THE CASE AGAINST STATISTICS-AS-METHODS: CONFESSIONS OF A BORN-AGAIN PLANMAKER

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In most planning programs, "methods" mean statistics. In a 1983 survey of 71 North American planning schools, E.H. Baxter found that statistics, chiefly inferential statistics, formed the core component of first-year planning methods classes in almost all of the planning programs surveyed (1983). What explains this popularity? Statistics, I suspect, has much the same appeal as a successful political candidate -- although exciting to only a few, it is nontheless acceptable to many.

Recently, however, planning educators have begun to re-think the role of statistics in the education of Master's-level planners. Mark Schuster, in a 1985 paper recounting MIT's attempts to reform its methods curriculum, suggested that planning educators focus not on statistics, but on methods of "quantitative reasoning." Schuster suggested that planning methods typically involve four types of generic activities (description, estimation, comparison, and explanation) and that statistics is but one of several sets of tools which can be used in these activities. Schuster concluded that statistics had become "the tail wagging the dog," and suggested that, in many curricula, teaching statistics had replaced the nurturing of quantitative reasoning skills.

Carl Patton and David Sawicki, in their recent text, *Basic Methods of Policy Analysis and Planning* (1985), eschew statistics altogether. Patton and Sawicki argue that product turnaround is of paramount importance in the real world of planning and policy analysis, and that planners rarely have the luxury of undertaking long-term research studies. Instead, planners are usually called upon for "quick" analysis, and must be able to size up situations and issues succinctly, propose workable solutions, and be able to communicate those solutions to clients and decision-makers.

This paper expands on the concerns voiced by Schuster and Patton and Sawicki to argue that: (1) planning programs have substituted the teaching of statistics for the teaching of quantitative reasoning (to use Shuster's phrase) and quantitative methods; (2) our over-reliance on statistics as the core of planning methods may actually be counterproductive; and (3) it is time to de-emphasize statistics in the education of Master's-level planning students.

As these points are likely to be controversial, I would like to clarify what I mean by de-emphasizing statistics. First, in arguing that we should de-emphasize statistics, I refer primarily to inferential statistics.

The includes the use of z-scores, t-statistics, the chi-squared statistic (and other summary test statistics) for the purposes of hypothesis testing, and point and interval estimation. I do not advocate de-emphasizing the teaching of descriptive statistics such as mean, median, and variance. Quite the contrary; all too often, the potential uses of simple descriptive statistics are given short shrift in the rush to teach inferential statistics.

Second, although I advocate de-emphasizing inferential statistics, I do not advocate its elimination. Survey methods, the analysis of samples, hypothesis testing, and multivariate analysis are techniques planners need to know, if not as formal researchers, then as educated consumers. Thus, my proposal to de-emphasize statistics is really an argument to reposition inferential and multivariate statistics in the planning curriculum: from first-level, or introductory methods courses, to subsequent, more advanced methods courses. In this way, planning students can learn statistical methods having already acquired some familiarity with quantitative reasoning and some confidence in the use of quantitative methods.

Before examining the case against statistics, two other points need to be stated. First, I do not propose de-emphasizing statistics because it is difficult and students do not like learning it, or because practitioners don't use it on an everyday basis. Many of the things most worth learning are difficult, and the fact that some students may not like learning statistics is irrelevant (provided that they do in fact learn it). Nor should the fact that practitioners rarely use statistics be of concern; the role of a professional education is to lead practice, not to follow it. Second, as often as not, the problem with statistics is not the material, but the way in which it is taught. Teaching statistics at all can be difficult and frustrating; teaching it well is doubly difficult. And the task is even more frustrating when statistical techniques are not followed up in later courses. In fact, several of the points that follow are relevant precisely because statistics is such a difficult subject to teach.

The Case Against Statistics

Questionable Relevance to Professional Practice and Effectiveness

The most practical argument for de-emphasizing inferential statistics is that the types of activities for which it is most commonly used -- including formal hypothesis testing, analysis of the reliability of sample surveys, and correlation analysis – are rarely undertaken by practicing planners. Because of the high costs of primary data collection, practicing planners typically rely on secondary data. And such information, whether it be population and employment counts obtained from the

Census publications, municipal expenditure data as obtained for local finance departments, economic feasibility data as applied to real estate projects, or soil quality summaries as prepared by the Soil Conservation Service, is rarely in a form amenable to the use of simple inferential statistics.

