A Holistic Approach to Training
Statistical Consultants

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Abstract

This paper describes a holistic approach to the training of statistical consultants which we are implementing at the Florida State University. Our program begins with the preconsulting course in which students first study general problem-solving techniques. Next, these techniques are applied to applied statistics "textbook" problems. Then problem formulation and research methods are studied. The structure of consulting sessions is then considered, along with the interpersonal questions that arise in consulting. In the consulting course, students work with actual clients in videotaped sessions, attend supervision sessions in which the tapes are reviewed, present case conferences, attend new material sessions and do a project. The paper ends with an appendix which summarizes what we have learned while developing this program.
1. INTRODUCTION

A number of authors have characterized statistical consulting and many of the skills required to perform statistical consulting as art. They have stated or implied that consulting can not be taught, but only learned through internship or a long process of trial and error (Cox 1968). Watson (1980) has even stated that consulting courses have no place in a statistics program. However a high percentage of M.S. and Ph.D. graduates enter jobs which have a large statistical consulting component. Where are the consulting skills to be learned? It has been argued that the universities are responsible only for formal statistics instruction and that consulting skills should be learned on the job (and maybe can only be learned on the job). Nevertheless, if statistics graduate students can be trained to move easily into the consulting role, further debate will give way to the reality of the market place.

Three years ago at the Florida State University Department of Statistics we set out to see if it was possible to develop a comprehensive program to train statistical consultants. The program is based on the hypothesis that most of the statistical and nonstatistical skills necessary to be an effective statistical consultant can be identified and systematically presented in discrete, easily managed learning units. Parts of this evolving program have previously been reported by Zahn (1982a, 1982b) and Zahn and Boroto (1981). Over the past year, we shifted our emphasis from the identification of key components of a course to the construction of a comprehensive curriculum for training statistical consultants. In this presentation
we describe the result of that effort, a holistic training program for statistical consultants. This program includes training in many skills identified by others as important to the effective statistical consultant (ASA Committee on Training of Statisticians for Industry 1980, ASA Committee on Training of Statisticians for Government 1982, Baskerville 1981, and Boen and Zahn 1982).

The article is divided into five sections:

1. The presentation of a rationale for the systematic training of statistical consultants rather than apprentice training by internship or trial-and-error methods.

2. The description of a preconsulting course which presents five separate components of the consulting process. The following components, although hierarchically ordered, are discussed in this paper in a step-by-step fashion for simplicity: a generic problem-solving strategy, a means of applying that strategy to applied statistics problems, practice in formulating statistical problems, techniques for consulting session management and an introduction to interpersonal relations as they relate to statistical consulting.

3. The description of a supervised consulting course that includes group supervision sessions based on the students' videotaped consultations. This course involves actual consulting under supervision as well as discussion of statistical methodology.

4. A list of competencies students are expected to have from other courses in the statistics curriculum.

5. An appendix which presents some observations on what we have learned while developing this program.
2. WHY A SYSTEMATIC TRAINING PROGRAM?

Many university programs (Cox 1968, Watts 1970, Zahn 1982c) use one of two methods of training consultants: an internship (observer-apprentice) model or a trial-and-error model. In the internship model, the students observe consultations between a client and an experienced consultant. Over time, the student increases his or her abilities to conceptualize and solve statistical problems. As student competencies develop, the student assumes a greater share of responsibility for the consulting session. In the trial-and-error model, students are scheduled with clients and have a supervisor to turn to for guidance in case of problems. Although these methods may be ultimately successful, we feel that they are inadequate for the following reasons:

1. University programs to train applied statisticians are often of limited duration (one or two years for most M.S. programs). There is simply not enough time to employ the internship or trial-and-error models, as well as train the students adequately in other, more traditional areas of statistics.

2. There is a need for the students to encounter a wide variety of problems with different characteristics. Intern programs may fail in this respect.

3. There is a need for the student to observe a wide variety of effective consulting styles.

4. Many skills are inefficiently or ineffectively taught by the apprenticeship or trial-and-error methods. Examples include problem
formulation (perhaps the key consulting skill) and resource use.

Of course, we also feel that actual consulting experience is essential and should be included in a training program which addresses the above-mentioned deficiencies of the internship and trial-and-error methods.

