THE STATISTICS TEACHER NETWORK

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by the American Statistical Association - National Council of Teachers of Mathematics
Joint Committee on the Curriculum in Statistics and Probability.

AMERICAN STATISTICAL ASSOCIATION TO CONDUCT QUANTITATIVE LITERACY WORKSHOPS IN SIX STATES

The American Statistical Association (ASA)–through its Center for Statistical Education–will conduct Quantitative Literacy (QL) Workshops during the summer of 1991. These QL Workshops are designed to promote professional development among secondary school teachers of mathematics and science while preparing them for the instruction of statistical and probabilistic concepts in the classroom.

The workshops will be presented by QL Staff made up of teams of classroom teachers and statisticians who have worked with the QL Project. ASA Chapter Statisticians are supporting and participating in each of the QL Workshops held in their locale. A network of secondary classroom teachers and statisticians from academia, government, and industry will form a support group within each of the geographic sites.

The 1991 QL Workshops are being sponsored and funded by local school systems/districts, universities, local ASA Chapters, and/or local grant monies. Confirmed sites thus far are: Cleveland, Ohio; Montgomery County Public Schools, Ohio; Fairfax County Public Schools, Virginia; Palm Beach County Public Schools, Florida; Valdosta State College, Georgia; University of Arkansas at Little Rock; and the University of Delaware.

For information on setting up a QL Workshop in your area, including specific details and cost, contact Kathryn Rowe, Center for Statistical Education, American Statistical Association, 1429 Duke Street, Alexandria, VA 22314-3402 or call (703) 684-1221.

WOODROW WILSON NATIONAL FELLOWSHIP FOUNDATION STATISTICS INSTITUTES

In the summer of 1991, the Woodrow Wilson National Fellowship Foundation (WWNFF), will administer eight one-week institutes conducted by secondary school mathematics teachers who attended an intensive WWNFF four-week institute in statistics held at Princeton University.

One-week institute topics center on statistics in society and include simple exploratory data analysis, simulations, probability, sampling and inference. Participants explore ways to incorporate statistical ideas into the traditional mathematics curriculum at various levels, with an emphasis on methods and materials readily available and usable in the classroom.

For a brochure/registration form, please call the site preferred:

MI, 6/17-21, Grand Valley State U., Dr. VanderJagt, 616-895-2045
VA, 6/24-28, George Mason U., Dr. Spikell, 703-764-6088
NY, 6/24-28, D'Youville College, Ms. Hari O'Conner, 716-876-9082
TN, 7/15-19, Maryville College, Dr. Nichols, 615-982-6412
NJ, 7/22-26, William Paterson College, Dr. Voos, 201-595-3417
MN, 7/22-26, College of St. Catherine, Dr. Vos, 612-690-6612
OR, 7/29-8/2, Portland State U., Dr. Enneking, 503-725-3630
IL, 8/5-9, Roosevelt U., Dr. Erbe, 312-341-3868

For information about other institutes in history, science and mathematics, please call Wes James at WWNFF, 609-924-4666.

– – Janet Gnall

USED NUMBERS

Used Numbers by Susan Jo Russell and Rebecca Corwin. Dale Seymour Publications, Palo Alto, CA, 1991.

"Look at those kids, what're they saying?"
"Why they're talking Math!"
"Did he say 'mode'?"
"Is she predicting what will happen on the playground if there are not enough teachers on the yard?"

An attention grabber that's what this videotape is ! Young kids are using numbers in ways they control. And, most importantly, the kids are constructing a variety of graphic displays to show the results of their data gathering and then discussing the meaning of their real numbers.

USED NUMBERS Real Data in the Classroom by Corwin and Russell Grades 3-4, and by Russell and Corwin for Grades 4-6, has an attractive, easy to watch, short (16 minute) introduction which should be playing continuously at every Math conference, teacher supply store, PTA convention, or any other gathering of thinking adults who work with children.

"So, how do I get my class into action using their own data and construction graphs which convey meaning to others and then thinking about the implications of their own data?"

