The Statistics Teacher Network

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QL in the Classroom

Quantitative Literacy in Action

Before taking the Quantitative Literacy workshop, statistics teaching was not new to me. I had taught it for a total of seven years, all in the traditional way. But although my students' grades were satisfactory, they seemed to lack an understanding of how to interpret results and apply statistical concepts. When I began working as an educational researcher, I was startled by the contrast between the artificiality of classroom statistics, where calculations were neat, decontextualized, and had one right answer, and real-world statistics, where intepretation and judgment played a major role, colleagues disagreed, and there was no textbook with the answer in the back. After ten years as a researcher, I vowed that I would not teach statistics again until I found a method that would allow students to experience it as I had, in a real-life context with real research problems and realistically messy but meaningful data.

Also In this Issue...

Just prior to getting my present job at Upsala College, I was fortunate to discover the Quantitative Literacy workshop given at the Center for Mathematics, Science and Computer Education at Rutgers University. The workshop was the answer to my prayers, with its emphasis on real applications, authentic data, and active participation. Rather than a dry set of procedures for performing artificial computations, statistics became a series of projects in which students discovered ways to make sense of the overwhelmingly disorganized and detailed information around them.

Upsala is a small, private liberal arts college located in East Orange, New Jersey. All students must take a halfsemester course in statistics as part of the college's Common Curriculum. Given the limited time allotted, as well as the limited mathematical background required (students need only have satisfied the college's basic math requirements of computation and beginning algebra), the course emphasizes elementary concepts related to simple graphic presentations, central tendency and variability, correlation and regression, and basic probability.

After taking the QL workshop, I made many changes in how I introduced these topics. On the first day of class, rather than jumping into formal definitions and calculations, I opened by asking students how they thought statistics is used in the real world. We discussed ways that many fields, especially those related to the students' prospective majors, use statistics to quantify information: business, marketing, psychology, sociology, economics, manufacturing, the health sciences, insurance, and politics. From these examples, we created a definition of statistics as a set of methods for gathering and

organizing information in order to reveal patterns that can be used to make decisions.

In successive lessons, all the examples used were drawn from realistic sources. To demonstrate methods for presenting information visually, we examined a variety of charts and graphs clipped from newspapers and magazines. We discussed which methods were useful for different types of data and how various styles of charts could serve different purposes. To illustrate measures of central tendency and variability, as well as seasonal trends, I distributed climatological data from the National Weather Service and had students compare temperature patterns in different cities, focusing especially on cities with the same mean but different variability. As suggested in the QL workshop, students answered questionnnaires for inclass data and summarized the results. I supplemented these activities with videotaped segments from the public television series *Against All Odds* showing how statistics is used in comparing batting averages, statistical process control, evaluating correlations, and assessing the odds of winning at the casinos.

At Upsala College, a strong value is placed on developing students' writing skills in a variety of contexts. Given my desire to develop students' interpretive skills, this seemed like the ideal place to introduce projects in report writing. The first assignment, an exercise in combining the results of a series of charts and graphs, was based on a set of four charts on the financial problems of Nynex Corporation that appeared in the newspaper after Nynex had announced major payroll cuts. The assignment read as follows.

Assignment: Interpreting Charts

Below are some charts describing the financial condition of Nynex Corporation, the New York New England telephone company. (They appeared in The New York Times on 1-25-94.) Write a brief report (1-2 pages) describing what you see in the charts. Pretend that you are a Nynex employee who has been asked to interpret these charts for the public. Therefore, please write clearly and specifically, in essay form; for each pattern you report, indicate where you see it and what the relevant figures are. In your report, address these questions:

- What decision did Nynex announce? In what chart is this illustrated and how?
- What does revenue refer to? What has been the trend in Nynex's revenue over the years?
- What is net income? What has been the trend in Nynex's net income, especially in 1993?
- What pattern do you see when the charts on Employment and New Income are taken together?
- What does the final table tell you?

The second assignment, drawn from an example in the QL book *Exploring Data*, asked students to interpret the results of a correlational study.

Assignment: Examining Relationships

Pretend you are a medical researcher studying the relationship between smoking and heart disease across countries. (This is called an epidemiological study.) You have collected the following data and now must report on what you found. Write a brief report (1-2 pages) interpreting these results. In your report, address these questions:

- What is the mean number of cigarettes smoked? The mean number of deaths from coronary heart disease? Is the United States above or below these averages?
- Is there a linear relationship between cigarette consumption and coronary heart disease? On what do you base your judgment?
- What is the correlation between cigarette consumption and coronary heart disease? What does this correlation mean?
- What is the regression equation predicting CHD mortality from cigarette consumption? How do you interpret this equation?
- What percent of variance in CHD mortality can be explained by cigarette consumption? What percent is explained by other factors?
- Based on all this evidence, do you judge there to be a strong link between smoking and heart disease? What would you recommend to the public regarding smoking?