The applied M.S. program at Florida State is a three-semester program in which actual consulting is a requirement. Students take the preconsulting course and the supervised consulting course in their second and third semesters, respectively. This short time frame makes it essential to train statistical consultants efficiently. For an internship or trial-and-error method to be effective, a longer time period is needed for students to acquire the requisite skills. In the internship model, they must be exposed to demonstrations of skills such as problem formulation, resource use, and interviewing techniques. Next, they must assimilate the specific demonstrations of skills into general patterns so that they themselves can apply them. Only then are they ready to begin consulting. Since these demonstrations of skills occur in an unsystematic pattern depending on the vagaries of client flow to the internship setting, a longer period of time is necessary to guarantee adequate coverage of skills. In the trial-and-error models, the students are expected to acquire these skills on their own. As we shall discuss later, many of these skills are not formally taught in traditional programs. A trial-and-error method virtually guarantees that the student will not learn some number of important skills. Thus, progress toward becoming
an effective statistical consultant depends on entering the pro-
gram with the requisite skills or identifying and acquiring them
without guidance.

In the internship method, it is often advocated that students
work on one project in depth. Depending on the nature of the pro-
jects available, the utility of the experience will vary greatly.
With this approach, one runs the risk of having available a project
which requires only a narrow range of skills. It also may be diffi-
cult to arrange the timing of the project to coincide with the aca-
demic calendar. Thus, a student might be required to continue working
on the project after the course is over or to discontinue the project
while it is incomplete.

In a systematic training program, a student can be exposed to
a set of problems which illustrate specific characteristics. For
example, problems requiring the formulation and interpretation of
a multiple regression model or the design of an experiment might
be presented. In this way, more common types of problems requiring
certain skills would not be omitted from a student’s training.

The same reasoning applies to styles of consulting. In a
training program, effective styles of consulting can be systematically
acquired, rather than relying on the observation of a few styles
(internship) or no styles (trial-and-error). For example, alterna-
tive interviewing styles can be illustrated and discussed through
the use of videotapes. In the next section, we present a course
which allows the students to study and learn various components of a consulting style.

Additionally, there are many skills that internship or trial-and-error programs are ineffective in teaching. For example, how does one learn to formulate a problem into statistical terms? If one is an apprentice-observer to an experienced consultant, how is this skill assimilated? The implicit steps and thought processes of the experienced consultant occur rapidly, with no "time out" to explain the reasoning. At another level pragmatic issues arise such as what questioning style is most likely to elicit relevant information from a client. The trial-and-error method does not address the training of these skills. Although there exists no logical reason that a skilled internship supervisor could not address all of these issues, in practice internship supervisors tend to be unsystematic in their coverage of such topics and thus internship experiences vary greatly. Our experience to this point encourages us to think that skills such as these can be effectively trained in a consulting course.

These considerations have led us to develop a program consisting of two components: first, a preconsulting course to systematically train various skills and techniques for statistical consulting and second, a supervised consulting course for practicing and extending the skills previously trained.
3. COURSE DESIGN STRATEGY

The course described below evolved from our quest for a better method of training statistical consultants. We began by conducting a task analysis of a consultant's specific duties and responsibilities. We wanted to identify what minimum skills and competencies are required. Though the list of characteristics of an effective consultant can fill several pages, we have focused in the consulting course on those skills which are most essential to the consulting process and are capable of being taught.

Given the parallels of statistical consulting to other service activities, we have searched the literature outside of statistics for validated methods of teaching the subset of skills that is generic to all forms of consulting and advising. Whether the service is legal aid, financial assistance or medical advice, individuals whose task it is to provide direct service must know how to diagnose problems and recommend solutions and how to work with people. Because statistical consultants work with people in addition to data, we strongly feel that a complete training program must include a section devoted to the interpersonal aspects and service function of consulting. We have examined, pilot-tested, and evaluated several teaching methods and have extracted those components which have the greatest applicability to our objectives.

Our holistic approach to the training of statistical consultants is consequently an eclectic approach. We have borrowed ideas from psychology and education in developing a systematic instructional sequence. The training of statistical consultants is a step-by-step
process where each successive set of skills can only be taught after a prior set of prerequisite skills have been learned and demonstrated by the student.