Get your hands on *USED NUMBERS*. There are two books, one for grades 3 and 4 and a second one for grades 4, 5, and 6. (All six volumes will soon be available – ed.) The activities may be simplified or augmented so any elementary grade may use them. You'll find a script to follow with specific directions on materials to have prepared and ready to use. If you want to know how to answer the questions most likely to be asked, the answers are there.

Here's the spoon full of sugar to help the statistics go down. Not for the kids, they'll love the activities. The sugar is for you, teach, and once you take your first dose of statistics you go eagerly back for seconds and more.

USED NUMBERS is written for the teacher who never had any statistics courses and is reluctant to try to use statistics in the classroom. Or for the mathematician who has no idea how to simplify the subject for young children.

Both books begin with the same three pages of basic, simple to understand information on data analysis. Following are three pages briefly describing the activities in that book. Then there are seven or eight detailed activities actually to teach statistics. Hard stuff like counting the raisins in a box as you eat them, or finding a chair that "fits", or holding your breath as long as you can, or trying to get close to a pigeon while your friend is a spotter to mark the spot the pigeon took off from. All this great data must be recorded. *USED NUMBERS* tells you how to do it. Bar graphs, line graphs, sure, that's what you already have the kids doing. But how about a stem and leaf plot? What about "clumps, bumps, and holes"? *USED NUMBERS* tells all about reporting the shape of your data.

"What, my graph doesn't have to be perfect?"
"You can use a sketch graph."
"Well, that's not so hard, and when I'm finished I'll make a better one to report my data so everyone can understand it."

The beauty of these activities in *USED NUMBERS* is how easy the authors make the lessons to teach. Discuss the question, decide on procedures, do the work, show results, but don't stop there – what knowledge is gained from the information? You can see that each activity will take several lessons to finish. There is a sequence of difficulty so that learning is advanced through the book. The authors supply interesting background information, tell what materials to prepare, quote dialogue

to use, inform you of possible pitfalls, anticipate student questions with answers, and provide some blackline masters. The Teacher Notes sections are specific and define every term used. ANYONE COULD TEACH THESE LESSONS. And once you have done a few, you can come up with many more ideas appropriate to your neighborhood, town, interests, or talents.

The result of making the average teacher successful in teaching statistics is a generation of kids who are statistics literate. In primarily classrooms where *MATH THEIR WAY* has become more than just a book title but is a way of teaching activity based mathematics, teachers will have no trouble using *USED NUMBERS.* Teachers with standard texts which direct children to push pencils NEED *USED NUMBERS* TO PUT LIFE INTO MATH AND A LOVE OF WORKING WITH NUMBERS INTO THE HEARTS OF THEIR KIDS.

– – Marguerite Campbell

MATH TOUR OF ENGLAND

Susan Indorf, math instructor at Skagit Valley College Whidbey Campus, will conduct a math tour to England June 22 to July 6.

The third annual tour will follow the footsteps of famous mathematicians and explore the history of mathematics. Though people interested in math will be especially interested in this tour, it is open to all. Former participants have included teachers from all levels, as well as students, spouses and other anglophiles.

The itinerary includes visits to Oxford, Cambridge, Stonehenge, Salisbury, Greenwich, Bath and Windsor as well as London attractions. The tour allows some afternoons and all evenings free for independent exploration.

Tour participants will stay in a University of London residence hall. The land portion of the trip will cost approximately $1,180 based on current exchange rates. Academic credit for the tour is available from Skagit Valley College upon request.

For more information about the math tour contact Susan Indorf, 675-6656.

– – Susan Indorf

STATISTICS AND INFORMATION ORGANIZATION

Statistics and Information Organization was developed at the University of Oregon, through the support of the National Science Foundation. It is one of five units in the *Mathematics Resource Project.* Although targeted toward middle school and junior high levels, the material is appropriate for general mathematics courses. Much of the content is appropriate for, or adaptable to, higher levels.

Statistics and Information Organization consists of seven components:

Content for Teachers: This section contains mathematical background in probability and statistics. Topics include: gathering and organizing data, measures of central tendency, probability, and inferential statistics. Twenty-two computer programs, written in BASIC, are included in the appendix.

