with other regional poster planners. Any of your comments would also be helpful, including suggestions, questions and concerns.

Rubric for the Judging of Statistics Posters

Score	**Overall Impact of the Display** Use of space, dimensions of question, readability, neatness, poster design aspects	**Technical Aspects** Spelling, Grammar, Consistency of colors or patterns	**Clarity of the Message** How well is a story told?	**Appropriateness of the Graphs for the Data** (Statistical Appropriateness)	**Creativity** (Data collection methods, sample size issues, who cares factor)
5	Poster is neatly constructed, including good use fonts, pictures, and extras. The overall display is eye-catching but retains statistical substance. Good use of space for graphical presentation. Addresses multiple dimensions of the question or problem.	Poster uses colors and patterns well. Correct grammar and spelling are used.	Question or purpose is clearly stated, and the presentation leads to the conclusion on a path that is easy to follow. The results of the study are immediately obvious to the viewer.	Graphs are appropriate for the question and data, and they are correctly constructed.	Overall question is interesting, phrasing of titles, captions, and question are creative. Shows creative thought in topic, graph design, or data collection. Collects data appropriately. Answers an important topic.
4	Addresses multiple dimensions of a question. Good use of space. Fonts could be larger but do not really detract from the message. Could be a little neater but really does not detract from the message.	Better use of color or patterns would help the presentation, but in general the poster grabs the attention of the viewer. Correct grammar and spelling are used.	At least one link in the chain from the question through the results to the conclusion is difficult to follow.	Errors or inaccuracies are present in at least one graph. More appropriate display(s) would improve the presentation.	Overall question is interesting. Some creativity in design or data collection. Collects appropriate data.
3	Good use of space. Addresses multiple dimensions of a question. Readability or neatness detract from the overall appeal of the poster.	Use of more or different colors, would vastly improve the appeal of the poster. Minor grammar and/or spelling mistakes.	The progression from question to conclusion can be followed, at least in part, but only with considerable effort, and the information on the back may be needed to confirm.	Significant gap exists in the demonstration of understanding of the graphics, or how the graphics relate to the purpose of the poster	Some creativity.Data could be better but it doesn't distract.
2	Serious problems with neatness or organization prevent the poster from being eye-catching and understandable. Multiple dimensions of the question addressed. Could use space better.	Serious problems colors or patterns prevent the poster from being eye-catching and understandable. OR Multiple mistakes in grammar or spelling prevent the poster from being eye-catching and understandable.	The information on the back is required in order for any relationships in the poster to be understood.	Although some part of the graphs is correct, substantial errors lead to invalid or inappropriate conclusions.	Creativity and topic are of some interest. Data collection could be improved with larger samples.
1	The poster is unidimensional. Poor use of space for graphics. Major neatness or readability issues.	The poster is has multiple spelling or grammar/spelling errors AND isn't consistent with colors or patterns so much so that it severely distracts from the poster.	The poster is virtually incomprehensible.	The displays are inappropriate and incorrect for the research question and data types. The question is badly misunderstood and the results are nonsensical.	The poster appears to have been constructed with very little or no creativity or with improper data collection methods.

Here are some general comments in poster construction that have been discussed during judging over the past few years:

♦ **Use of 3-D graphics**—3-D graphics have proliferated with the use of computer generated graphs. However, they can be deceiving to read and interpret —where does the bar end, is the pie piece bigger that shows depth? Three dimensions should be used only when the third dimension means something.

♦ **Computer versus hand drawn**—both types of graphs are acceptable and have won. The tradeoff seems to be readability versus neatness. Computer generated graphs may be neater and more accurate but they may use smaller fonts that sacrifice readability. Hand drawn graphs allow for larger fonts but may require more time to be neat and accurate (straight lines, coloring within bars). Computer graphs may require time to get colors and scales to be consistent between graphs to add to the interpretation, as well as increasing font size for readability.

♦ **Use of space**—The purpose of the competition is to tell a story with graphs. Therefore the graphs should take up the majority of the poster. Titles can be readable without taking up a third of the poster. Graphs should take up at least 75% of the poster.