Students' papers in response to these assignments showed an improvement over

what I had seen in previous classes; they were now focusing not only on drawing charts and computing numbers, but on drawing conclusions about a situation they might well read about or encounter in their jobs. Similar questions on the examinations showed that most students were developing a facility for interpreting and writing about the patterns they saw. Overall, I felt far more satisfied and had more fun teaching, than in the days when I taught statistics as mathematical formulas for artificial data.

Applying what I learned in the QL workshop was a growth experience for me as well as for my students. QL is more than a series of methods. It is an orientation toward the field of statistics that invites students to enter it and see it from within, as professionals do. It has helped me to examine not only how I teach statistics, but how I can teach other subjects.

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A Poster of Data

America's Lifeline

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Has immigration changed from 1900 to 1990, either in number or nationality of the immigrants? Has the leading cause of death changed since 1900? These are only a few of the questions answered by "America's Lifeline", a poster and reference guide which are intended to provide a framework for teaching health, scientific reasoning, and graph reading skills. The poster depicts health and population trends in the United States in each decade from 1900 to 1990. Major components of the population, measured by birth, death, and immigration, are displayed via pyramid charts, histograms, pie charts, and scatter plots. The reference guide contains suggested lesson plans and exercises. The poster (24" x 35") is available for $14.95 + $3 shipping; a classroom wall chart (40" x 58") is available for $34.90 + $5 shipping.

Data are displayed in ten rows and eleven columns. Each row represents a different component of the population, including the population of males and females by age group, the number and origin of immigrants, expected family size, the percentage of deaths in the population, the leading causes of death, and life expectancy. The first column provides an overview of each component of the population; the remaining ten columns show more detailed information for each decade, typically by gender, race, and age.

The poster has several features which aid in understanding the content. Color is used to highlight differences in race, gender, or other grouping factors of interest. Pie charts are of varying size to illustrate differences among decades of some components of the population. This makes it easy, for example, to note at a glance that the number of immigrants in 1990 is about the same as it was in 1910 (pies of approximately the same size), but the composition has changed dramatically (pie pieces of very different colors). A disadvantage of the poster is its size; in order to read the labels, you need to be close to the poster. In a classroom setting, this would limit the number of students who could use the poster simultaneously. The classroom wall chart may solve this problem, but I did not see it and cannot endorse this solution.

The reference book supplies detailed information about the content of each row on the poster and discusses events which influenced certain data trends. It also lists sixty-four references to various journals and publications where additional information on these topics may be found. It contains suggested questions and exercises in three areas of teaching: reading and drawing graphs, health, and scientific reasoning. The questions range from simple questions (Determine the risk of death in 1990 for a 15-year-old white male.) to more complex exercises (The birth rate since 1970 has been approximately constant yet the annual number of births has increased. Describe at least one possible reason that accounts for the difference in these two trends.) The suggested exercises

provide a good starting point for using the poster, but should not be viewed as an exhaustive list of exercises. The applications of this poster are limited only by the user's imagination.

Examination of the graphs reveals interesting facts about America's population and can lead to many questions. This material may be used as a tool to stimulate interest in learning and to teach students the process of seeking answers to their questions. In addition to the areas of learning cited by the authors, the data can be used to generate interest in historical events. For example, a scatter plot of mortality since 1900 shows a relatively steady decline in deaths except for one noticeably large peak between 1910 and 1920. One might think that this peak was due to a large number of deaths resulting from World War I; however, one might note that there is no corresponding peak for World War II. Additional research would uncover the fact that an influenza epidemic occurred in 1918, thus accounting for the peak in mortality.

This material is suitable for all age groups and audiences. It can be used in the classroom to help students become comfortable with the concept of expressing information graphically. It shows them that graphical presentation of data is not limited to math class, but can be used across a wide variety of disciplines. This idea will be extremely beneficial for students when they create science fair projects. It also serves as an excellent introduction to the concept of a statistical poster, which uses a series of inter-related graphs to tell a story.