Didactics: This component deals with learning styles, teaching techniques, diagnosis and evaluation, as well as goals and objectives. Classroom management is also discussed. Information in this section is applicable across the curriculum – it is not strictly statistically oriented.

Teaching Emphases: These emphases are: critical thing, decision making, problem solving, models, and simulation. Also included are calculators, computers, and the laboratory approach to learning. Discussed clearly and thoroughly in this component, these processes, approaches, and aids are emphasized throughout the entire resource.

Classroom Materials: These materials are correlated to topics in the Content for Teachers component. Included are reproducible worksheets (some answers in blue ink) transparency masters, games, and activity cards (can be laminated or reproduced as worksheets). Teacher ideas and teacher directed activities are abundant. "Teacher Commentaries", which preface each section, suggest alternate approaches to material presentation, give rationale for teaching the material, and highlight various aspects of each section.

Glossary: Accurate, informal definitions of the statistics and probability terms used in this resource are explained.

Annotated Bibliography: Over one hundred sources used to develop *Statistics and Information Organization* are listed.

Selected Answers: Answers to many of the activities in the Classroom Materials component are organized.

Each of the seven components is very well organized and clearly written. The mathematics involved is accurate, and is presented in a style comfortable to even the non-mathematically inclined. As a unit, the compo-

nents relate well and are clearly keyed to one another. Critical thinking, problem solving, and related careers, as well as hands-on and discovery learning, are common themes throughout the resource.

Generally, each subsection in this resource is arranged in order of increasing difficulty. Due to the numerous topics considered in each subsection, introductory pages can be found throughout. As the materials are not intended to be followed consecutively, and as prerequisites are not listed for individual activities, it is imperative that the teacher carefully examine and become familiar with the material in the resource.

Statistics and Information Organization can be used to vary and supplement existing mathematics curriculum or to serve as a basis for teacher developed curriculum. Materials in this resource encourage and stimulate creativity in both teacher and student. These materials are quite suitable for teacher in-service or workshops which emphasize critical thinking skills, problem solving, simulation, etc. It is not intended that all information be read or used in one year, nor that it be presented in class in the order it occurs in the resource.

Statistics and Information Organization includes tabbed dividers to organize the 850 pages in the resource. Materials are binder-ready or can be filed in the mailing carton. The resource is available for $58.00 from Creative Publications, 5040 West 111th Street, Oak Lawn, IL 60453-9941

– – R.E. Maggard

QUEUES – Will This Wait Never End?

by Clifford Sloyer, Wayne Copes, William Sacco, and Robert Stark. Providence, Rhode Island: Janson Publications, Inc., 1987, v + 41 pp.

This booklet is part of Janson Publications' innovative Contemporary Applied Mathematics series, designed to introduce important areas of mathematical applications to students (and their teachers) in grades 7-14.

The preface to the booklet provides a "stream of consciousness" approach to queues, demonstrating their frequent occurrence in modern life. This provides motivation for examination of queues mathematically and statistically.

The body of the booklet consists of four parts. Part I: *Basic Ideas* builds on the preface, provides several examples of queues in everyday life, and shows the major features of queues: each queueing situation is concerned with customers, with a service or processing facility, and with a service performed. The common characteristic is that the service is provided sequentially, which means that waiting lines (queues) may form as more customers arrive.

Part II: *Constant Arrival Rates and Service Times* begins the mathematical and statistical treatment of queues by presenting a spraying machine that sprays at a constant rate with items arriving at a constant arrival rate. This idealized situation allows easy discussion of the process. A queue is produced by providing for the spraying machine to be serviced at the beginning of the shift, resulting in a backlog of items to be sprayed. On page 6, exercise # 9, this is incorrectly referred to as a "breakdown". For me, an interesting question which could be treated algebraically or graphically would have been "When does the spraying machine catch up?" (The answer, with shift startup at 8:00 a.m., and the spraying machine starting at 9:00 a.m., is 10:24 a.m.) The next example in fact provides such an analysis, but only to the nearest hour, by generating a table. A nice graphical technique of visualizing customer arrival and customer departure is included in the section.

