PARAMETER

AMERICAN STATISTICAL ASSOCIATION / CHICAGO CHAPTER

Vol. 33 October 1990 No. 3

Measuring Poverty: A Statistical and Political Problem

As we continue to describe the importance of the role of statistics in public policy issues, let us turn our attention to the poor and the problems of accurately identifying this important, but elusive group. Our October speaker, Professor Rebecca Blank, draws upon her experience as a researcher, educator and government consultant to address this sensitive issue. The luncheon will be held on Tuesday, October 9, 1990 at the Midland Hotel, 172 West Adams at LaSalle in downtown Chicago. Registration will start at 11:45 a.m. and lunch will be served, starting at noon.

The current official method of measuring poverty is being increasingly criticized as an outdated procedure that may provide serious misinformation. In her talk, Dr. Blank will describe some of the statistical procedures that have been proposed to increase the accuracy of our poverty statistics. Past efforts to address this issue have floundered on the political problems inherent in changing the official poverty count. While some people primarily emphasize the need to improve the measurement of income among the poor, others focus on developing a better measure of the threshold (poverty level) at which households are considered as poor. Dr. Blank's discussion will consider both the current problems with the poverty line, and the statistical and political feasibility of various current proposed changes.

Dr. Rebecca Blank has just been appointed as an Associated Professor on the faculty of Northwestern University, with a joint appointment in the Department of Economics and in the School of Education and Social Policy. She received her Ph.D. from M.I.T. and works primarily in the areas of labor economics.

Much of Dr. Blank's research has focused on analyzing various questions relating to the well-being and behavior of low-income households. She spent this past year serving as Senior Staff Economist with the Council of Economic Advisors, the in-house economic advisory group to the White House. She worked on a variety of domestic social policy issues, including chairing an inter-agency group charged with designing and implementing a proposal to initiate research on potential improvements in the measurement of poverty.

Dr. Blank has published extensively, focusing her research efforts on the poor, part-time employment and women in the work force. She has been honored by the National Science Foundation and is a Faculty Research Fellow of the National Bureau of Economic Research.

To make reservations, call Sheila Proietti, (312) 727-4373, or Kenneth Wollenberg, (312) 727-7575, by **noon**, Friday, October 5. The cost is $20 for members and $22 for non-members. If you make reservations and then are unable to attend, please let Kenneth know, since the Chapter must pay for luncheons prepared for no-shows.

As usual, the Chapter's Lucile Derrick Fund will purchase a limited number of luncheon tickets for students who wish to attend.

The Parameter *received the following unsolicited letter earlier this year which proposes a different approach to teaching statistics. We are publishing the letter to pass these ideas along to the Chicago statistics community for discussion.*

Teaching and Learning Statistics: The Importance of Context

By Leo T. Upchurch
Statistical Services Inc.

Few individuals will deny that statistics has assumed a highly prominent place in the college and university curricula of today. Virtually every discipline has been jolted by statistics. It may not be overstating the case to say that all of us have been witting or unwitting participants in a sweeping statistical revolution. It appears ironic, however, that the subject remains highly unpopular among most who have attempted to achieve more than a nodding acquaintance with the subject. Experience suggests that a great degree of the "bad reputation" the subject of statistics endures is due to "poor teaching," "poor

(Continued on next page)

(Continued from page 1)
training," and a general lack of sensitivity to the general processes of learning (learning styles, learning modes, etc.). Although it is not clear how many statisticians share the views expressed by B. L. Joiner at the 1989 Joint Statistical Meetings held in Washington, D.C., the session at which he made the remarks below was well-attended, and many recognize that the statistics profession is managing to turn more people away from the profession than it attracts. He said:

" . . . we are turning out generation after generation of statistical illiterates."
" . . . we have a bankrupt profession."
" . . . we need to change some things."
" . . . much of what we teach is too bowl-based."
" . . . continuous rapid learning is essential to the further improvement of our country."
" . . . how fast improvement is made is more important than mere improvement."
" . . . most of the statisticians today are teaching from a quicksand base."
" . . . we cannot leap-frog the Japanese from quicksand."