In summary, "America's Lifeline" provides a wealth of information which can be an invaluable tool in the classroom. It has the potential for an almost unlimited number of applications. It can be used to introduce the concept of graphical representation of data and can proceed from there to excite in students the desire to find answers to questions which are generated by the material presented in the poster.

Reviewed by Lisa A. Rybicki
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A Data Driven Curriculum Strand for High School Mathematics

The NSF-funded Data Driven Curriculum Project targeted for grades 9-12, addresses two complementary needs: how to use data analysis to motivate some essential topics of a restructured mathematics curriculum and how to teach those data analysis skills required for effective participation in society. Ten modules, developed for classroom use, integrate data analysis into the teaching of many traditional and important mathematics topics that are motivated from real problems and applications of interest to students. The statistical concepts included in the modules, as a whole, provide a unified and complete presentation of the subject at the secondary level. Data analysis skills are used to help build connections between mathematics and other school subjects, and between mathematics and the world outside.

The modules are written with sufficient detail and can be used as the sole reference to teach many topics emphasized by the NCTM Standards, for example, linear equations and inequalities, data transformation, or logarithms. The modules, however, are not intended to provide a complete 9-12 curriculum. The intent is to help the Standards take on a concrete form for teachers so they can effectively and efficiently use the materials that contain new motivation for mathematics and that present mathematics from a different perspective. Algebra and geometry are integrated throughout the modules, and technology is used as a tool to solve problems and to advance student understanding of mathematics.

The modules from this project differ from traditional materials in the United States, and they will encourage teaching to differ from current practice in several major ways. Each module is based on answering questions about issues in the student's environment. The need for mathematics is provoked by attempting to answer questions and solve problems efficiently. The modules are written so that students

must assume responsibility for reading and learning. Although essential skills, such as solving simple linear equations, must still be mastered, the emphasis is on applying knowledge and using mathematics. Rather than memorizing algorithms and manipulating symbols following explicit directions from the teacher, students explore, investigate and interact with each other and the teacher when confronting problems, many of which are open ended. There is a strong emphasis on communication, both in terms of justifying a reasoning process and writing to convey a problem solution.

Each module includes an assessment component that is designed to provide information on the process and progress of student learning. Suggestions are given for the use of student reports, summarizing tasks and its results, student created tests, and small individual and group projects to enable teachers to learn what students know and are able to do.

As a part of the NSF grant, five regional two day conferences were held during the spring of 1994 and three more will be held during the spring of 1995. These conferences are to introduce supervisors, curriculum coordinators, mathematics educators and lead teachers to the modules and to explore their use in the secondary classroom. If you are interested in arranging for such a conference to be held in your area and being its host, please send a request for consideration to: Gail Burrill, Data Driven Mathematics, 12155 W. Luther Avenue, Hales Corners, WI 53130.

Your request should include the following:

- Suggested location for conference
- Possible dates
- Name of person who would be willing to serve as local facilitator
- General description of possible participants
- A short rationale for why your site should be selected.

Pat Hopfensperger
Homestead High School
Mequon, Wisconsin

Editor's Note: It is hoped that the data-driven materials will be published sometime next year.

Project Competition Involvement

Have you ever wondered what a statistical project is and whether you could help students participate in the ASA Project Competition? I have. That is one of the reasons I volunteered the Nebraska Chapter of ASA to serve as the judges for this year's Project Competition. This gave me the opportunity to read all of the projects that had passed the initial screening by classroom teachers. I learned two things. First, a statistical project is not as complex as I imagined. One can be completed by most students in grades four and up. Second, it is a powerful teaching tool that integrates numerous concepts and skills presented in the classroom. The purpose of this article is to make teachers aware of exactly what is involved in a statistical project.

A statistical project is the process of answering a research question using statistical techniques and presenting the work in a written report.

The research question may arise from any field of scientific endeavor, such as athletics, advertising, aerodynamics, nutrition. It differs from a statistical poster in that a written report is used to present the findings.

The process of developing a statistical project should demonstrate the scientific method of solving a problem:

1. Pose a focused question or questions
2. Collect appropriate data
3. Analyze the data intelligently
4. Draw correct conclusions

Because students are continually asking questions about things that touch their lives, they should have little trouble generating questions about themselves, their schools, their families, their neighborhoods, or interesting phenomena in the world. Once a question is proposed, they should examine it. First, is it a question that can be answered? ("Is there intelligent life in the universe that does not come from Earth?" is an extremely interesting question, but not one that is likely to be answered in

a short-term project.) Second, is it possible to collect data to answer the question? If not, has someone else already collected data that could be used to find the answer?