Part III: *The First No-Wait Customer* continues the situation of early arrivals before the process begins, with customers arriving at equally spaced intervals during the process. The notions of "average waiting time" and "actual service time" are introduced and developed. Algebraic solutions (involving inequalities) to different questions are provided, as extensions to the general case. (To this reviewer, the notion of "average waiting time" is slightly misleading. Zero waiting times are included in the calculation of average waiting time, but customers arriving with no queue don't wait; they will be happy with the way the system functions. Any customer who actually waits for service will, on average, wait longer than the "average waiting time". Possibly a better measure would be "average time waiting in the queue".)

Part IV: *Variables Arrivals and Service Times - Simulation* makes a large conceptual jump. Suddenly both arrival rates and service times are variables, represented by probability distributions. To deal with this variability, random number tables are introduced, and the reader receives instruction in how to read and use these tables. Finally, the notion of simulation (using the random number tables and the probability distributions) is developed. All of these ideas are clearly presented. The

total simulation is illustrated with 87 customers arriving during a 30-minute postal work period. However, all the exercises deal only with the first 15 customers. Working through the simulation with all 87 customers and answering some key questions would have been a nice extension.

Following the simulation, the need for many replications of a simulation, and the consequent value of computers in analyzing such situations, is clearly set forth.

A smoother transition from constant arrival rate to the full-blown simulation based on probability distributions could have been accomplished in only a few more pages. The first stage might have been to maintain constant service time, but to move to an "on average" arrival rate; that is, the items for the sprayer might arrive *on average* every seven seconds, rather than a new item exactly every seven seconds. Also, rather than moving immediately to random digits, an intermediate step could use probability devices. For example, the variable arrival time distribution on page 16 could be generated by flipping two coins, letting two heads represent the arrival of one customer, HT or TH the arrival of two customers, and two tails the arrival of three customers. (The reviewer's experience is that in simulation situations, hands-on involvement of students is appealing to them; then random digits, and finally computer runs, are used to generate results more quickly.)

Since the situation in which arrival time and service time are equal is not explicitly dealt with, students may have the impression that equal arrival time and service time works out well. This is only the case if arrival time is constant (not just equal "on average") and if there are no early arrivals. Otherwise the queue tends to grow over time.

Within the size of the booklet, the authors have developed an excellent set of activities related to queueing. They have developed the important concepts, and illustrated them well. The writing is clear and accurate. The reviewer's suggestions should not be viewed as negative, but as possible enrichment, addition, or extension of the activities and exercises presented. The reviewer heartily endorses this useful, clear addition to the student-usable material on statistics and probability.

– – Al Shulte

APPLIED ELEMENTARY STATISTICS

Richard C. Weimer, Brooks/Cole Publishing Company, Monterey, CA, 1987.

This text is intended for use in an introductory college-level course in statistics for students with a non-calculus background. Both the topics covered and the approach to the material are traditional. The first few chapters cover descriptive statistics, followed by an introduction to probability theory, and a study of the binomial and normal distributions. Later chapters include sampling theory, estimation, hypothesis testing, an introduction to analysis of variance, linear regression analysis, and finally non-parametric statistics. The explanations in the text are clear and many of the problem sets, particularly those in the earlier chapters, are thought provoking. Unfortunately, the key to the solution of many problems in the chapters on estimation and hypothesis testing seems to be one of merely finding the correct formula and making appropriate substitutions.

Although the presentation is traditional, there are several variations which make this book above average for texts of this type. For example, the chapter on descriptive statistics includes a discussion of the four types of measurement scales and an excellent representation of stem-and-leaf plots. Tree diagrams and Venn diagrams are used in the chapter on probability to help the students visualize the various laws of probability. In addition, the author has chosen not to rely heavily on combinatorics in the study of probability. This approach makes sense for students with limited mathematics backgrounds who are often able to solve problems intuitively using conditional probability rather than combinations. Many histograms of empirical sampling distributions are used to illustrate the Central Limit Theorem and range plots are used in the chapter on analysis of variance to illustrate within-group and between-group variation.

