SELF-INSTRUCTIONAL TEACHING
OF BIOSTATISTICS FOR MEDICAL STUDENTS

Harry Robinson, Sc.D., Robert Burke, M.S., and Sidney M. Stahl, Ph.D.

ABSTRACT: A growing body of literature deals with the use of self-instructional methods for teaching biostatistics to medical students. The University of Tennessee Department of Community Medicine tested the hypothesis that, in controlled, randomized situations, learning of statistical material by self-instruction is equivalent to learning identical material by the lecture method. An analysis of student performance, in terms of the grades obtained on two separate examinations, showed that students learning by self-instruction did as well or better than their colleagues taking lectures. On the basis of these results, self-instructional biostatistics for medical students at the University of Tennessee has been selected as the major teaching method of that subject.

The training of today's physician is oriented toward the solution of clinical problems. The physician is taught to approach each patient as a clinical experiment and to answer a series of questions before he arrives at a diagnosis, treatment, and prognosis. The basis for most diagnoses lies in the area of probability, that is, the probability that a patient presenting with certain clinical signs has a given disease. Current research literature contributes to this decision-making process; and this literature, in turn, is based on statistical decisions about the probability of the stated conclusions.

To encourage the critical reading and appropriate use of this literature, most schools of medicine try to provide the student with a firm understanding of statistical methods, including the probabilistic underpinnings needed for making clinical decisions. Of the 107 schools of medicine throughout the United States and Canada who responded to Colton's 1970 survey, only half provided formal training in biostatistical materials in the form of a "separate, distinct, required course". An additional 20% require some form of statistics exposure but not a formal course. Many schools of medicine seem to assume that sufficient statistical background will be acquired during the student's stay in medical school without the aid of systematic, integrated, statistical presentations. Various schools have recog-
nized the implicit problems associated with this assumption, but an already crowded core curriculum often necessitates a low priority for a formal commitment to biostatistics.

For 15 years, biostatistics has been taught by lectures to second-term medical students at the University of Tennessee College of Medicine and, for the two years prior to the experiment reported here, the course was evaluated by the students after its completion. In none of the unsigned evaluations did the percentage of students grading the course as satisfactory or better fall below 85%. However, curriculum revision, combined with the emergent popularity of alternative methods to lectures in education, led us to consider the possibility of using self-instructional techniques for this important medical requirement.

Within recent years, a number of experiments have been reported about attempts to facilitate the teaching or, more appropriately, the learning of statistics in medical schools. These experiments have essentially consisted of stating certain specific learning objectives and then preparing statistical textual materials in a self-instructional format. Although some success has been reported in bringing students to a level of mastery considered adequate by the faculty of each institution, no design using an experimental setting has been tried to test the efficacy of this timesaving learning technique, as applied to the teaching of statistics in medical schools. To meet this deficiency, the Department of Community Medicine at the University of Tennessee College of Medicine designed an educational experiment to test the hypothesis that, in controlled, randomized situations, the learning of statistical materials by self-instruction is equivalent to learning identical material through the use of the traditional classroom situation.

Thus, the research reported here provides a crucial link in educational experimentation, testing the efficacy of self-instruction as opposed to classroom learning in biostatistics for medical students. The use of specific learning objectives as a motivating and guiding force for students has been well documented and is used here. The central thesis is: students who learn materials on their own, making use of prepared, objective, self-instructional study materials, should be able to perform as well on a standardized examination as students who are placed in a learning situation that requires their attendance at formal classroom lectures for content mastery. Because biostatistics is usually viewed as one of the less popular experiences during a student's career, it was felt that allowing the student the maximal amount of flexibility in deciding when and how to study statistical materials would make the required task a more acceptable alternative.

**EXPERIMENTAL DESIGN AND METHOD**

Materials developed at the University of Missouri School of Medicine for a learning machine were modified, supplemented, and presented in