STATISTICS EDUCATION IN THE USA AND CANADA AS VIEWED BY AN ENGLISHMAN

In August and September 1983, Warren Gilchrist, co-chair of the Centre for Statistical Education in Sheffield, England carried out a study tour of statistics teaching in United States and Canadian schools. Excerpts from his report follow.

Statistics in U.S. Schools

An effect of local control in the U.S. school system is that there can be no universally true statements about the system. The statistical content at school level varies from zero to separate one-year courses in probability and in statistical methods.

I sat in on classes and discussed with teachers in four schools and was very impressed with the quality of the teaching, the amount of effective student involvement and the use of games and diagrams. Clearly I did not see a random sample but I certainly saw what was scheduled for that day, as all courses are very closely planned. I saw some of the best, but that is what I went to see.

A major problem in statistics is the lack of good high school level texts. All the schools I visited were using texts written for college level. For the less mathematical students they were using non-math college texts written for social science students.

Teaching support materials such as *Statistics: A Guide to the Unknown* have had little use, partly because of their sophistication and partly because of the lack of a school level text that they could be related to. One proposed statistical education project is to try to "engineer" together current texts, support materials, etc. so that they can be used effectively within the real classroom/school/system constraints.

Though there are not national examinations at "O" Level or "A" Level, there are national aptitude and achievement tests that are more and more used as a means of assessing standards in schools. The tests were seen as valuable in helping to raise the standards in areas where education was very poor. There were concerns, however, that they could act as conservative force in better regions. There are some questions on very simple probability ideas and on the definition of average in the papers. Current research is focusing on how to improve test scores, some of which leads to the obvious conclusion, but also obvious sources of danger, that scores are maximized if class time is maximally devoted to the topics covered by the tests — which form a very minor set of a good mathematics course. The approach clearly mitigates against the teaching of statistics within mathematics.

My personal conclusion is that when, as seems likely, three years of mathematics is introduced as national policy, then there will be a massive increase in the amount of statistics taught.

It is fairly clear that the U.S. did not go as deeply into recession as the U.K. is doing, and that it is more clearly emerging from that recession. There appeared to be no shortage of jobs for statisticians and indeed some industrial developments suggested a growing demand for industrial statisticians. There was also a rapidly growing need for teachers of maths/stats/computing, though the pay is poor compared with industry.

Topics that re-occured in talks and conversations were: (a) The growing importance and development of graphical data analysis. I saw quite a number of new plotting techniques. Interest is now on multivariate plotting and on plots for monitoring and control. (b) The continuing computing developments emphasize the analysis of large data sets (e.g. the researcher who had 100,000 observations — on one pig). This links to (a) in that classical summary statistics can pre-judge and hide detached features that can be studied with large data sets.

(c) The need to deal with verbal and written communication was emphasized, particularly in the sense of the statistician taking a positive role in firms rather than a purely passive, responsive, role. (d) The growth of industrial statistics and the current major position of government and international statistics should be reflected in curricula.

It became apparent on my tour that in the area of statistical education Sheffield leads the world. However, perhaps a more realistic statement would be that we know as little about statistical education as anybody in the world. The area of mathematics education has been consciously researched and developed for several decades. The analogous R and D in the area of statistical education has hardly begun. Perhaps the first job is to see what research from mathematics education has relevance in statistics education. The early years development of number concepts and the later development of problem solving skills will clearly have some relevance. I traced some research in the development of the concept of chance but that is about all.

A report on a small experiment I found discussed the issue as to what predicts ability at applied statistics. A traditional mathematical aptitude test was of little use, a battery of cognitive tests were more effective. This again implies a questioning of the traditional pairing of maths and stats. Though clearly in the States, and probably here, the development of statistics benefited immensely by being associated with mathematics and seen as a way in which mathematics related to the real world. The commonality and the distinctiveness need very careful balancing in the development of statistical education.

Warren also discusses inservice training in statistics, the four booklets that the ASA/NCTM Joint Committee are producing, continuing education for statisticians, statistics and the quality control movement, and this newsletter. To get a copy of his complete report, write Warren at the

   — Centre for Statistical Education
      25 Broomgrove Road
      Sheffield S10 2BP
      England.