One reason statistical methods are not more widely used by practicing planners is a lack of knowledge. Another is that statistical results are not always amenable to addressing the types of issues which most concern policy- and decision-makers. It is a measure of great progress that we have taught many planning professionals to think about issues in a probabilistic rather than deterministic fashion. Unfortunately, many planning clients have not shared the benefits of this education, and still want their questions answered with certainty and in a concrete fashion. As an example, consider that when recalling the wealth of statistical findings about housing preferences that emerged from the Experimental Housing Allowance Program, most people still remember just the bottom line, "Americans are satisfied with their housing: given more money, they would not spend it on housing."

Numbers Anxiety

Most entering MCP students do not have a good background in mathematics; many have never been exposed to probability or calculus, and some are not even proficient in algebra. Faced with having to learn inferential statistics in their first quarter or semester, many students react anxiously; some quickly fall behind, and a few turn off completely. "Numbers anxiety" represents a formidable hurdle for even the best of teachers. And once established, an aversion to numerical methods may also extend into other courses.

Among first-year planning students, I have found numbers anxiety to be the greatest single impediment to learning and using inferential statistics. The need to diminish numbers anxiety is but one reason why inferential statistics should be postponed until after students have acquired confidence in their own "numbers sense" and the use of simple, non-statistical methods.

Difficulty in Understanding Basic Concepts/Procedures

In teaching inferential statistics, I have found student resistance to be focused on two types of concepts and procedures. The first is hypothesis testing. Some students find it difficult to frame meaningful research hypotheses. Many more question the basic relevance of true-false hypothesis testing procedures, particularly when so few planning problems or issues are amenable to such types of nominal tests. Such students find the ways in which statistical tests are judged and reported ("There is a 95 percent probability that we can correctly reject the null hypotheses") artificial, uninteresting, and fundamentally lacking in insight. I must confess considerable sympathy for this position. All too often we fallaciously assume that by providing a solid foundation of statistical methods we are also teaching the appropriate use of statistics in planning. Thus, we end up teaching technique instead of technique and application. As above, I think our collective intentions are honorable, but that time constraints are often binding.

The second problem, especially for students who lack familiarity with probability, is in really accepting the basic axioms underlying inferential statistics – that randomly selected samples and sampling distributions behave in numerically consistent fashion irrespective of the underlying phenomenon being analyzed. I have found, for example, that despite my best efforts, many students do not believe or understand the Central Limit Theorem. They just take it as an article of faith, at least until the course is over. It is this failure to understand the basic principles of sampling that I believe explains the difficulties many students have in applying inferential tests to planning-type problems.

Lack of Reinforcement in Subsequent Courses

Statistics, unlike many other planning methods, has an extremely short shelf-life. For students to understand statistics, they must use it, and often. Statistical methods, like most techniques, are quickly forgotten if not reinforced in subsequent courses. Unfortunately, the course structure of most two-year planning programs is not oriented toward such reinforcement. Quite the contrary. The first-hand use of statistical techniques is often avoided in "advanced" planning and concentration courses, the presumption being that the student has already learned and integrated such material.

Emphasizes Description Rather Than Planning

My greatest concern about the central role of statistics in planning programs is that it confuses data analysis with problem-solving and plan-making. As above, I doubt that this confusion is intentional. Most planning educators realize that statistics is but one set of tools in the planner's toolbox, a realization shared by most planning students. At the same time, the central position of statistics in many planning programs elevates it above other, more important methods. Data analysis emerges as the most important analytical activity, crowding out other activities and skills: problem description and structuring, the conceptualization of real alternatives, the ability to produce reliable (as opposed to mathematical) models of complex systems, the structuring of information into intelligence, the development of informed judgment, and the ability to consider long-term issues and implications.

It is of course true that many of these skills are learned elsewhere in the planning curriculum, and that methods courses should therefore emphasize skills which, to use Patton and Sawicki's term, cross-cut many fields and activities. My critique of statistics is therefore two-fold. First, as above, I argue that statistical methods are not widely enough applied outside the classroom to be truly cross-cutting. Second, and I think more significantly, many students learn how to analyze and describe (or to use the current expression, "how to run the numbers") without learning how to extract meaning, actions, or implications from their descriptions

Let me give an example of how statistical analysis can obscure problem-solving instead of improving it. As a typical statistics problem, I ask students to determine the likelihood that a municipality's water supply is contaminated with a disease-causing bacteria. If the students solve the problem correctly, they conclude that they are 99 percent sure that the water supply is free from contamination. I next ask the students whether, based on their analysis, the municipality should spend $100 million to absolutely guarantee that the city's water is free of contaminants. The most common student response is that I have not provided enough information to answer the question properly. The second most common response is that the public's health must be maintained, regardless of the cost or the likelihood of contamination. Only rarely do students make use of their statistical results by considering the tradeoffs between the cost of constructing the necessary treatment facility and the risk of illness or death. This is an example of what I call "paralysis by analysis": being able to run the numbers, but not being able to use the results of the analysis to address the underlying problem.