In synthesizing a comprehensive program from other curriculum areas, we have used a number of instructional design principles. In designing our instructional activities, we have used the guidelines of Gagné (1970) in identifying the events of instruction:

1. Gaining the learner's attention.
2. Increasing the learner's motivation.
3. Informing the learner of the objectives.
4. Stimulating the recall of prerequisite skills.
5. Presenting the instruction.
6. Providing an opportunity for practice.
7. Providing feedback to the learner.
8. Ensuring that the learner retains what is taught.

Our goal is for each instructional activity to encompass these events. This systematic approach to the design of our instruction has made the task of implementing and evaluating the curriculum easier. The systematic structure of the curriculum also provides a framework that may be applicable to other statistical consulting training programs.
4. **The Preconsulting Course.**

We developed the preconsulting course to systematically train skills necessary to be an effective statistical consultant. To achieve this goal, we have divided the consulting process into five segments:

1. General problem-solving
2. Applied statistics problem-solving
3. Formulation of statistical problems
4. Consulting session management
5. Interpersonal relations and communication.

We regard these five segments as layers in the consulting process.

In a consulting session, the consultant must first deal with a person. The consultant must establish a working relationship such that the client understands that the consultant is there (1) to provide a service rather than to judge and evaluate and (2) to facilitate the emergence of a cooperative working relationship. The consultant must be able to identify the needs of the client and to communicate his or her understanding of those needs effectively to the client. This is the first layer.

The second layer inward is the ability to manage the consulting session. We do not mean manage in the sense of manipulate, but more in the sense that the consultant must be aware of session organization to know when the problem has been identified and formulated to the extent that it is possible to move on to other tasks, such as problem solution.
Third, the consultant must have the ability to translate the client's questions into a statistical framework. This involves the operationalization of ideas, as well as some basic scientific research design.

Next the consultant must be able to devise solutions to the formulated statistical problem. We call this layer "applied statistics problem-solving" in which the task to be done is working with the client to develop a plan of action which is appropriate to the statistical problem, given the constraints of the client, consultant, and the problem to be solved.

The last layer is general problem-solving, that is, the consultant must have techniques available for solving problems of all sorts. These problem-solving skills are similar to those described by Polya (1957, 1962).

The segment of the course on general problem solving is based largely on Wickelgren (1974), which is in the spirit of Polya's books but not restricted to solving only mathematical problems. We train the students in general problem solving in a largely traditional manner. First, basic terms in problem solving (givens, operations, goals, problem state, solution, action tree) are defined and then each of several problem solving methods (inference, classification of action sequences, state evaluation and hill climbing, subgoals, contradiction, working backwards, solving a simpler problem, solving a more general problem) is presented. Next, each of the methods is illustrated with examples. These are
largely taken from Wicklegren, with at least one statistical example included for each method. The examples are solved as a class effort to familiarize each student with the thought processes involved in arriving at the solution. Further discussion afterwards focuses on the relative merits of the chosen method. After the entire group of methods has been considered, the class discusses the relative merits of each, focusing on characteristics of problems which make specific techniques especially useful. The class then practices jointly on a set of problems. This segment of the course is tested by a homework assignment in which the students are asked to identify the elements of the problems (goals, givens, etc.) and to solve them. They are also asked to write down their thought processes while attempting to solve the problem and the problem-solving methods used or attempted. This information is used in subsequent class discussions to expose the students to the different ways people have of thinking about the same problem.

The second segment of the course is applied statistics problem-solving. In this segment, the general problem-solving methods are brought to bear on the specific problem — "What is appropriate advice to give or actions to recommend to the client?" The necessity for this segment of the course is argued for eloquently by Feinstein (1970) by analogy to clinical training:
The preparation for work as a consultant thus contains antipodal contrasts in the education of clinicians and statisticians. A clinician is taught to identify and formulate patients' problems in a carefully structured manner; but he is then left to develop diverse tactics of "judgement" for managing the outlined problems. A statistician is taught a carefully organized set of mathematical structures for managing an outlined problem; but he is left to develop diverse judgmental methods for identifying and formulating the problem. The clinician may emerge able to express the right questions but unable to find the answers; the statistician may emerge with the right answers but unable to select the questions.

Kimball (1957) also argues along these lines, defining errors of the third kind as those in which a consultant gives the right answer to the wrong problem. We believe more time should be spent in statistics programs teaching students to apply statistics (judgmental methods for identifying and formulating the problem) rather than just teaching applicable statistics (a carefully organized set of mathematical structures). We approach this segment by pointing out the differences between the formal (puzzle) problems on which the general problem-solving methods were illustrated and the applied statistics problems. Some of these differences are:

1. The goals of the problem are not as well-defined as in a formal problem.

2. Alternate solutions will exist at different levels of expertise of the client.

3. Constraints on the resources of the consultant and the client will play a large role in determining the practical solutions.