STATISTICS INSTITUTE

A four-week institute on statistics was sponsored by the Woodrow Wilson Institute on High School Mathematics this summer at Princeton University. Forty-nine participants from thirty states were introduced to new and innovative statistical techniques by statisticians and educators from across the country. The primary purpose of the institute was to prepare leaders to promote the teaching of improved statistical content in the secondary schools. The institute was directed by James J. Fey from the Departments of Mathematics and Curriculum and Instruction of the University of Maryland who served as academic director and Jim Swift, coordinator of International Baccalaureate Program, Mathematics Program, Nanaimo, B.C. who was the computer laboratory director. The first week lecturer was Richard Scheaffer, Department of Statistics, University of Florida, who treated the scope of present day statistics, including concepts and methods. Alan Schoenfeld, Education and Mathematics, University of Rochester, spend the second week on problem solving, and William Hunter, Statistics and Engineering, University of Wisconsin, was the lecturer for the third week on applications of statistics. A variety of other topics and issues were presented by a series of guest lecturers, including John Tukey, Princeton University, and Henry Pollak, formerly at Bell Laboratories and now with Bell Communications Research.

Participants were introduced to the concepts of exploratory data analysis and to a variety of statistical applications suitable for the secondary school curriculum. Emphasis was switched from traditional mathematical statistics and probability to focus on data gathering, graphic representations of the data, and evaluation and analysis procedures. Projects from the institute written by the participants are currently being edited and will soon be available for dissemination. These projects include units on computer applications in statistics, on graphing techniques, geometric probability, informal approaches to the normal distribution, and many others as well as a booklet on projects and a complete bibliography. Information can be obtained either from James Fey or directly from the Institute through Rebecca Shaw, Box 642, Princeton, NJ 08540.

Each institute member is willing to share experiences or to provide assistance in teaching statistics, whether as a separate course or when integrated into the curriculum. Current plans include state and local workshops and other forms of inservice directed by the Woodrow Wilson participants. Local publicity should provide the details for the various geographic regions.

To obtain specific information concerning the

participants in your area, contact either James Fey or Rebecca Shaw.

— Gail Burrill
   Whitnall High School
   Greenfield, WI

Another participant had a witty and distinctive view of the institute:

MAMA, DON'T TAKE AWAY
MY BALLS AND URN

Mama, don't take away my balls and urn.
It's the only probability I ever learned.
If you take them balls and urn out of my reach
There's no probability I'll be able to teach.
Mama, don't take away my balls and urn.

The first thing they told us
Is Probability won't do;
And while you're at it
Throw out Calculus, too.
Roll dice and flip pennies
From dusk until dawn
And analyze the results
All semester long.
If your students complain
About what they should do,
"What's the answer? What's the question?
We haven't a clue.
We used to like numbers,
But this data is so messy."
You can tell them on good authority
Things are supposed to be fuzzy.

Mama, don't take away my balls and urn.
It's the only probability I ever learned.
If you take them balls and urn out of my reach
There's no probability I'll be able to teach.
Mama, don't take away my balls and urn.

We heard from Lord Demming,
That curmudgeon on high.
Japan's kicking our butts
And statistics is why.
Digram Pareto
And Ishikawa Fish,
Check Sheets and Run Charts,
Make as many as you wish.
Good old Box and Whiskers,
Interocular Stem & Leaves.
Can this really be the mathematics
Which brought Detroit to its knees?

Mama, don't take away my balls and urn.
It's the only probability I ever learned.
If you take them balls and urn out of my reach
There's no probability I'll be able to teach.
Mama, don't take away my balls and urn.

Okay, mama, I'll throw away
My balls and urn.

After all, nobody even knows
What the heck's an urn.
But if I be good
And promise data to explore
On weekends, will you let me
Pull socks from a drawer?

— Peter Barbella
   Edgewood High School
   Madison, WI

NEW PUBLICATIONS
AND PRODUCTS

Bibby, John.
Quotes, Damned Quotes, and ...
Halifax, England: Demast Books, 1983,
52 pages, paper, US $6.00

This booklet contains hundreds of quotes, verse, and cartoons about statistics and probability. Some examples:

If a coin falls heads repeatedly one hundred times; then the statistically ignorant would claim that the 'law of averages' must almost compel it to fall tails next time, any statistician would point out the independence of each trial, and the uncertainty of the next outcome. But any fool can see that the coin must be double headed.