An architect friend remarks on this same problem when explaining the difference between an architect and a planner. An architect, he says, is someone who, no matter how little information he has, will always make a decision. A planner, on the other hand, is someone who no matter how much information he has, will never make a decision. My greatest concern as a planning educator is that we are educating a generation of planners who know only how to describe the status quo, not imagine how it might be different.

To summarize, I offer three arguments against "statistics as planning methods." First, I argue that statistical techniques will never be widely enough used by practicing planners to justify their central role in most two-year planning programs. Second, I argue that exposing students to inferential statistics without first developing and reinforcing their own "numbers sense" produces needless anxiety and thus detracts form the learning process. Third, I believe that unless students learn statistics in the context of making decisions, creating plans, or taking actions, they will come to view analysis as synonymous with description.

The Core of Planning Methods

Planning educators recognize that methods courses must teach more than numerical techniques, they must also teach quantitative reasoning skills. If not statistics, exactly what is quantitative reasoning? I offer three suggestions:

Problem Structuring

In many respects, planning is a lot like the practice of general law. Planners and lawyers are both called upon to summarize problems and issues quickly, to separate essential and non-essential information, to abstract key issues, to apply known rules, tests, and standards, and to propose workable solutions. Fortunately for the legal profession, many of these skills are taught under the formal rubric of the legal method. But because planners have agreed to disagree on whether there is a planning method, the skill part of problem structuring -- identifying and classifying key problem elements and constraints -- often goes unaddressed. This is not because of a lack of problem-structuring methods. Most good planning and policy analysis textbooks (including those by Dunn, Patton and Sawicki, and Stokey and Zeckhauser) offer models and methods for structuring problems. Nor is the need for problem structuring limited to planning. According to the authors of *In Search of Excellence*, one of the characteristics that distinguishes top-notch business leaders is an ability to structure (or "chunk") problems in a way which makes them solvable.

In my experience, very few planning students (or professionals, for that matter) are capable of abstractly structuring original problems. Rather, students learn to structure problems by one of three general methods: (1) through the application and extension of a normative theory or model of significance, as in economics; (2) by "bending the problem in order to apply specific quantitative techniques; and (3) through "learning by doing" -- by incrementally adapting familiar techniques to a new problem.

The idea that students structure problems primarily by adapting existing techniques, models, and theories, and not through deductive reasoning, is the last, and I hope, final nail in the coffin of statistics as planning methods. Put another way, statistical analysis is an inefficient approach to problem structuring.

Numbers Sense

Mark Schuster argued that one of the goals of any planning methods course should be to teach "numbers sense." This term connotes many things, but in essence refers to the ability to extract significant meaning from a series of numbers. Schuster put this another way, suggesting that numbers sense is a series of semi-intuitive tests: "Is the particular piece of quantitative information large or small? Unusual or typical? Suspicious? Is it masked or confused by something else that is going on simultaneously? Is it relevant to the problem at hand?"

I strongly suspect that numbers skills are similar to writing skills. Just as some students tend to have more of an innate feel for the variety of logical and communicative skills involved in writing, so too have many students developed greater facility at using and manipulating numbers. As an example, consider the exercise of looking at a table of information and telling a story based on the data. Some students find this exercise trivial while others find it nearly impossible.

Also, just like writing, numbers sense is best developed through repeated use and application. For some students, learning statistics does in fact improve their numbers sense. For many others, the difficulties and anxieties involved in learning statistics undermine their confidence in their ability to use and interpret numbers. The key, I think, is for students to develop their numbers skills more completely before studying inferential statistics.

It is in the area of helping students to develop numbers sense that I believe the microcomputer has had its greatest impact on planning education. In the process of setting up their own spreadsheets and databases, students are confronted with the necessity of drawing information from numbers. At the same time, the microcomputer frees the student from the tedious work of replicating hundreds of calculations. Spreadsheets have emerged not only as a planning tool, but, more important, as a learning tool. Techniques like cohort-survival analysis, shift-share analysis, input-output analysis, and travel demand estimation can be easily and effectively adapted to a microcomputer environment. Thanks to the microcomputer, teachers can discard many of the simple and artificial examples of past years and require students to involve themselves with meaningful real world data.