4. It will be more difficult to decide when a solution has been reached.
Using the general problem solving methods as a base, we next present an expanded model of problem solving that can be used on statistical problems encountered in a consultation. Following are the steps in this model.

I. Determine the nature of the problem
   A. Identify characteristics of the problem
   B. Make a preliminary classification of problem characteristics

II. Determine the scope of the problem
   A. Identify prior actions and outcomes
   B. Identify constraints and limitations

III. Determine solution requirements
   A. Identify desired outcomes
   B. Define requirements the solution must meet

IV. Determine resources
   A. Define client resources and constraints
   B. Define consultant resources and constraints
   C. Define alternative resources and constraints

V. Propose solution alternatives
   A. Determine relevance to solution requirements
   B. Determine feasibility of solutions, given resources and constraints on them

VI. Recommend a solution
For this segment of the course we illustrate the use of the model on some real consulting problems. The students are evaluated by asking them to identify the steps of the model while attempting to solve applied statistics problems. In this segment students also read Kimball (1957) and begin sitting in on consultations by experienced consultants.

The third segment of the course is on problem formulation and scientific methods. We illustrate the operationalization of vague ideas (e.g., what does the client mean by "related to" or "look at differences") using several real consulting problems; we discuss several examples demonstrating how it is that many statistical problems get formulated in terms of means, proportions or correlations. Discussion of problem formulation and the kinds of conclusions that are possible from an experiment leads naturally to a discussion of research design, experimental design and scientific methods. Some basic terminology (experimental unit, confounding, replication, etc.) is defined and illustrated on good or poor experimental design.

The material on problem formulation is evaluated using a written simulation: The students are given the barest background to a real problem (actually the information form required from the client before the first consultation at the Florida State University Consulting Center) and are asked to begin formulating the problem. They also are required to list information they need and questions they would like answered about the consulting project. The evaluation
then proceeds in a sequential manner, with more information
being given to the students, who then attempt to formulate the
problem again, etc. This simulates an actual consulting session
but removes most of the interpersonal element so the students can
concentrate on problem formulation and "asking the right ques-
tions." The material on research design is evaluated by asking
the students to criticize and improve several designs on a home-
work set.

For the fourth segment of the course, the consulting model
is enlarged to just short of having to deal with interpersonal
relationships. Session management is discussed and the article
by Zahn and Isenberg (1979) is assigned. This segment of the
course introduces a sequential element into the model, i.e., it
identifies in what order various parts of the model are treated
(it is quite possible that at some point in the consulting session
a return to the discovery and identification part of the model, part
I, will occur) and how to recognize when to move on to another part
of the model. This segment adds another step to the model, called
"summary discussions" by Zahn and Isenberg. In this part of the model
implementation of the chosen solution is discussed. Discussions
must occur to determine exactly how this will come about. This
segment is evaluated by asking the students to identify parts of the
model while viewing videotapes of consulting sessions.
The last segment of the course provides a didactic/experiential learning unit on interpersonal relations as they relate to a statistical consultation. The didactic component concerns the necessity for paying attention to nonstatistical aspects of a statistical consultation, as well as some tools used to recognize characteristic problems of a consultation and strategies for effectively handling such problems. The experiential component includes making and viewing videotapes, doing roleplays, participating in exercises designed to produce some psychological experience or state likely to be encountered in a consultation, e.g., interpersonal anxiety, evaluation apprehension, seductiveness (Zahn and Boroto 1981). The topics covered, although embarrassingly simplistic to an experienced consultant, have been found to be necessary for the novice consulting student. For example, the first task is to convince the apprentice consultants, through the use of videotapes of consulting sessions performed by experienced consultants, that nonstatistical aspects of the session can determine the ultimate efficacy of a consulting hour. They demonstrate that the attitudes and biases of both the client and the consultant have a powerful effect on its direction and ultimate success. A representative videotape that students view initially in this section of the course shows a client who was sent by the major professor to work out an experimental design to do hypothesis testing. The client, however, was ill-equipped either to
conceptualize or implement the project. The client's basic aim was to fulfill demands of the major professor. The consultant, on the other hand, was insulted that he was expected to provide pat answers to difficult questions in such a way that the client might satisfy degree requirements without mastering the rudiments of research design and basic statistics. Parts of the videotaped interaction were sadly comical. It should be pointed out that this was a real consultation with an experienced statistical consultant. Next, a communication model is presented that focuses on intentions and motivations of the consultant and the client and demonstrates how intentions that are not in alignment lead to inefficient and frequently ineffective consultations. Finally, students participate in a series of roleplays to give them practice in dealing with a range of problem situations that occur with high frequency in consulting interaction. Topics of these roleplays include situations in which the client questions the consultant's credentials or expertise, makes unreasonable demands, wants to develop a passive-dependent relationship, presents an amorphous problem for which a specific answer is expected, or demands a solution requiring far more statistical expertise than the client (or, perhaps, the consultant) has. In the roleplays, students have an opportunity to play both the client and the consultant. We have found that the ability to effectively play a client increases students' empathy and understanding of the client's dilemma. The ability to play the consultant provides them with an
opportunity to explore various problem-solving techniques at both a strategic and verbal level.