— Ludwik Drazek

And then he knew that something within him more powerful than his common sense would force him to stake that five-franc piece. He glanced furtively at the crowd to see whether anyone was observing him. No. Well, it having been decided to bet, the next question was how to bet? Now, Henry had read a magazine article concerning the tables at Monte Carlo, and, being of a mathematical turn, had clearly grasped the principles of the game. He said to himself, with his characteristic caution, "I'll wait till red wins four times running, and then I'll stake on the black."

("But surely," remarked the logical superior person in him, "you don't mean to argue that a spin of the ball is affected by the spins that have preceded it? You don't mean to argue that, because red wins four times, or forty times, running, black is any the more likely to win at the next spin?" "You shut up," retorted the human side of him crossly. "I know all about that.")

— Arnold Bennett — *A Great Man*

He uses statistics as a drunk uses a street lamp, for support rather than illumination.

— Andrew Lang

Statistics can be used to support anything — especially statisticians.

— Franklin P. Jones — *Women's Realm*

In earlier times, they had no statistics, so they had to fall back on lies.

— Stephen Leacock

I've always said statistics are like loose women; once you get them you can do anything you want with them.

— Walt Michaels
of the New York Jets

To order consult your bookstore or send the money to   John Bibby
33 Haugh Shaw Road
Halifax HX1 3AH England

Random News.
Newsletter of the Centre
for Statistical Education,
25 Broomgrove Road
Sheffield S10 2NA England.

The new Centre for Statistical Education in Sheffield, England has started a newsletter. The first four-page issue discusses the aims, background, and future plans of the Centre. Courses and workshops for secondary teachers have already been held and various publications are available. Computer programs and booklets on probability games and simulations will be available shortly. To get on the mailing list, write Peter Holmes, Director, at the address above. There is currently no charge.

Hooke, Robert.
How to Tell the Liars
from the Statisticians
Marcel Dekker
270 Madison Avenue
New York, NY 10016
1983, 173 pages, hard cover, about $16.

In 76 succinct essays, this lively books shows us the effects of statistical reasoning and its misuse on our lives. Unfortunately, the book has very few references, making it difficult for teachers who wish to use its ideas. The following two excerpts show the flavor of the book.

If a manufacturer says, "90% of the cars we've ever made are still on the road," this may exactly be true, but its meaning is up for grabs until some other facts come to light. The whole truth indicates telling how long the company has been making cars — if it has been in business for only the last four years, the claim lacks significance. Even if it has been going for thirty years, it may be a growing company, so that most of the cars it has built are less than four years old.

A well-known university was accused of discrimination against women who applied for admission to its graduate school. Simple statistics showed that the acceptance rate for woman applicants was definitely lower than that for men. Since prospective graduate students apply to a particular department, and since each department selects its own applicants to be admitted, it appeared to be a simple matter to rectify this situation by finding out which departments were guilty of discrimination. But a breakdown of the statistics by department showed, paradoxically, that no department was discriminating. Rather to go into the extensive data of the real case, I will give a simple hypothetical example that is easy to follow:

Graduate School Admission by Sex, Hypothetical School

	No. applied	No. admitted	% admitted
Department A			
Women	50	25	50%
Men	100	50	50%
Department B			
Women	100	30	30%
Men	50	15	30%
Total school			
Women	150	55	37%
Men	150	65	43%

Here we see that 37% of women applicants to the whole graduate school are admitted while men are admitted at a 43% rate. Yet each department admits men and women at the same rate.

The explanation is that ...

HELP!

I am particularly interested in a good, simple high-school statistics book to be used by students who have completed intermediate algebra.

— Marguerite O. Micciche
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Deer Park Avenue
North Babylon, NY 11703

WHERE TO WRITE

Send all letters, announcements, questions, and requests to get on the mailing list for the newsletter to the editor,

— Ann Watkins
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