Starting with the definition of Statistics, (i.e., it is concerned with the characterization, the development, and the application of techniques and procedures for (i) statistical design~~ing~~ investigations, (ii) statistical summarization of data from an investigation, and (iii) statistical inferences from investigation facts to parent population parameters), a distinction is made between the professional statistician and the user of statistical procedures. For the latter, ~~Stat. they are only~~ Statistics provides scientific tools for the investigator, and Statistics along with Mathematics, ~~Every Languages~~ English ~~or other written la~~, Chemistry, and Physics, provides a ~~scient.~~ a language for Science. Statistics, per se, will be increasingly used a a scientific tool and language in the future.

With regard to the teaching of Statistics, it is felt that a distinction between Mathematics and Statistics both must be made in the mind and in the methods of the teacher of Statistics. Failure to do this often results in presentation of nonusable material for the user of Statistics. Most Statistics courses, sometimes called "service courses", ~~are for~~ are presented to potential users of ~~statistical procedures~~ of Statistics. Much of the material presented is not applicable in the form presented. How often does homoscedasticity, a linear model, ~~identically and independent~~ N.i.i.d., etc. hold in practice? Probably very infrequently, but procedures based on these ideas may be "good" first approximations which ~~textbooks fail to never bother to~~ to tell the ~~users~~ reader. Data analytic techniques are a welcome addition in this respect. The over-emphasis on hypothesis testing, the dearth of procedures for sequential experimentation (~~the rule rather than the exception~~), the dearth of ~~methods~~ theory for handling large data sets, the emphasis on number and symbol manipulations (statistical ~~methods~~ computing and mathematical statistics), the ~~the~~ lack of emphasis ~~of~~ on statistical design as related to inference, ~~the~~ the lack of statistical modeling theory, and need to be corrected in ~~to~~ the future.

and other topics has put Statistics in a narrow rut. ~~As a result it~~ is believed that many teaching innovations are needed ~~and in~~ and that it may be necessary to ~~start~~ ~~develop~~ ~~several~~ produce at least three ~~more~~ new statistical journals, ~~to the growing list~~ namely one on Statistical Education, another on Review and Expository Articles, and a third on Short Papers and Extended Abstracts. ~~Finally~~,

A comment ~~is~~ is made on the teaching of "service" courses. Considerable changes in course content and presentation will be required for potential users of Statistics in the future. The past and the present statistical offerings are already ~~considered quite~~ inadequate for the needs of present students, ~~and will become more~~ so let alone future students.

BU-618-M   Aug 1977

STATISTICS YESTERDAY, TODAY, AND TOMORROW, ONE MAN'S VIEW

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A lecture presented to the New South Wales Section of the Australian Statistical Society, May 5, 1977.

I. Introduction

Prior to commenting on Statistics of the past, present, and future, it is necessary to state what I believe is encompassed in the subject of Statistics. It is also necessary to state what is not the main part of Statistics. A definition of Statistics with which I feel comfortable is that Statistics is concerned with the characterization, the development, and the application of techniques and procedures for

(i) the statistical design of an investigation whether it be an experiment, a survey, an observational study, or a model building study,

(ii) the statistical summarization of the facts from an investigation, and

(iii) the statistical inferences that may be drawn from the facts of the investigation about the parameters in the sampled population.

Others, like I. Parzer, e.g., add other components to this definition but the above should suffice for our purposes here.

To enlarge on the above three parts of Statistics, it is my view that the statistical design aspect encompasses the following items:

1. Variables and Populations: A complete description of the variables of interest including the population characteristics for each variable separately as well as jointly. The nature of the variation and the goals of the investigation should be as precisely and completely specified as possible.

2. Measurements and Measuring Instruments: The method of measuring, the measuring instrument, and the properties of the measurements with respect to repeatability and accuracy should be described in detail.

3. Treatment Design: The treatment design constitutes the selection of treatments (entities of interest) to be used in an experiment. It must be such that the objectives of the investigation can be achieved. Adequate points of reference (controls) must be included.

4. Experiment Design: The experiment design is the arrangement of the treatments in the experiment. It should be one allowing contrasts among treatment parameters to be estimated with high repeatability and accuracy.

5. Sequential Design: In a sequential design the observations are taken sequentially and the next treatment observed is determined by previous results. It should be one producing minimum average sample size and having a small variance among sample sizes in repeated samplings.

6. Sample Survey Design: A sample survey design refers to the method of selecting sampling units in a survey, with the probability of selecting a sampling unit either being known or unknown. It should be one which allows estimation of parameters of interest with high precision and accuracy.

