

TEACHING STATISTICAL STUDENTS TO COMMUNICATE AS CONSULTANTS – AN EXAMPLE IN BIOSTATISTICS

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Introduction

Graduate students in statistics receive training in both the theory and application of statistical techniques. Many of these students will begin careers as statistical consultants after graduation. The need for professionally trained statistical consultants has grown tremendously in the last ten years and will continue to grow because of the computer oriented information age in which we live. It is important for these graduates to be fully prepared for the consulting career they will be entering. To be a successful consultant, one must possess both good oral and written communication skills. These skills are especially important for a statistical consultant because of our complex field that needs to be used and understood by so many people in a wide variety of fields. This paper will present the communication concepts that are important to master and the methods used to teach these concepts to the statistics graduate students in the Biostatistics Unit at the University of Florida.

The Ideal Client – The Consultant's View

The ideal client should be relaxed and not in a hurry to get somewhere else. The consultant must learn to be wary of the client who calls to ask "Do you have five minutes?" This client most likely does not have a proper understanding of the role of the biostatistical consultant. Even though he will be explaining some biological process for his research project, the client should speak in English instead of "Medicalese". He should have a good understanding of the real objective of his research project. Although he will not be a statistical expert, the client should have a basic knowledge of statistical terminology and methodology and the understanding that statistics is more than a t and chi-square test. The client should have reasonable time demands for computerizing and analyzing the research data. A comprehensive overview of the different client types is available.^{1,2}

The Ideal Consultant – The Client's View

The consultant should take a real interest to learn the biology involved in the project in which he is consulting. Although the consultant's job is to provide advice on statistical methods, he should speak English, not "Statisticales", and minimize (or avoid) the use of complex statistical terminology which is beyond the understanding of the client. Instead of lecturing, demanding, or harshly criticizing the client's research efforts, the

consultant must understand the practical limitations of research and provide constructive criticism so the client will learn from his errors and avoid them the next time by including the statistician earlier in the project. The consultant must also realize the time constraints facing the researcher and provide the most reasonable and correct analysis, even if it is not the consultant's first choice.

Research Design Discussions

Hopefully, the statistician will become involved at the beginning of a research project and the first consultation will involve the design of the research project. Although many statistics graduate students take courses with "Design" in the title, few students learn the practical design concepts that the biomedical researcher must face and that should be discussed in all design consultations. (1) The consultant must get a clear understanding from the researcher of the research objective. It is amazing how much research is done in which the researcher is not clear on the objective he hopes to accomplish. (2) The consultant must learn the specific types of data that will be collected – nominal, ordinal, discrete, continuous – as the analysis to be performed will depend on the type of data. (3) The consultant must learn whether some sort of repeated measure design can and should be used in this project. This valuable technique increases the amount of information in a project while keeping the needed sample size to a minimum. Few researchers understand this important concept and yet it is essential in some studies where small samples are necessary. (4) The consultant must learn how the sample of experimental units is to be chosen for the project to ensure that the sample will be representative of the population. In the real world, true random samples are seldom taken in biomedical research and the client must learn how to achieve a representative sample. (5) Probably the single most important design question is determining the needed sample size to achieve the research objective. The consultant must give the client an educated estimate of how many experimental units are needed in the study and the implications of obtaining a larger or smaller sample. (6) The last design concept to be discussed involves the randomization technique to be used to assign experimental units to the treatments being studied. The consultant needs to learn that these concepts should be discussed in each project. A detailed discussion of each of these important research design concepts is available.³

Data Analysis Discussions

The consultant must learn that he is the expert in statistics, just as the client is the expert in his area. The consultant must learn to be in control of the statistical aspects of the project. When the client says "I would like a t-test done because Journal X publishes them" the statistician must be prepared to convince the client if another test is more appropriate. When statistical significance is not obtained and the researcher asks "Can we do another test that may be more significant?" the consultant must convince the client that the most appropriate test was performed and the obtained results are the most valid. When the researcher has measured 50 variables and asks "I would like all possible comparisons" the consultant must be

able to explain why this is inappropriate. In each of these situations, the consultant must try to educate the client so he will learn the proper statistical concepts for future projects. The consultant should strive to explain all reasonable analysis alternatives and explain why the chosen one is best. The consultant must learn how to balance the constraints of providing the absolute best statistical analysis versus a simpler, yet correct, analysis that can be accomplished in the client's time frame. Clients need to learn and understand the considerations necessary for choosing the proper statistical analysis.⁴

Other Considerations to be a Successful Consultant

The consultant should get in the habit of visiting the client in his office or lab. Much more can be learned about the biological process involved in the project by seeing it directly. The client will be expected to learn little of our statistical process so there is little advantage in having him visit your office. It is also desirable to sit next to the client instead of across from him to promote the feeling of working together instead of an adversarial relationship. Making light talk before beginning the consultation can help put the client at ease, especially if it is his first meeting with you. Provide only constructive criticism so the client sees that you are sincerely interested in helping him improve his research. In doing so, you will gain his respect and confidence and he will want to return again. It is extremely important for both the client and consultant to strive for team play and to avoid letting either become a power broker. The most important qualities of a successful consultant are patience, tolerance, flexibility, ability to think on his feet, oral and verbal communication abilities, and can take pressure. More information is available on the role that a statistical consultant can and should play in collaborative research.⁵⁻⁷

University of Florida Program for Training Consultants

At the University of Florida, graduate students in statistics have the opportunity to gain consulting experience by working on assistantships in our Biostatistics Unit which provides statistical consulting advice to biomedical researchers in the colleges of medicine, pharmacy, dentistry, veterinary medicine, nursing, and health related professions. The students sit in on all consultations between biostatistical faculty and medical researchers. If data analysis is required, the student provides the data management and analysis services. The written report is developed by the student and faculty member and both meet with the researcher to discuss it. As the student gains experience, he becomes more involved in the consultation process and, eventually, is allowed to consult alone. The time to develop into a consultant differs between students but most students are experts after completing two years in our program. They benefit by learning from experienced consultants and being exposed to a variety of biomedical researchers and projects. The design and analysis concepts discussed earlier that are not taught in their courses are learned quickly in the actual consulting situations and usually not forgotten because they are used over and over again. This program has worked well for us and our

students have left feeling comfortable about their first full-time consulting position.

References

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