Using and Developing Indicators

Numbers are one-half of quantitative reasoning; the other half is units. Numbers typically come with units, units connoting temperature, size, dollars, people, or votes. Statistics, by contrast, are largely unitless. For many students, making the jump from systems which are dimensioned (and are therefore measured in units) to a system which does not rely on units is extremely difficult. There is of course a halfway point between the world of concrete measurement and the realm of abstract reasoning, and it is in this world -- the world of indicators -- that quantitative reasoning skills can be developed. Clearly, one of the goals of an introductory planning methods course should be to give students experience in the use, interpretation, and development of planning indicators.

Back-to-Basics: Plan-making as Methods

Instead of statistics, a first planning methods course should concern itself with the practical planning methods -- the types of techniques and skills a planner is likely to use on his or her first job. These include, among others: trend analysis, trip generation, and the development of criteria for judging program/policy effectiveness. Practical planning methods also include techniques of graphic and verbal presentation, and, increasingly, the use of simple microcomputer models.

Chief among the virtues of practical planning techniques are relevance and simplicity. Because they are relevant, practical planning methods reinforce the link between education and practice. And because they are simple, students quickly become adept in their use. This in turn builds two types of confidence: confidence in the use of numbers, and pride in the possession of a rapidly-filling planner's toolbox. Practical planning methods also provide a broad exposure to planning indicators and planning data. Finally, practical planning methods provide a starting point for the process of problem structuring.

There are, of course, many ways to teach practical methods of planning and policy analysis. One way is to offer a survey course tied to a text such as Krueckeberg and Silvers' *Urban Planning Analysis: Methods and Models.* Another is to follow the lead of Stokey and Zeckhauser, or Patton and Sawicki, in demonstrating how a variety of crosscutting analytical techniques can be applied to specific planning and policy problems. A third approach, and the one which is discussed here, is to use the task of community plan-making to tie together a variety of useful and usable practical planning analysis methods.

The challenge of building a long-term plan, whether for a city, county, village or neighborhood, provides an excellent opportunity for co-learning quantitative skills (which are usually taught in a lecture format), problem-structuring and resolution skills (which are usually taught in a studio environment), and effective verbal and graphic presentation skills (which are often not taught at all). Effective planmaking involves the following technical activities:

- o Descriptive analysis of the current population from secondary data
- o Identification of key population subgroups
- o Analysis of economic activity
- o Forecasting of population and/or economic activity
- o Use of ecological, physical economic, and social indicators to prioritize development activities
- o Technical evaluation (cost-benefit; goals-achievement; impact; and matrix-methods) of different alternatives.
- o Mapping and drafting skills.

As shown in Table 1, these activities can encompass a wide variety of techniques and planning methods. But effective plan-making is much more than technical analysis. It is also:

- o learning how to identify and prioritize key issues and problem parameters
- o learning how to manage personnel and resources
- o learning how to develop and evaluate different alternatives
- o learning how to synthesize alternatives
- o learning how to link objectives to implementation strategies

Most important, plan-making requires being able to loosen the apparent importance of present-day constraints in order to think strategically about the future. It is in the area of helping students develop vision that plan-making is most appropriate.

Given the title of our profession, it is indeed curious that so few planning programs teach plan-making. Some programs use the "studio" experience as a substitute for teaching plan-making. Others teach plan-making as part of a land use concentration. While these approaches are certainly better than not teaching plan-making at all, they fail to take advantage of the natural relationships between plan-making skills and planning methods. Put another way, plan-making is the perfect context for teaching practical planning methods.

TABLE 1:
Plan-Making Activities and Cross-Cutting Methods

Descriptive Analysis of the Population and Population Sub-Groups:
- -demographic analysis

Analysis of Economic Activity:
- -trend analysis
- -"step-down" techniques
- -cohort survival analysis
- -shift-share analysis
- -transportation forecasting models

Evaluating Alternatives
- -cost-benefit analysis
- -matrix methods
- -fiscal impact analysis

Problem Structuring
- -"Chunking"
- -project management
- -workplan construction

Microcomputer Skills
- -spreadsheet construction and use
- -relational databases
- -thematic mapping

Verbal and Graphic Presentation Skills

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