7. Model Building Design: The process of model building involves formulation of model-obtaining data to test the model-testing adequacy of proposed model-reformulation, -reexperimenting, -retesting, etc. until an adequate model has been devised. The process or method of selecting observations is known as the model building design. (So far the literature on model building is mostly deterministic, appears in nonstatistical publications, and is written by non-statisticians. Model building is an important aspect of Statistics that has largely been ignored by most statisticians. Stochastic models are important, and it is a rare situation when a real world model can be obtained by definition as is often done in the chalkboard world of the professor.)

8. Principles and Properties of Statistical Designs: Such principles of statistical design as blocking, replication, randomization, orthogonality, confounding, sensitivity, balance, etc. need much more study before we become fully aware of their nature, properties, and consequences. The property of variance-optimality has received considerable attention by statistical researchers. The property of connectedness has been recently studied by a number of individuals. The combinatorial nature and properties of blocked designs have received the attention of a number of mathematical researchers.

9. Determination of Sample Size: Several statistical procedures specify all unknowns except sample size; then, from these known quantities, the sample size may be determined. For example, suppose it is known that the observations are independent normal random variables, that their common variance σ^2 is known, that the error γ of misclassification in correctly ranking the population means is specified, and that a minimum difference δ of importance between two means is specified. From this information, it is then possible to determine the sample size n meeting these specifications. A more general problem is: given any three of the four values σ^2, γ, δ, and n, what is the value of the fourth? In some procedures, a type I error α and a type II error β are given instead of γ.

With regard to the second part of the definition of Statistics, this is and has been an important area of activity for statisticians. Considerable effort is expended in developing and in applying statistical procedures for summarizing facts from a set of data obtained from an investigation whether planned or unplanned. Some data summarization procedures are:

1. Graphs, tabular arrays, and charts
2. Measures of location
3. Measures of dispersion
4. Measures of association and relationships
5. Tests of significance
6. Residual analyses
7. Data analyses
8. Distribution-free procedures
9. Univariate and multivariate analyses of variance
10. Multivariate procedures
11. Simultaneous confidence intervals
12. Etc.

With respect to the third part of the definition of Statistics, that is making inferences about population parameters based on sample facts, a considerable amount of effort in teaching and research has been devoted to this topic, almost to the exclusion of the first two parts of the definition in some courses. For example, some teachers tell their classes that "Statistics is inference". Some inferential procedures and studies are:

1. Testing of hypotheses
2. Simultaneous confidence interval inferences
3. Theoretic decision theory
4. Bayesian inference
5. Fiducial inference
6. Empirical Bayes and related procedures
7. Multiple decision procedures
8. Conclusion theory
9. Properties of test and summarization procedures
10. Error rates
11. Etc.

Statistics is not one part of the entire definition, but is all three. It is incorrect to say that "Statistics is inference" and leave out the other two parts. A number of the more mathematically oriented individuals, by their actions, consider Statistics as a branch of Applied Mathematics and/or as a branch of Probability. The "linear models" oriented individual obtains the statistical model by definition without regard to what happens in the real world of investigations. This concept is so universally used in statistical writings that students and teachers are propagandized to the extent that they never think of any other statistical model. Then, of course, we have the asymptotic theory statistician who is busily worrying about what happens in the limit without any concern of what is needed in a real world investigation. We also have the subjective probabilists who are busy with their personal priors, others are only concerned with the combinatorial properties of statistical design or probability. These examples are given to illustrate the narrowness with which some individuals appear to consider Statistics, i.e. if they never mention the broader aspects but only their particular interests, we must infer that they do not accept the entire definition of Statistics.

II. Statistics as a Tool for the Investigator and as a Scientific Language

In the past, statistical procedures were used widely to plan surveys and to summarize the collected data for state purposes. This use continues today in that we have many national, private, and international data -gathering organizations. With the advent of the high speed computer, this aspect has increased to the extent that considerable interest in "the right to privacy" is being generated. There is little doubt but that the data gathering aspect will increase in the future under the pretext that it is vital to private, national, and/or international interests. We may reach the stage where our every move is entered into a computer, a plan which some branches of the bureaucracy in Russia would like to instigate in the hope of increasing worker productivity.