Once the question is chosen, data must be collected. If published data are used, students should understand how they were obtained and record the source. Usually students choose to collect their own data. If so, time should be spent deciding how to collect them. If a survey is used, then how are the people chosen to answer the questionnaire. If two treatments (treatments could be models, grades, genders, etc.) are to be compared, how can the comparisons be made fairly? How will the data be recorded? After the details have been worked out, then the students are ready to take the data. Great care should be exercised at every stage of data collection. Remember that careless measurement or recording of data cannot be remedied in the analysis phase of the project.

Intelligent analysis of the data may take many forms and should be guided by the question and how the data were collected. Usually it is best to begin by graphing the data. Can graphs be used to give the answer to the question or questions? Most of the time, graphics has been the sole method of data analysis for grades 4 through 6. As the students gain in experience, some simple statistical methods such as a chi-squared test or a t-test may be used. Regression has been used occasionally. Sometimes, estimation is most appropriate, and hypothesis testing is not needed. Other methods may be used depending on the question and the data.

Once the analysis is complete, the question should be answered correctly. The data may not be able to provide a conclusive answer. For example, one treatment may appear to be better than another, but the difference was not significant. If the question has a definite answer, then that should be presented. A check should be made at this point to make certain that the answer matches the question. It is easy to get "caught up" in the anlysis phase and obtain many answers, none of which addresses the research question.

Finally, consider the strengths and weaknesses of the project. What went right? What went wrong? What would be changed if it was done again?

Great latitude may be taken in developing the written report. Students should plan how to effectively communicate their work. The longest report does not necessarily represent the best project. However, the report MUST do the following:

1. Demonstrate how and why the particular topic was chosen.
2. Show how the research was conducted.
3. Delineate what conclusions were obtained.
4. Include the collected data and analysis of the data.
5. Discuss the strengths and weaknesses of the selected statistical methods.

Sometimes the complexity of the data is such that it is difficult, if not impossible, to answer a research question using graphics alone. In such cases, the project competition permits a fuller statistical treatment of the data that does the poster competition. The statistical project is a powerful tool for integrating problem solving activities with subject matter interests while exercising essential communication skills. At the same time, it is a fun activity that students can really enjoy!

Linda J. Young
Nebraska Chapter, ASA

Book Review

Introducing Data Analysis in the Schools: Who Should Teach It and How?

Edited by Lionel Pereira-Mendoza, 1993. Published by the International Statistical Institute. (Available for $25 from the ISI, 428 Prinses Beatrixlaan, PO Box 950, 2270 AZ Voorburg, The Netherlands.) (email:isi@cs.vu.nl)

This book contains papers and summaries of discussions held at the second ISI Round Table Conference, held in Quebec, Canada in August 1992. Eighteen papers presented by participants from eleven different countries are arranged into six sections, each followed by reports of the general

discussion on that topic. A preface by Pereira-Mendoza, the conference organizer, provides an overview of the conference and some of the important issues that arose during the five days of the round table.

The first section of the book describes the "Current Situation" in four countries: Turkey, Pakistan, Indonesia, and France. These papers present an overview of statistics education in each country as well as the role of data analysis in the curriculum. Meral Aksu's paper on statistics education in Turkey reports on a survey of mathematicians and statisticians in different universities and high schools. He asked these instructors about their educational background, teaching experience, and views of issues relating to statistics education at the primary and secondary level. Saleha Habibullah's paper on the "Pakistani Scene," describes the place of statistics in different college-level programs and problems associated with the country's socio-economic condition. Andi Nasoetion's paper discusses the Quantitative Data Literacy curriculum in Indonesian junior and senior high schools and weaknesses in this curriculum. The final paper, by Annie Morin, discusses differences in instruction in data analysis at the primary and secondary level in France, and describes a project designed to improve the teaching and learning of data analysis at the secondary level. This project involves using newspapers and magazines as sources of data and graphs and the use of data bases of medical causes of death.

The second section, "Who Can Teach? and Electronic Data Bases" consists of two papers. The first paper by Anne Hawkins reports on a survey of 349 teachers of statistics at the primary and secondary levels in the United Kindgom. The teachers surveyed were asked about their own training in statistics, their perceived areas of difficulty with statistical content, their teaching methods and use of resources, and their attitudes towards the teaching and practice of statistics. Teachers were also asked about their views of who should teach statistics and probability and the place of these topics in the school curriculum. The second paper, "E-STAT: An Electronic Learning Package for Teaching Statistics Across the Curriculum" by Joann Morton and Nicole Benoit of Canada, describes an electronic learning tool based on CD-Rom technology. Different data sets and guidelines for their analysis are presented that can be used in different subject areas (e.g., geography, accounting, and mathematics.)