The interpersonal component of the course is evaluated on several levels. Prior to the dissemination of any content, students view a videotape of a statistical consultation session. Two-to three-minute segments of the tape are identified; for each segment, students respond to a general question, "What has taken place in this segment?", and several more specific questions, such as "What are the tasks confronting the consultant at this point?", "At this point in the session, what are the goals of the consultant and the client? Which are congruent? Which are incongruent?"

At the conclusion of the interpersonal section, students view a different videotape and respond to similar questions. These questions are evaluated in terms of focus, i.e., statistical or nonstatistical focus, as well as the level of analysis of the problem, both statistical and nonstatistical. In addition to this pre-post evaluation, roleplays performed within the section can be evaluated by a criterion-based standard. That is, immediately after a roleplay, feedback is given and it is reenacted until the basic lesson has been mastered. The roleplays often raise so many questions that only a small fraction of them can be explored in the class time available. Even with the time limitation, the process works because important points will reoccur until they get discussed.
5. **THE SUPERVISED CONSULTING COURSE**

The supervised consulting course is a repeatable, semester-long course in which the students do actual consulting and extend and sharpen the skills learned in the preconsulting course. The students schedule two hours of consulting per week and are required to videotape all consulting sessions. The course meets three times a week and is divided into three sessions: supervision, case conference and new material.

In the supervision sessions segments of the videotapes of the consulting session are reviewed. The instructor's supervision can take several forms: clearing up minor statistical problems, observing and commenting on consulting session management, consulting style, or interpersonal relations. Especially in this last task, instructors may need the assistance of a clinical psychologist to learn how to supervise. If there are not specific segments of the tape to be studied, the student is asked to replay four short segments of the tape: the beginning, the end, a spot where the session was going well and a spot where the session was going poorly. We have found that this is usually sufficient to generate useful discussion. Again, as in the roleplays, it is usually necessary to pick among several potential issues to consider, given the limited time available. We emphasize that these are peer supervision sessions also; the students in the course are expected to take part in constructive criticism of the videotape segments. The fear of evaluation that videotapes evoke is quite strong. An effort must be made
to view them in a supportive atmosphere and to ensure that all participants in the group contribute to creating this atmosphere.

The case conferences are used to discuss statistical problems of a more complicated nature. A student who wants to schedule a case conference distributes a summary of the problem to each member of the class. The class then meets to discuss the problem, with the student acting as mediator and being responsible for guiding the discussion to get a solution to the problem. In this way, the student gets practice in writing about and summarizing statistical problems and in running a group discussion of a technical problem.

The new material sessions are reserved for discussions or presentations of new material relating to any segment of the course; these run the gamut from applied statistical procedures not covered in other courses to interpersonal relationship material. The students participate by presenting one or two topics. In this way they get practice explaining statistical procedures and also practice in identifying and exploring sources for material on statistical procedures. (These sessions only provide an entrée into the topic.)