All workers in empirical science use some type of statistical design and summarization for their investigations. For them, statistical procedures provide a means of data reduction in a usuable form. Mathematics has been described as the language of science. This may be true for the deterministic part of Science but not for the stochastic. English, Chemistry, Mathematics, and Statistics must be regarded as the languages of Science. Not only then is Statistics a language to users but it also is a tool for data design, summarization, and inference. It is doubtful if this outlook and use of Statistics will change in the future. There will be more emphasis on model building aspects in the future than in the past.

The collection of observational data such as medical records in hospitals and municipalities, traffic records, pollution measurements, etc. will increase to the limit of the budget and computing facilities. There will be increasing efforts to summarize these data and to draw inferences from them. Very few individuals are trained in procedures for handling massive data sets. One notable exception is the Department of Statistics, University of Wisconsin, which is involved in the statistical analysis of the Los Angeles air pollution data that has been continuously collected over a period of years.

Since statistical procedures have been, are, and will be used extensively, the statistician has an obligation to be aware of these uses and the appropriateness of the applications. He cannot afford to pretend they do not exist. It will do him or the field of Statistics no good to hide within the confines of his department of Mathematics or Statistics. One method of becoming involved in real world investigations is through statistical counselling with investigators. Being an active member of several diverse investigational teams would be an eye-opener for most statisticians. Many of us wish to consult not at all or only on aspects of our particular specialty. It would do all of us considerable professional good if we were to read, with pencil and paper, at least one book or expository paper not in one area each year. By not doing this we become compartmentalized into mathematical, social, biological, engineering, medical, etc. statistics. We should be statisticians in the broader sense. Statistical research, teaching, and counseling would be much improved if this were done.

In summary then, a user of statistics regards statistical procedures as tools and Statistics as one of four languages of Science. The implication is that statistical procedures must be such as to be useful to investigators concerned with design, statistical analyses and statistical inferences from sample facts to population parameters. This means also that statistical theory must be put in a form that investigators can and will use.

III. On the Teaching of Statistics and On Statistical Services Courses

Since empirical investigators utilize the methods of Statistics, teachers of statistics courses need to present useful and realistic statistical procedures. Mathematical sophistication may be irrelevant for the consumer of statistical procedures. Since pure mathematics makes no pretense of being useful, in fact quite the opposite in certain cases, statisticians must not think like mathematicians in this respect. The latter quite often lose interest in courses that are not "mathematically sophisticated" and/or are not "rigorous". This has resulted in poor instruction in certain introductory courses offered by mathematicians. It has also resulted in poor instruction in statistics courses when the instructor believes the important part of the course is mathematics and that the mathematics required for the course is too elementary to be of interest. This is why statistical methods courses have a difficult time in departments of Mathematics. The mathematicians only comprehend the mathematical level and not the scientific philosophical level. The transfer from their deterministic world to the stochastic world is too much for many of them.

I consider Mathematics, Probability, and Statistics as three distinct fields. I do not consider one a branch of the other. I firmly believe that each field should be made as complete and as rigorous as is possible, I definitely do not consider Statistics as a branch of Applied Mathematics. Mathematical and probablistic procedures are definitely useful tools in Statistics but this does not imply that Statistics is a branch of either. I wholeheartedly agree with Jerry Neyman when he said he believed he was giving a mathematician a very high compliment when he told the mathematician that he was good enough to be a statistician. Too many statisticians are striving to be known as mathematicians. It is vital to keep the fields distinct and if one can become proficient in all three fields, then he is a truly remarkable and perhaps, useful individual.

The mathematicians have been and are in a calculus stereotype with respect to their introductory calculus courses. It appears that this resulted from thinking of their own requirements in Mathematics without regard to the needs of users of Mathematics. I firmly believe that any reputable Mathematics department should offer introductory courses in calculus, discrete mathematics, algebra, and geometry. The students of Mathematics would be required to take all the introductory courses in order to go on to more advanced courses. Students not in Mathematics could take the course of interest to them. This would provide a choice whereas now all students are required to take calculus as their introductory course.

Many statisticians have followed the mathematicians in that they have a probability stereotype for their courses. Regardless of the type of course, they feel it necessary to start off with probability concepts and techniques. To become stereotyped and inflexible can be damaging to the field involved. Students from such curicula will have a limited view of what the field is all about.

Mathematics proceeds from axioms to definitions to lemmas to theorems to the proof of a theorem. In Statistics, there may be several solutions to a problem rather than a single one as in mathematics. For example, for one set of experimental data, many statistical analyses may be appropriate. Despite the truth of the preceding statement, statistical texts, almost without exception, give one solution for each example presented. Here again they are following the mathematician and keeping the student ignorant of alternate analyses for the same set of data.