The exposition being considered is based on pedagogical concerns, and a new taxonomic scheme for "old ideas." For example, the entire subject of statistics is presented as a "handful of big ideas" which allow the learner to be in an active participant role from the very beginning. This approach contrasts sharply with what is usually done in statistics courses given in colleges and universities today.

The essence of this idea is that the most effective teacher of statistics is one who is able to break-away from the rigid format usually employed in teaching statistics, and to focus on the few essential ideas associated with the subject of statistics. Five or six key ideas constitute the basis of statistics. These few ideas, which if properly presented, will be properly understood by students (the great majority of them, anyway). The approach advocated here does not gravitate toward a purely qualitative presentation which is devoid of any attempt to develop a strong analytical/theoretical appreciation of the subject matter. In fact, the contention here is that the proposed approach will actually accelerate the development of a firm grasp of the mathematical foundations which underlie the exposition of topics and ideas central to statistics.

What is being proposed is not so much a development based on strict theory and application of statistics as one which concentrates on specifying a set of prescribed behaviors which lead to the goal of making statistics more appreciated, more useful, and more enjoyable to teach and to learn.

To begin matters, let's just say we are interested in specifying as well as we can exactly what statistics is about. I have posed this question many, many times to beginning students, as well as to very advanced students (those studying statistics at the doctoral level in statistics itself). I require (accept) only a one-word response. In all the years I have taught the subject (more than 20), I don't recall ever getting the expected response — even from teacher-colleagues!

Two words — UNCERTAINTY and VARIATION — can each singly "fill the bill." Curiously, both of these words are quite familiar to practically everyone — novices and experts alike — those without any training in statistics, as well as those with extensive training, yet it is the failure to understand these two words in their connection with the subject of statistics which makes the subject difficult to learn (and, for some, to teach!).

The case can be made that UNCERTAINTY and VARIATION are closely related, perhaps, approximately synonyms, as far as statistics is concerned. For example, it is VARIATION that causes UNCERTAINTY. In trying to understand what statistics is about, we have provided two, presently fuzzy words — "IDEAS," which are still somewhat embedded in abstractness. Things start to become clearer, more in focus, if we are able to define the words UNCERTAINTY and VARIATION. To some, it would seem that we have come "full-circle." We reach for more abstractions, more fuzziness, to say what we mean. For students (and teachers, too, I suppose), this is where "the trouble with statistics begins."

Among statisticians, the term "bootstrap" has a very specific meaning, but a crude translation of the term into common language is that knowledge of something virtually impossible to know (or to obtain), can be reasonably well approximated by repeated use of a very small available component of the "nearly impossible entity." If we use the terms UNCERTAINTY and VARIATION as the small available components, we can do an "analogous bootstrap" to construct a fairly clear picture of what statistics is about (certainly, clearer than the ubiquitous one familiar to students).

Definition: UNCERTAINTY is the inability to determine precisely states of nature.

Definition: VARIATION is distinguishable diversity from a reference point.

Using only these two definitions, it is possible to "bootstrap" our way to a good understanding of statistics. To give life to the definitions given above, we require a physical embodiment of the terms. Simply put, this means quantification of the definitions, and exhibition of the same using symbols, diagrams, pictures, etc.

Handling uncertainty requires that we recognize "degrees" of uncertainty in numerical terms. This is the very natural justification for probability (however it is defined). To handle VARIATION, we

(Continued on next page)

(Continued from page 2)
require only a reference point to gauge the degree of diversity in terms of "distance" from this reference point. From this point, and onward, the introduction of symbolism and diagrams can facilitate understanding.

Earlier introduction of symbolism more often than not leads to difficulty for quite a high percentage of learners.