Each of the students in the course is required to do a project. The project consists of an extensive report on one of their clients. They are expected to identify and discuss statistical and nonstatistical aspects of their interaction with this client.
6. PREREQUISITES FOR THE CONSULTING COURSE SEQUENCE

Inherent in the consulting course is the assumption that the students are minimally competent in several areas. We expect students to have basic statistical skills (a good list can be found in ASA (1980)). We expect the students to have basic computer skills: the ability to use one or two statistics packages, interpret basic output from statistics packages, and set up simple data files. We also expect the students to have basic oral and written communication skills, though we emphasize how to write and explain statistical ideas clearly in the program. One of the problems we encounter in the course (especially with the M.S. students) is that some of the students do not meet these minimum expectations. This limits the amount of progress that these students can make and requires additional supervision.

7. SUMMARY AND CONCLUDING COMMENT.

In this presentation, we described a comprehensive consulting curriculum that systematically incorporates statistical and nonstatistical aspects of statistical consulting. We have discussed the limitations of internship and trial-and-error methods of training statistical consultants in time-limited university programs. Key parts of the program are:

1. A preconsulting course which systematically trains skills required for consulting and not taught in traditional statistics programs.

2. A supervised consulting course which combines consulting experience with videotape supervision, case conferences and presentation of new material.

3. Evaluation of competencies achieved at each stage in the program.
We will be pleased to correspond with anyone interested in discussing this program or implementing any of its parts. In the Appendix below, we have listed some observations on what we have learned while developing this program.

REFERENCES


Following are some observations on what we have learned while developing this program.

Organization of Consulting Activities

Consulting Center operating procedures which help students as they are beginning to consult include (1) a clear policy statement which tells clients what services we do and do not provide; (2) a client information form submitted by every new client at least 24 hours before the initial appointment; (3) the requirement that all clients seeing graduate students sign a release form agreeing to be videotaped and agreeing to do an evaluation of the sessions; (4) a filing system containing notes on clients seen in previous semesters by other graduate students in the consulting course; (5) the presence of a consulting room with our own videotaping equipment already in place, ready to be turned on.

Videotaping

Videotaping the students' sessions is an essential part of the system. By providing a complete account of what happens in a session (rather than selective, second-hand information via selective recall by one participant) the taping sessions have benefits to the training program that offset the costs of videotaping. These costs include an increase in the level of consultant and client anxiety that occurs as a reaction to the taping and other, more physical costs, such as the time to set up the equipment at the
beginning of the session, teach videotaping, establish and monitor the security of the system, and maintain the equipment. Though anxiety levels may be higher, we have noted that after five or ten minutes in many sessions, the consultant and client often appear to pay little attention to the camera (unobtrusively placed on a shelf in a cabinet in the corner of the consulting room).

Though the camera may be more bothersome to some individuals, we have not made its use elective. All clients seeing graduate students in the Consulting Center sign a consent form allowing videotaping and we require the taping of all sessions. The taping policy has not decreased our clientele. Any adverse effects of videotaping from the client's point of view are outweighed by the more accurate and helpful input the student consultant receives from the faculty supervisor reviewing the tapes. The taping also signals the clients that we take the supervision process seriously.

Supervision

Supervision is a complex task. While supervising, one is watching a tape of a session with the student consultant and two or three peers present. The supervisor must identify effective and ineffective parts of the session in both statistical and interpersonal areas. This information must be delivered to the apprentice in a constructive, helpful manner which clearly communicates that the purpose of the whole endeavor is to help the apprentice learn how to consult better. We often found that it was useful to have a psychotherapist on the team to help us learn to identify interpersonal aspects of the sessions that were interfering with statistical
progress and to teach us some effective strategies for dealing with some of the more common and problematic interpersonal situations that arise in consulting sessions. Supervision sessions have been one of the hardest parts of the program to implement because they require of statistics faculty knowledge and skills in the areas of supervision and identifying interpersonal events on videotapes that interfered with the statistical work being done. These are skills that were new to the statisticians involved in our program, and, we suspect, to most other statisticians starting such a program. Another aspect of these sessions that can make them challenging is working with a student who is having trouble with a certain type of client when you also have trouble with that type of client.

Time use in supervision sessions needs to be carefully monitored. The most effective use of this resource is to use it to identify problematic areas of interpersonal interaction in the session. However, there often is a tendency on the student consultant and supervisor's part to shy away from potentially difficult discussions of interpersonal material by focusing on familiar and comfortable statistical topics. This must be guarded against. Other sessions, namely case conferences, are the place for the extended statistical discussions which are necessary in most interesting consulting problems.
Beginning to Consult

Some students are not well prepared for their first client by the preconsulting course. They are very uneasy and do not do well — statistically or interpersonally. Asking questions of a stranger to get accurate statistical information is a tough task. Additional steps we are considering for the program to improve this include making more extensive use of roleplays and pseudoclients (individuals from other departments who present practice problems and who provide feedback after the practice sessions) in the preconsulting course and starting off the supervised consulting course by having the supervisor actually sit in on a student's first few sessions, with the student having the responsibility to be the lead consultant.