♦ **Labeling**—To ensure accurate interpretation, graphs should be adequately labeled, including labels for axes. These labels should be spelled correctly and be large enough to read.

♦ **Consistency of colors**—Color is a powerful way to tie graphs together for comparisons. When possible, identical colors should be used to identify identical categories. Also, categories should be shown in the same order when possible.

♦ **Pie charts**—Be careful using pie charts when the number of categories is large. The pie segments become difficult to distinguish and more difficult to interpret. When possible, consider placing the labels around the pie. It allows the viewer to make conclusions with one less step (going to the legend to figure out what category is which pie segment). This also helps when the colors or patterns are really close and it is difficult to distinguish on the legend. If you want to make comparisons between several pies, the segments should be ordered in an identical fashion. Sometimes a segment is zero and does not show up in a pie; this can be an important fact.

♦ **Dimensionality of the data**—A good poster addresses multiple dimensions of the main title. This may include comparisons between groups (such as male/female or different grade levels) or several questions all related to the same topic. Posters that show the same data using different graphs (a pie chart and a bar chart) may not really be enhancing the story being told by the poster.

♦ **Frequency versus Percentage**—When sample sizes are not equal and you are trying to draw comparisons, it is better to use percentages. When percentages may not be appropriate for some k-3 students, it is important to try to make the comparison groups as equal in sample size as possible. It is always nice to see what sample size the graph is using.

♦ **Line plots**—Line plots, where data points are connected with a line, is usually appropriate when the horizontal axis is ordinal. When the horizontal axis has nominal data, consider the impression the graph would have if the categories were re-ordered. The incorrect use of this graph usually eliminates the poster from award consideration.

♦ **Bar Charts showing averages** —While bar charts can be used to show averages, if the raw data is available, there are other graphs that might be considered that could give even more information. Consider how a boxplot or a dotplot might provide even more information.

The future of the competition looks promising. An effort is being made to increase the number of local or regional competitions. If you have an interest in creating a competition in your area, please contact me. Poster quality is slowly improving. We are hopeful of significant improvement as statistics and statistical concepts continue to be more integrated into school curricula. From only 91 entries in 1990, the competition has grown to 912 in 1997 and 1,852 in 2002.

There are several resources available to teachers. The ASA will attempt to put you in contact with a local statistician that could visit your classroom. If you are interested in this, contact Monica Smith at *monica@amstat.org. What is a Statistics Poster* is available on the web at *www.amstat.org/education/statposter.html.* Finally, there are several local competitions that act as feeders to the national competition but also allow for local posters to receive recognition within their region. Visit the Pennsylvania competition at *http://renoir.vill.edu/~short/posters*; the Michigan competition at *www.gvsu.edu/stat/statposter*; the Northeast Ohio competition at *www.bio.ri.ccf.org/ASA/poster.html.*

Statistics Teacher Network
c/o American Statistical Association
1429 Duke Street
Alexandria, VA 22314-3415
USA

Let us know your Zip +4!

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Farewell...

The *Statistics Teacher Network* newsletter began in 1982 with Ann Watkins as editor, followed by Beth Bryan (1985), and Jack Kinney (1988). In 1992, I was privileged to have been asked to be its fourth editor and have enjoyed bringing issues 31-62 of statistics articles and reviews to you terrific teachers of statistics across the nation. But it is time, past time, for STN to have new leadership with new ideas and energy. Paul Myers has agreed to be the new editor and I wish him all the very best. I trust that you will make his tenure as enjoyable as you have made mine.

I am indebted to all of you who contributed articles to STN, and in particular Cyrilla Bolster, Susan Bates, and Joyce Conway who helped provide input at the elementary, middle, and high school levels, resp. Thank you all very, very much.

The present and future are very bright for statistics education. Keep up the wonderful work that all of you are doing to make statistics an integral part of your students education.

I promised the ASA/NCTM Joint Committee that my parting task would be to get STN on the web. Thanks to Ryan Bell, ASA's web master, all issues under my editorship are located at *www.amstat.org/education/stn/index.html.*

All the very best!
Jerry Moreno

Send mailing address corrections and additions to: Madge Haven: *madge@amstat.org*