There are three papers in the third section, which echoes the conference theme: How to teach data analysis and who should teach it?.Flavia Jolliffe argues that data analysis should not be limited to "statistics lessons" but should be integrated in courses throughout the curriculum. She gives an example of how to approach the analysis of a set of data on birds of Britain. Abdelmegid Farrag offers a framework for a course on data analysis for schools in Egypt, focusing on what the role of the teacher should be in order to have effective instruction of data analysis. Susan Starkings of the UK examines areas where data analysis is currently being taught: in mathematics courses, statistics courses, courses in other subject areas, and courses which assume statistical knowledge. She concludes by asking if schools need a statistics coordinator who would consolidate the teaching of data analysis in various subject areas.

Four papers in the "Teaching Data Analysis" section offer different approaches to integrating data analysis within the curriculum. Andrej Blejec of Slovenia focuses on the use of computer graphics in teaching data analysis. Gail Burrill of the USA describes the third Quantitative Literacy Project, "A Data Driven Curriculum" for students in grades 9-12, giving examples of data sets and analyses that relate to different topics in the high school mathematics curriculum. Andrejs Dunkels discusses his experiences introducing topics of exploratory data analysis to primary students in Sweden, and argues for the need to integrate these topics in the official primary curriculum. Kerstin Vannman, also from Sweden, provides examples of EDA that can be used by mathematics teachers in the upper secondary grades.

The fourth section of the book extends the topic of teaching data analysis and related issues. Carolyn Maher and John Pancari of the USA suggest teaching exploratory data analysis through problem solving and present two examples for use in a physics or mathematics class. Iddo Gal of the USA addresses the problem of how to expand statistical instruction to reach more students, and offers suggestions for the development of new training and instructional materials for teachers. He also offers detailed recommendations for teachers who are teaching statistics to students who lack strong mathematical skills or motivation to learn statistics. Didier Dacunha-Castelle presents a socio-historical perspective of why French students have not developed important concepts in

probability and statistics and offers suggestions for how to convince teachers of the importance of this information in the school curriculum.

The last section consists of two papers dealing with research needed in the area of teaching data analysis in the schools. Andy Begg of NZ offers a research agenda for statistics education, including the areas of errors and misconceptions, communication, assessment, equity issues, and teacher development. David Green of the UK summarizes what research has revealed so far, and raises questions for future research based on this accumulated knowledge. His questions relate to topics including proportional reasoning, modifying intuitions, longitudinal studies, graphical representation, simulations, and transfer of learning.

Although there is variability in the quality of the papers in this book, which is not surprising given the diversity of authors and the countries they represent, nonetheless the papers offer an excellent overview of issues relating to the teaching of data analysis. The collection of papers and summaries of discussions are important reading for anyone interested in this important aspect of statistical education.

Reviewed by Joan B. Garfield
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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 the Curriculum in Statistics and Probability.

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 the editor:

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

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Winners of the 1994 American Statistics Poster Competition

The American Statistics Poster Competition is a joint project of the Section on Statistical Graphics and the Center for Statistical Education of the American Statistical Association. The basic purpose of the competition is to encourage our school children from kindergarten through the twelfth grade to use their creative skills to analyze data graphically. The contest is open to all public or private schools in the United States and Canada.

There are four categories: grades K-3, 4-6, 7-9, and 10-12. Prizes totaling $200 are given in each category. Plaques are given to the schools of the winning entrants. Honorable Mention certificates are awarded as well.

To obtain a copy of the poster brochure for the 1995 competition, write to the Center for Statistical Education, American Statistical Association, 1429 Duke Street, Alexandria, VA 22314-3402.