Continuing with our "analogous bootstrap," a few more components (ideas) are needed — namely: RANDOM(IZE, IZATION), VARIABLE, DISTRIBUTION, POPULATION/SAMPLE.

The most interesting thing about beginning a course in statistics (any level, even as a quick review) with the approach discussed here is that the student is always moving from the "concrete to the abstract" — building every aspect of the subject on a familiar and solid foundation.

In elementary courses, demonstration of the six ideas discussed above can be done using dice, cards, coins (and/or computers). A "big hit" in elementary classes is the use of a pair of dice (initially) to help students understand one definition of probability, and to understand what is meant by the terms: RANDOM VARIABLE, PROBABILITY DISTRIBUTION, and EXPECTED VALUE.

Using the pair of dice, define and demonstrate what a random variable is (in this case, the sum of the two up-faces showing after a toss). Then complicate the simple experiment by asking for the up-faces sum when there are five dice. This presents a natural interface for statistics and statistical computing —even some elementary programming, depending on the availability of computers and/or software.

Almost without exception, students leave this initial experience with statistics excited and feeling in control of the basic ideas of statistics. For a large number of students, this experience can be achieved in only a few hours (lectures). A few students need a more lengthy exposure, but nearly everyone has a very positive experience with statistics.

If one has the luxury of an entire semester or quarter, deep appreciation for the sweeping applications of statistics can come from requiring students to read ten or more of the short essays in *Statistics: Guide to the Unknow,* Tazur, Mosteller, O'Rourke.

To make sure that the essays are read, require a minimum one-page written summary for each essay read (I ask for three pages). This is very beneficial — even for students who have strong mathematics preparation. The point I make by requiring such reading is that students are not asked to accept by statement that "statistics is probably the most important course they will ever take." Usually, students snicker when they hear this statement for the first time, but when I point out that every area of human endeavor harbors UNCERTAINTY and VARIATION, the snickers fade into nods of strong agreement.

Another point worth stressing is that this approach knows no disciplinary specificity. If these basic notices are learned well, then changing the labels to: DESCRIBE, EXPLAIN, COMPARE, CORRELATE/ ASSOCIATE and PREDICT/FORECAST in any context is quite easily done. Yes, this means that I do not ascribe to the notion that separate courses are necessary for students in biological sciences, social sciences, business, and physical/engineering sciences. Those who ascribe to this notion do so on the fallacious assumption that differences in the degree of mathematical readiness justify the separation. Separation beyond the first course, yes! But, in the initial course, the enrichment that comes from having variability in the distribution of mathematical preparation can be exploited to great advantage.

This is the proper role of the teacher. Lack of mathematical preparation does not mean lack of ability to comprehend statistical ideas when they are presented well and explained well.

My approach in the beginning is to use three separate books. One book is for almost effortless, enjoyable reading without any troublesome symbolism *(Statistics: Guide to the Unknown).* Another book covers the same material I am presenting, but bears a title linking it to a specific discipline. The third book is one which provides a mid-level mathematical treatment of the material. This may appear ambitious, but remember the student is not totally (perhaps, not to any degree) dependent upon any book for mastery of the basic notions. The books merely reinforce the "handful of key ideas" essential to thorough grounding in the subject of statistics. The importance of the teacher is clear; the context is clear. In summary, this approach results in a positive experience with statistics for both students and teachers.

Please send your comments or other articles to the editor for publication. We encourage the exchange of ideas in Parameter.

Editor: Kathy Morrissey **(708) 564-6380**

Parameter, the official newsletter of the Chicago Chapter of the American Statistical Association, is published 11 times per year as a service for its members. Materials for publication should be submitted to the editor at Household Bank — 2N, 2700 Sanders Rd., Prospect Heights, IL 60070. **Deadline for the November *Parameter* is Oct. 29.**

Parameter offers a free placement service for ASA Chicago Chapter members. Job applicants should send a draft of their advertisement and a resume to the editor at the above address. Applicant names will remain confidential if requested.