The copying of mathematical teaching methods and concepts carries over into the classroom in another way. In Mathematics the chalkboard world, i.e. the axioms, definitions, and lemmas presented on the chalkboard are all that matter. No realism is intended. The same procedure is used in classrooms of Statistics courses. For example who would think otherwise than $E(\underline{Y}) = X\underline{\beta}$ $\underline{\varepsilon} = \underline{Y} - E(\underline{Y})$, and $E(\varepsilon\varepsilon') = \sigma^2 I$ in considering a model for a set of observational data given as the column vector $\underline{Y}$? Normality would also be assumed in most cases.

The goal of a Statistics course should be to teach Statistics rather than to show the student how clever one can be in manipulating symbols using mathematical procedures or how clever one can be in manipulating numbers and in writing computer programs for said manipulations. Other teachers of Statistics overemphasize applications to particular examples at the expense of omitting statistical concepts, theory, and procedures.

From the older textbooks of Statistics a common format was to present the material in the following order: probability, measure of location and dispersion, distributions, tests of significance and/or tests of hypotheses such as the t-test, chi-square test, F-test, correlation, and regression. Many present texts use the same format but add nonparametric procedures such as the sign and rank sum tests, analysis of variance procedures, and type I and type II errors. Statistical methods books by and large are watered down versions or rephrased versions of the Snedecor text and probability texts are copies of the Feller, volume I, text in one form or another. Since the development of the Neyman-Pearson lemma in 1932, there has been a development of overemphasis on hypothesis testing to the extent that population definition, sampling procedures, and response models are considered to be the problem of the investigator. The statistician obtains these via definition.

Inference based on defined rather than realized statistical design considerations, is being practiced by most writers of statistical textbooks and papers. Hence, its usefulness is in question. The causes of the overemphasis on inferential procedures to the exclusion of statistical design procedures is causing many mistakes to be made in subject matter areas which use statistical procedures. I attribute this to the inadequate instruction in Statistics rather than to the "ignorant investigators". The Statistics profession must take the blame for this and not try to shift it to other fields. Perhaps this overemphasis was caused by the several controversies that have raged over the years on statistical procedures and concepts. Perhaps there is a lack of creativity in textbook writers when they copy the Snedecor or Feller prototypes. Perhaps the mathematical sophistication of the writings of R.C. Bose, his students, and co-workers frightened many less mathematically sophisticated (in these areas of mathematics) statisticians away. Perhaps the narrowness of outlook of many statisticians is due to their training in that they could comprehend a new result if written in the style to which they are accustomed. For example, W.G. Cochran once said that whenever he wrote a research paper he really should write three papers in order to convey the results. One paper should be an application of the results to an actual investigation, one paper should be written giving the proofs from a regression or analysis of variance viewpoint, and the third paper should give proofs using probabilististic or distributional theory. We have some of this now when results are presented from

Bayesian and from non-Bayesian viewpoints. Some individuals may understand one of the proofs but not the other.

For the future, new formats will need to be developed. Perhaps a logical one would be to proceed as in the definition of Statistics from design, to summarization; and then to inference. The econometricians place considerable emphasis on regression and on modelling and probably will be using data analytic techniques to a considerable extent. Thus, one format of the future will need to emphasize design, modelling, and data analysis along with presently emphasized procedures.

One very large duty of academic statisticians is the teaching of so-called "service courses" for non-Statistics majors in colleges and universities. A service course has been defined by the author to be one in which at least 50% of the students are non-Statistics majors. At present there are many types, some of which are:

1. Introductory statistical methods
2. Introductory probability and statistics
3. Statistics and probability for students of Mathematics
4. Data collection, principles of scientific investigation, statistics in every-day-life, and statistical concepts and philosophies with symbol and number manipulations held at a minimum.
5. Data analysis, patterns, and re-expressions.

In many universities, it is not difficult to find 10-15 courses of each of the types listed as 1 and 2 above. These will be taught mostly by subject matter specialists who have, or profess to have, statistical expertise. Most of them emphasize either number manipulations (computing) or symbol manipulations. Often the statistical theory and philosophy are almost not existent in these courses.

For the future, I forsee more emphasis on the following topics in all types of Statistics courses:

(i) statistical design and its relation to inference
(ii) bioassay procedures
(iii) data analytic procedures
(iv) sampling and sample survey procedures
(v) analysis of large data sets
(vi) teaching methods and teaching materials.