The Fifth Annual American Statistics Poster Competition

WINNERS

Grades K-3, Co-winners:
($100 each)

When You Roll Two Dice 1000 Times, What Sum Do You Get the Most? 7!!, by Ryan Spurrier, Harbison West Elementary School, Columbia, South Carolina
Advisors: Kay Mackey and Pamela Spurrier

Where Will a Squiggle Ball Roll?, by Travis Colopy and Glen Colopy, Doolittle School, Cheshire, Connecticut
Advisors: Mike Colopy and Jo Fackler

Grades 4-6
($200 each)

1994 Winter Olympics Medal Count, by Mary Burke, Andrea DeRusha and Sara Vine Meadowview Elementary School, Eau Claire, Wisconsin
Advisors: Linda Korpi and Roxanne Mower

Grades 7-9
($200 each)

Breaking Through...or Just Making a Crack?, by Minda Huebner and Marion Karl, Sudlow Junior High School, Davenport, Iowa
Advisor: Diane Wirtz

Grades 10-12
($200 each)

GPA vs SATs, by David Bustos, Huyen Nguyn, Amanda Sandoval, Emma Vega, Rosemead High School, Rosemead, California
Advisor: P. Denson

HONORABLE MENTION AWARDS

Grades K-3

Favorite Foods, Sports, Colors and Animals, by Kristine Falk, St. Thomas More School, Chapel Hill, North Carolina
Advisor: Hilda Bukowski

Grades 4-6

Tardiness at Annie Snipes School, by Jordan Booth, Allison Sidders, Amy Wright-Frierson, Annie Snipes School, Wilmington, North Carolina
Advisor: Ruth Edmunds

Grades 7-9

Video Arcade Players: Who Are They?, by Chris Homiak, Jefferson Middle School, Albuquerque, New Mexico
Advisor: Paul Mitschler

Does Weight and Speed Correlate?, by Tam Le, Tu Anh Ta, Thanh Van Tran, Thanh Ngoc Tran
Rosemead High School, Rosemead, California
Advisor: P. Denson

What Kind of People Does a Healthcare Clinic for the Homeless Serve?, by Amalia Gonzalez-Kahn, Jefferson Middle School, Albuquerque, New Mexico
Advisor: Paul Mitschler

Grades 10-12

Boston Marathon: What Affects the Winning Times?, by Jeremy Gries and Michael Riedeman, Roncalli High School, Indianapolis, Indiana
Advisor: Mary Riehle

Winners of the 1994 American Statistics Project Competition

The American Statistics Project Competition, sponsored by the Center for Statistical Education of ASA, is designed to offer an opportunity for students to work as a team to discover the scope and applicability of techniques in statistics. The competition is open to students from grades four through twelve in both the United States and Canada.

Prizes totaling $300 will be given in three categories; grades 4-6, 7-9 and 10-12. A plaque will be given to the school of each winning team. A prize of $100 is awarded for the project making the best use of a computer. Certificates are given in recognition of Honorable Mention.

To obtain a copy of the project brochure for the 1995 competition, write to the Center for Statistical Education, American Statistical Association, 1429 Duke Street, Alexandria, VA 22314-3402.

The Eighth Annual American Statistics Project Competition

WINNERS

Grades 4-6
($300)

What are the Fifth Graders' Concerns About Going to Intermediate School?, by Jason Held, Ben Irey,Pat Mobley, Joey Pollard, Sarah Warren, Eisenhower School, Davenport, Iowa
Advisor: Christine Agy

Grades 7-9
($300)

Correlation Between Grade Point Average and Number of Days Absent of 9th Grade Students, by Brian Bondari,Melissa Goebelbecker, Reneé Pittman, Jennifer Thompson, Tift County Junior High School, Tifton, Georgia
Advisor: Reneé Bridges

Grades 10-12
($300)

The Diameter of Hair: Is There Any Rhyme or Reason to It?, by Theresa Mai, Collen Marion, Lincoln Southeast High School
Lincoln, Nebraska
Advisor: John Kastl

Computer Prize
($100)

Scoops in Winter,by Tia Black, Dorothy Chavez, Jennifer Gibson, Tony Morey, Megan Murphy-Lee, Raymond Wardy, Jefferson Elementary School, Fayetteville, Arkansas
Advisor: Kim Shiver, Melissa Lee

HONORABLE MENTION AWARDS

Grades 4-6

Type to Learn - With Covers or Without Covers, by Kevin Barrington, Andrew Campbell, Ryan Robson, Brookwood Elementary, Houston, Texas
Advisor: Linda Barrington

Grades 7-9

Can a Naturally Occurring Pesticidal Bacterium Adapt to Agricultural Chemicals?, by Emily Griffin, Adams Central High School, Hastings, Nebraska
Advisor: Dr. Louis Perino

Grades 10-12

1993 New Hampshire Beach Cleanup, by Anthony Auer, Joseph Foley, Salem High School, Salem, New Hampshire
Advisor: Alice Friedenson