What is not found in the text is an emphasis on data analysis. Graphical techniques such as box plots, plots over time and control charts are not presented as methods for exploring data. There is no attempt to get the student concretely involved through the use of probability experiments and Monte Carlo simulations. If one is looking for a traditional introductory text, *Applied Elementary Statistics* is a good choice. However, there are now other materials and texts available which give students a better sense of what statistics is about, how to obtain information from data, and how to use statistics to solve problems.

– – Margaret Butler

THE SHARP EL-5200 CALCULATOR A REVIEW

The Sharp EL-5200 is a versatile tool for use in a statistics course because of its graphics capabilities, simple operation, ease of programming, fairly large memory for program and data storage, and relatively low cost ($80 to $100).

The Sharp EL-5200 has a soft plastic case that opens for use of the two keyboards. Wires which connect the left and right keypads run through a flexible hinge which causes some concern for the durability of the calculator. It is the most compact of all the currently available graphing calculators with unfolded dimensions of 13.8 x 17 x 1.1 cm and a folded size of 13.8 x 8.2 x 1.4 cm. The Sharp EL-5200 weighs 150 grams, has a display screen size of 5.6 x 2.7 cm, a graphics display of 96 x 32 pixels and a text display of 16 characters by 4 lines. With 8K memory of which 5.12K is available for data storage and programming, a maximum of 99 programs can be entered. This calculator also has a matrix mode and the feature that graphs can be scrolled. There is a built-in equation solver, and automatic zooming and autoscaling of graphs is easily accomplished. Programs and graphic screen contents are automatically saved when the calculator is turned off and a "power off" feature is activated when the calculator is not used for approximately ten minutes. An optional implement printer is available, but there is not commercially available overhead projector version. Programs may be loaded into memory very easily via a cassette recorder and the printer.

The Sharp EL-5200 has four operating modes that are controlled by the slide switch on the side of the left-hand keyboard. The AER-I and AER-II (Algebraic Expression Reserve) modes are for programming, the COMP mode is the computations and graphing mode, and the STAT mode is the one used for statistical operations.

The EL-5200 has three display screens: text, graphics and data. The text screen displays algebraic expressions and answers to calculations and various commands. The graphics screen displays graphs, and the data screen displays statistical and matrix data. Four types of memories are available for storing numerical data. The independent accessible memory, the memories for constants (store memories for variables A - Z), the memory for array variables used in the MATRIX and STAT modes, and the memory for flexible variables used in the AER-II mode.

The AER-I and AER-II modes have the capability of assigned user names which allow for a great variety of programs and programming symbols. These two programming modes allow programming that is relatively simple and logical as well as being a convenient tool for performing repetitive calculations. The calculation steps are executed in the COMP mode. The AER-I mode is useful for writing programs that repeatedly use the same variables, while the AER-II mode allows the use of lower case letters, Greek letters, and other special characters as variables. Each program has a maximum length of 160 steps (bytes).

In the AER-I mode, variables may consist of uppercase letters whose values are stored, respectively, in store memories A through Z. One uppercase letter may be multiplied by another by entering the variables next to each other (for example, AB) without having to use a multiplication sign. A value stored in the memory for the variable may be used directly in a particular calculation in the COMP mode by simply entering the letter of the variable in the calculation. In the AER-II mode, lowercase letters may be used as variables and may be combined to create names of variables. For this reason, lowercase variables must have the multiplication sign between them to indicate multiplication, and one cannot use a combination of upper and lowercase variables for the name of a single variable. Expressions may use lowercase letters, Greek letters, numeric characters reduced in size and other special symbols in addition to uppercase letters in this mode. Lowercase letter variables have their assigned values stored in the program memory whereas the values of the uppercase variables are stored in the store memories. One very nice feature of the Sharp EL-5200 is that whenever a program encounters a variable, it will automatically prompt for the value of the variable without that prompt having to be entered into the program. Subroutines may exist within programs, but one program cannot call upon another during execution. Programs are given user-defined names, and up to 61 characters may be used in a single program title. When programs are named with the first letter of the title capitalized, a program search function can be activated to locate all programs beginning with that letter for easy access.

