THE TEACHER'S CORNER

The Teaching of Personal Interaction in Statistical Consulting

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Consulting training has been discussed by panels at statistical meetings, e.g., the spring meeting (ASA, Biometric Society, and IMS) at Blacksburg, Virginia in 1968 and papers have been appearing on the subject. The recent paper by Watts [12] describing the statistical consulting training program at the University of Wisconsin will hopefully stimulate discussion of other existing approaches.

Candid reports, such as that by Daniel [7] which was very helpful to this author, are in shorter supply than impersonal descriptions of ideal consultant behavior.

In 1964 the Department of Biometry at the University of Minnesota began to offer a course in statistical consulting to its own graduate students. In the years previous to 1964 the students were officed so close to the faculty that it was easy to get student help in consulting. As the Department added three faculty members from 1964 through 1966, and the graduate students lost office space to the new faculty, the student offices were moved to another building a block away. As the new faculty became available for consulting, the old method of involving the students became less "necessary" as well as less convenient, and it was felt that student consulting education was beginning to suffer. To meet the need anticipated in 1964, it was decided to offer and require one quarter (three credits) of consulting education in the form of a seminar-like course, to be offered all quarters of the academic year as well as both summer sessions.

The debate about the structure of the course involved two issues: (a) should it be for beginning, intermediate, or advanced students? (b) should the problems be essentially a random sample of the faculty's consulting practice, or should "good" problems be selected? For (a) it was decided to aim the course toward students beginning their second graduate year in Biometry; for (b) we chose the "random problem" approach, subject to the practical limitations of the schedule and willingness of the client. During the years of "easy" medical research grant money about two new problems per week came into the Biometry Consulting Laboratory as potential for the course (we now get less than one per week).

The students are generally quite surprised at the portion of the course content relating to personal interaction between consultant and client. (The sessions on robustness and statistical techniques particularly useful to medical research are neither as surprising to the students nor new enough to the readers of this journal to warrant mentioning here.)

Students enter the course with preconceived views on consulting relationships. Some begin (and end) with the attitude that personal interaction gets in the way of science, that personal feelings are a nuisance to science and should be dealt with by being ignored as much as possible. These students feel that there is only one satisfactory way for a statistician and scientist to interact: the adult-to-adult reasoning manner of reserved, mature, gentlemen-scholars; they have clear images of unhurried, highly competent collaborators. These students seem to plan to avoid consulting relationships that are very far from this model, particularly if they feel professionally inadequate. As the class views the "clinic" of live clients, however, and they are asked by the instructor to tactfully ascertain the relationship the client is seeking, they see there is not only a broad spectrum of statistical difficulty and expense, but a wide range of client attitudes about the relationship. Some clients, of course, are very ignorant about what a statistician is and does. This is particularly true of the young resident physician who is being assigned his first research duty. For such clients the statistician is the one to offer a relationship as well as attempt to describe his (the statistician's) area of competence. Others (e.g., Sprent [11]) have described the client who worships statistics and expects our field to perform objective miracles; this type of client obviously needs some role clarification, but the student is surprised at how difficult it can be to give such a client a realistic view of our field's capabilities.

The most frustrating relationship requests the students see are those that come from clients who insist on a child-to-parent or parent-to-child relationship. Berne [3] has described these kinds of relationships in general and Bellville [2] discussed them in the doctor-patient context. The client who insists on a parent-to-child relationship is one who makes it clear that he is the boss and will decide what will be done and when. Some physicians seem to demand this kind of relationship with every non-physician they contact. This can be very hard on some types of statisticians. Through class discussion the student is encouraged to look at himself and consider whether this kind of situation makes him so angry he would be rendered ineffective as a statistician by being taunted into a

status fight. Some students feel they could never make the adjustment and should somehow refer overly-dominant clients to another statistician. Other students feel they don't mind the dominating client so much but what they can let him be the "boss" and get their satisfaction from helping him scientifically.

The opposite kind of relationship, in which the client feels he is doing the right thing by being almost totally open-minded and indecisive, seems even harder for some students. These students feel that the client, in his child-to-parent manner, is going to get the statistician to take too much responsibility in areas he (the statistician) knows too little about. This touches on a tender area for almost all students who are generally apprehensive about the responsibility in consulting and tempted to force the client to make statistical judgements (e.g., can we assume the negative-exponential distribution?) when he (the client) has no notion of robustness. The colorful description due to Lippman [6, p. 232] of how statisticians and scientists foist the "normality assumption" off onto each other is applicable here. I tell the class that my physician, who is also a researcher, wants to be the parent when medicine is the topic and the child when statistics is the topic. The student is thus encouraged to see that the client is not necessarily insulted by the child role and may simply want to be told what to do statistically without much explanation. Also, many students dislike being the parent because they dislike giving orders as much as taking them.

A question that concerns every student who seriously considers consulting is that of deciding to whom he will look for professional standards. It soon becomes clear to him that statisticians differ noticeably in their consulting techniques, particularly in thoroughness. While no one can disagree with thoroughness in principle, the statistician has real decisions to make about spending the client's money and time, along with the more subtle expenditure of his credibility. If the statistician has his hands full of clients, doing too thorough a job on some may mean that others will do their research without statistical advice. The busy statistician thus has to make many more value judgments than the typical student first supposes; the student naturally wonders whether statisticians or scientists are to set the standards. The student contemplating employment in industry is more fearful that he will face pressures to compromise, but most are aware that any position will produce frustrating realities. The student who is personally close to a senior statistician has a chance to discuss personal-professional relationships, but the shy student who may not take the opportunity for such discussion perhaps should be formally assured that the topic of "data-side manner" is a legitimate one open to discussion.

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On the Use of the Incomplete Gamma Table to Obtain Unbiased Tests and Unbiased Confidence Intervals for the Variance of a Normal Distribution

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1. *Introduction*

Let $X_1, X_2, \ldots, X_n$ be a random sample from a distribution having a normal probability density function with unknown mean μ and unknown variance σ^2. Denote the unbiased estimator of the variance by S^2. It is well known that $Y = (n-1)S^2/\sigma^2$ has a chi-square distribution with $n-1$ degrees of freedom and that most inferences concerning σ^2 are based on Y. For a chi-square density with ν degrees of freedom we will use the notation $g_\nu(y)$ and a percentage point of the chi-square distribution $\chi^2_{\nu;p}$ will be defined by