An unanticipated piece of information from the taping is that the students still have more problems with various statistical questions than we had anticipated. We plan to add more activities in the preconsulting course directed at extracting the relevant information from the client and at translating the client's problem into a statistically formulated problem.

Timing

The majority of the students in the consulting sequence at the Florida State University Department of Statistics are applied master's degree students. This is a twelve-month program, so that these students start consulting with their own clients in the Summer Semester after 2 semesters of graduate study in statistics and after taking the preconsulting course in the Spring Semester.
One of the major constraints we have encountered in developing this program is the limited time available in the master's degree curriculum. (We advise doctoral students to take the sequence in their second or third year.) Students are uneasy about the amount of statistics they know when they begin to consult in the Summer Semester. Some are very uneasy about consulting with a client, even after taking the preconsulting course. The step from practice consulting in this course to actual consulting with their clients is a large one for most students; no amount of practice will totally eliminate the apprehension associated with this step. However, we have found that they can make a substantial contribution to the problems of most graduate student clients they see. The videotaped sessions and subsequent supervision help to identify when they are "in over their heads" and then assistance is given by one of the faculty members of the Consulting Center.

We encourage longer-term students to repeat the supervised consulting course in that there are so many things to be learned as one is starting to consult. By beginning to train students in interpersonal aspects of consulting, we have substantially increased this number. One semester is not enough time to ingrain in a student new ways to handle a difficult interpersonal situation that they may have frequently experienced. Under stress, a person tends to revert to long-established habits, rather than to use newly learned skills.
For example, a student may find it difficult to say "No" to a request, even when the request is for a service the Consulting Center does not provide. Tendencies like this which may have been going on for years will often show up in roleplays in the preconsulting course where we can offer suggestions and practice in ways to say "No". However, when encountering an unrealistic request in the heat of a consulting session from, say, a domineering client who is years older, the student is likely to revert to the old behavior of saying "Yes" when he or she means "No".

Experience from the training of therapists suggests that it could take as much as three or four years of supervision to replace habits such as this one with new skills. Thus, we must be realistic in our expectations about how much progress students can make in these areas while in statistics graduate programs. Our aim is to help them identify their major habits or viewpoints which interfere with the effectiveness of their consulting. Then we offer some alternatives to their habitual response and help them to see, in the very least after-the-fact on videotapes, how these alternatives could be used.

Teaching Consulting

Consulting can be taught! We have found it useful to break the consulting process into the five layers from pure problem solving to interpersonal issues that arise in dealing with a client, and the consulting session into parts ranging from establishing a relationship to final discussions on who will do what when. This analysis has been useful in our own consulting and has provided a valuable structure as
we have begun to develop materials for the course. Watching tapes of students we have been teaching to consult has given us data on how to improve this program, such as improving the student's statistical problem-solving ability and doing a better job of getting them ready for their first client. The tapes also identify areas for individual students to work on, such as design of a survey or how to deal with a harried, unfocused client.

Faculty

To develop a program such as this, it is necessary to have faculty who are willing to learn and teach about such nonstandard topics as the consulting process and interpersonal relations. They must also be willing to deal directly with student anxiety in the face of videotaping and questions from faculty colleagues as to whether this course is appropriate for a statistics department to teach. We have found that most colleagues respond favorably to the concept that the overall theme of the course is the improvement of the quality of the science being done in consulting.

The expanded program to teach consulting does not make things easier on the faculty. In fact, it substantially expands the set of questions and issues to be dealt with — from just statistical to statistical and interpersonal. It reveals what faculty and students do not yet know or cannot yet do. Thus, it is far easier and less unsettling not to teach consulting at all, at the cost of leaving a major hole in the curriculum. We do encourage people who are (1) able to work on interdisciplinary teams, and (2) willing to experiment, to identify professionals with the requisite supervisory skills and interpersonal knowledge and to develop this sort of course in collaboration with them.