It would be desirable if mathematical comprehension, not necessarily more mathematics, and facility were taught to secondary school students. There are good mathematical texts in this area but the teaching is considered to be severely deficient. The effect of the pocket computer on the students' comprehension and on teaching will need to be taken into account. Perhaps the programmable pocket computer will be a great boon to statistical comprehension as the investigator will be closer to his data than now when he ships the data off to a computing center. New developments in technology will force changes in emphasis and content of Statistics courses. The teacher of Statistics must be flexible enough to take these into consideration.

IV. Some Present Innovations in Teaching Statistics

At present several universities (Massey, New Mexico State, Wyoming, e.g.) are utilizing a system called personalized system of instruction, or simply PSI, which partitions a course into n parts with problems and an examination on each part. The student must pass k of these parts with a grade of X, say 90, percent or better in order to pass the course. For example, a one semester course might be considered to have 14 parts, one a week, and the student must pass 11 of them with a grade of 85% or higher. He might be allowed a three-week period in which he would elect to take an examination for each part.

Another form of teaching innovation has been denoted as modular instruction which takes many forms. The American Statistical Association has published a booklet of the papers given at a Conference on Modular Instruction in Statistics. This booklet is edited by Donald Guthrie. One form of this type is to present several short courses instead of a one-semester course with students allowed to register for any or all of the short courses or modules. For example, the second semester course in statistical methods for graduate students, has been partitioned into Analysis of Variance I, Analysis of variance II, and Regression I. In addition, three other modules were added. The modules and their sequences are:

First 1/3 of semester	Second 1/3 of semester	Last 1/3 of semester
Analysis of Variance I	Analysis of Variance II	Regression II
Sampling Biological Populations	Regression I	Nonparametric

Analysis of variance I is a prerequisite for all modules except Sampling Biological Populations and Regression I is also the prerequisite for Regression II. Students may take one to six modules but the instructor is now considering requiring students to complete the work for three modules before receiving credit for any one module. Students tend to consider a module as another course in Statistics and several students and advisors consider two courses in statistical methods as sufficient for their needs. Instructor and teaching assistance effort has been increased by going to this method of teaching at Cornell University. It does provide much more flexibility in course offerings by a department and for the users of statistics. For example, economists are interested in the sequence analysis of variance I, Regression I, and Regression II, whereas other subject matter specialists consider a different sequence.

Still another kind of innovation is to include introductory data analysis into an introductory statistics course. It has been found that none of the previous material in the introductory statistics course need be omitted and that students do not feel that the difficulty of the course has increased. The data analytics procedures tend to motivate students and hence the statistical part becomes less difficult.

Another innovation being tried is to relate statistical concepts and philosophies with everyday life. For example, the book entitled Statistics and Society by the author is an attempt in this direction. Some 12-15 characteristics on the students themselves are obtained and groups of students conduct and analyse surveys of their own choosing. The data obtained have real meaning to the students. This particular approach provides the motivation for many statistical concepts. One could intersperse data analytic procedures into the course. This has been done successfully in the summarization of the 12-15 measurements on the entire class of students. Stem and leaf diagrams with medians, swings, and hinges are easy to present and comprehend.

Statisticians still are in the process of formulating how much or how little of programming and statistical computing is to be included in a statistical methods course. The more time one devotes to programming and computing, the less time there is to teach statistical procedures and theory. At present, some instructors appear content to regard a statistical methods course mainly as a computer programming course. In the future we shall need to determine the appropriate amount of effort that should be devoted to computing in a statistical methods course.

With regard to teaching and materials, the age-old materials of chalk, eraser, and a chalkboard are still in heavy use today in Mathematics and Statistics courses. The overhead projector has made and is making significant inroads into Statistics classes. Prepared slides, projectors, and movies are used by a relatively few instructors of Statistics. Special equipment for teaching geometrical aspects of regression, of frequency distributions, etc., though available, do not have wide usage in the teaching of Statistics. It is believed that more use will be made of these techniques in the future. One can expect to see many new visual aids for teaching purposes.

Some teaching materials for special purposes in a class have been published. The materials have not been found useful as texts but rather for enlivening and raising the interest level of a lecture. Some of these are:

1. Statistics in Action (editor, T.J. Sielaff).
2. Federal Statistics, volumes I and II (editors, W.A. Wallis _et al_.)
3. Statistics: A Guide to the Unknown (editor J.M. Tanur _et al_.)
4. Statistics by Example (F. Mosteller _et al_.)
5. Teacher's Commentary and Solutions for Statistics by Example (M. Zelinka and S. Weisberg).
6. The American Statistician, June 1972, papers by Hogg, Good, and Blyth.
7. Statistics at the School Level (editor, L. Råde)
8. Communications in Statistics, volume 5, number 10.