Editing expressions that have previously been entered is easily accomplished by recalling the expression with the playback key and using the four cursor keys. The playback key also will position the cursor at the location of an incorrect keystroke or instruction during entry of an expression or execution of a program. The EL-5200 results in a memory overflow when calculating combinations or permutations involving more than 69 factorial.

This problem can be remedied by algebraically rewriting, in programs, the combination and permutation formulas to not involve factorials. Upper-tail probabilities are not available from built-in memory.

One or two-variable statistical data is entered in the STAT mode which contains two submodes: the DATA-STORE mode and the NON-STORE mode. Users must choose one of these two modes whenever the STAT mode is selected. In the DATA-STORE mode input data is retained in memory array S until that memory location is manually cleared. Results of statistical calculations are automatically stored in memory array Z and remain there when another mode is selected or when the calculator is turned off. In the NON-STORE mode the input data is not retained in the memory. Data may be displayed once entered, edited, named, write-protected, transferred to another memory location, appended, deleted individually or totally, and specified data values may be masked. Summary statistics for two-variable data are easily obtained via single keystroke.

The graphing screen on the Sharp EL-5200 can be accessed in either the COMP mode or the STAT mode. Statistical graphs are drawn with the calculator in the STAT mode. Built-in graphics interfaces allow single keystroke construction of histograms, broken-line graphs, cumulative frequency graphs, normal distribution graphs, scatter diagrams and linear regression lines. Users may overlay any combination of graphs for single or two-variable data. Unlike other graphing calculators, graphs on the EL-5200 are not displayed until the complete graph has been formed, and the amount of time it takes for the graph to appear depends on the complexity of the function being graphed. The Sharp EL-5200 allows for variable interval widths for histograms, and the number of class intervals can be set from 1 to 32. Once the histogram has been drawn, this calculator has the unique feature of the trace function giving the frequencies of the data as the y-coordinates and the class boundaries as the x-coordinates rather than giving pixel coordinates.

Simulation techniques are easily programmed, and formulas for single-sample and two-sample confidence intervals and hypothesis tests may be entered into the calculator with prompts for values using, in most cases, the same symbols as in the student's text.

References

Sharp EL-5200 Graphic Scientific Calculator *Owner's Manual.* Mahwah, New Jersey: Sharp Electronics Corporation.

Fetta, I. and J. Kenelly *The Informed Consumer's Instructional Guide to Graphing Calculators.* MAA Minicourse # 17, American Mathematical Society and Mathematical Association of America Joint Meeting (January 1990), Louisville, KY.

Fetta, I. "Graphing Calculator Enhanced Introductory Probability and Statistics", *Statistics for the Twenty-First Century.* MAA Notes Volume (to appear) Washington DC: Mathematical Association of America.

-- Iris Brann Fetta

LETTER

Dear Editor,

I am collecting examples of the use of the "law of averages." Any that you run across would be appreciated. Some of my favorites include:

In a recent Laker game, Perkins had made the last six out of six free throws. As he came up for another free throw, the announcer said, "The law of averages starts working for Golden State."

"I do think," Kate said as they got in, pressed '8' and watched the doors close, "that such consistent pessimism is surely the triumph of experience over hope, not to mention reason. Even this University's elevators must work occasionally. The law of averages..." Kate's voice faded away as, between the third and fourth floors, the elevator came to a reluctant, but by no means uncertain, stop. (From *Poetic Justice* by Amanda Cross.)

I looked at the man in a kindlier spirit than I had been able to up to date. This evidence that he had sporting blood in his veins made him seem more human, I'm bound to say. If only I'd known earlier that he went in for that sort of thing, I felt that we might have had a better time together.

'Oh!' I said. 'Did you click?'

He sighed heavily.

'If you mean was I successful, I must answer in the negative. I rashly persisted in the view that the colour red, having appeared no fewer than seven times in succession, must inevitably at no distant data give place to black. I was in error. I lost my little all, Mr. Wooster.' (From *The Inimitable Jeeves* by P.G. Wodehouse.)

-- Ann Watkins