V. Methods of Putting Statistical Ideas, Applications, Concepts, and Theory to Practice.

Three methods of presenting new ideas in the teaching of Statistics, new statistical theory, new and novel applications of statistical procedures, and statistical concepts (and misconceptions) are professional meetings, special symposia or conferences, and publication in a journal or special publication. In recent years, there has been a considerable increase in the number of statistical journals. Some of the new journals containing some or all of the papers related to Statistics are:

South African Journal of Statistics (volumes 1-11)

Commünications in Statistics (volumes 1-6; editor, D.B.Owen)

Utilitas Mathematica

Discrete Mathematics

Canadian Journal of Statistics (volumes 1-4)

Scandinavian Journal of Statistics

Journal of Computing & Simulation (editor, D.B. Owen)

Journal of Statistical Planning and Inference (editor J.N. Srivastava, Dept. of Statistics, Colo. State Univ., Fort Collings, Colorado)

Journal of Educational Statistics (editor, Melvin Novick, Amer. College Boards Testing Service, Univ. of Iowa, Iowa City, Iowa)

International Journal of Mathematics & Statistics (editors d'Ambrosio and Rathie, UNICAMP, Departments of Mathematics and Statistics, Campinos, Brasil)

The Mathematical Scientist (editor, Joe Gani, C.S.I.R.O., Canberra, Australia)

Despite the long list above, it is believed that new types of journals are needed simply because some types of articles of statistical interest are not being published in the above or any of the more established statistical journals. For example, it would currently be impossible or very difficult to prepare a syllabus on the teaching of Statistics courses. Articles on this aspect of Statistics are very infrequent and scattered. It appeared that The American Statistician would serve this purpose but it is rapidly becoming another statistical paper journal. Hence, a "Journal of Statistical Education" containing articles on statistical consulting and teaching is needed. If such a journal were available, it is possible that young graduates would write an article on teaching before they become settled in their respective ruts. It is anticipated that material of the type listed at the end of section IV would appear in this journal.

Another journal of "Review and Expository Articles" is needed. It is felt that such a journal would encourage individuals to prepare appropriate articles on various aspects of known theory in order to get the theory into practice. Theory from individual articles may be of little use in a Statistics course but a review of theory from several articles may be very useful in a course. At present, statisticians are busily writing papers on new material but are spending precious little effort on a synthesis of theory in an area. With the present editorial policy of present statistical journals few of us can be encouraged to write such articles or do such a synthesis.

A third possible type of statistical journal may be needed to head off the present rapid emergence of new journals. A "Journal of Statistics: Short Papers and Extended Abstracts" could serve this purpose if the editorial policy were appropriate. For example, individuals would be allowed to publish a two or three page abstract of their results, with review only by the editor. This length of abstract would be sufficient to satisfy publication needs and a copy of the complete paper could be on file in the editor's office. A copy could be sent to interested individuals at cost. If such a journal were successful, it could lead to a decrease in the present number of journals of Statistics.

It is felt that there is an overspecialization in Statistics. Individuals become expert in one or two areas and are very deficient in many other areas.

This leads to a narrowness in teaching and in statistical consulting. There are strong feelings in certain quarters that if one is well versed in Mathematics and Probability that he is qualified to teach any kind of Statistics course. There are equally strong feelings in certain areas that one cannot teach courses in Statistics without knowing the material in the subject matter area of the students. There is considerable evidence to illustrate that these opinions are incorrect. Regardless of one's other areas of expertise, he must know the material he is teaching. Thus, there is a need to broaden the training of students in Statistics and re-educate many of the people who currently are called statisticians. The latter can be reeducated through sabbatics, study leaves, and special study grants. The requirement should be to become expert in areas outside one's speciality.

Another problem that needs resolution in the future is the teaching of service courses in Statistics by non-statisticians. This should be accomplished by replacing these individuals with statisticians well-versed in the subject matter area. It does no good to teach mathematical and statistical procedures which are not used in a given area. Perhaps one reason why so many introductory courses are taught by subject matter specialists who are not primarily statisticians is due to the strong prior beliefs of statisticians on what they believe should be taught rather than what is needed. A case in point is hypothesis testing when most other aspects of Statistics are ignored. When more broadly educated statisticians are available, it will then be possible to upgrade the teaching of introductory Statistics courses and to replace the nonstatisticians who teach introductory Statistics courses.

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