Ann. Soc. belge Méd. trop.
1987, 67, 79-81

A COMPUTER AIDED TEACHING PROGRAM IN EPIDEMIOLOGY AND BIOSTATISTICS

by

A. DE MUYNCK[1], A. CUYT[2], R. LIEFOOGHE[1], M. PARENT[1], P. VAN DER STUYFT[1] & B. VERDONK[2]

[1]*Institute of Tropical Medicine, Department of Epidemiology, Nationalestraat 155, B-2000 Antwerpen, Belgium*
[2]*University of Antwerp (UIA), Department of Mathematics and Computer Science, Universiteitsplein 1, B-2610 Wilrijk, Belgium*

Medical professionals working in third world countries show an increasing need for epidemiological and biostatistical know-how [1]. The planning, monitoring and evaluation of health programs and services without a basic knowledge of epidemiology and biostatistics are virtually impossible. The actual trend of integration of vertical programs into basic health services even augments the necessity for base line data in order to assess the communities' health profile, the choice of priorities and the subsequent evaluations of the health programs.

The enormous success of short training courses in epidemiology and biostatistics, such as the French and English European Courses of Tropical Epidemiology, reflects the demand from the medical professionals to get a supplementary training in this field. Indeed, a survey carried out at the Institute of Tropical Medicine of Antwerpen, among medical doctors specializing in Tropical Medicine, showed that the university students are insufficiently trained in epidemiology and biostatistics. While about half of the students had followed a course of epidemiology and 40 % a course of biostatistics, the residue of acquired aptitudes was almost nihil.

This brings us to the problem of the training of medical professionals in quantitative methods. Several recent publications analyse the difficulties students experience in understanding epidemiological and biostatistical methods [3, 4]. These authors reach the conclusion that there is clearly a need to change the didactic approach when teaching these subjects. The emphasis of the teaching should be more on the practical use of these methods than on the theoretical underlying principles. This new teaching approach should be conceived in such a way that it helps students overcome their fear and subsequent rejection of mathematical equations and inferential reasoning.

This new teaching approach is mainly based on the following four items:

1. Integration of biostatistics and epidemiology as EPISTAT [4, 2]:

   By incorporating biostatistics in the epidemiological process, the student perceives the statistical concepts as a tool for epidemiological quantification rather than as an isolated set of mathematical concepts which he or she strongly rejects [4].

2. A problem solving methodology:

   The starting point of the training should be a real health situation, which stimulates the medical doctor to make a quantitative analysis of the health problem and its alternative solutions. Emphasis should be put on the exploration and quantification of the observed health problems instead of on the theoretical statistical distributions.

3. Maximal reduction of calculations:

   The use of programmable calculators should reduce the calculations to a minimum.

4. Possibility for dialogue and discussions:

   Teaching should take place in small groups of 6 to 8 students, guided by one teaching assistant so that discussions and feed-back are possible.

Very few third world centers are able to provide this kind of teaching which is time consuming and requires an important staff trained in epidemiology as well as in biostatistics. Attempts have been made to help those centers by intensifying the training of future staff members in our western institutes or by exporting courses. The export to third world countries of short training courses like the European Course of Tropical Epidemiology is however only a partial solution because it reaches only a limited group of participants.

In order to help solve these teaching problems, the idea originated to develop a computer aided course in tropical epidemiology and biostatistics, which integrates the above mentioned principles. The advantage of Computer Aided Instruction (CAI) is that students can assimilate and integrate the material of the course at their individual learning speed. If necessary they can even run certain chapters of the course more than once. In this way uncertainties that remain after a first contact with the new study material are taken away. Students can also work in small groups and, while running the program, discuss together the concepts, their applications and the interpretation of the findings. Such a computer aided course has been set up by the Department of Epidemiology of the Institute of Tropical Medicine and the Department of Mathematics and Computer Science of the University of Antwerp. A preliminary version was presented at the first and second «Cours Européen d'Epidémiologie Tropicale» (Antwerpen, 1985; Marseille, 1986) where it turned out to be very successful.

The starting point of this course is a real life situation in a developing country in which the student is confronted with the whole process of data collection, analysis, interpretation and decision making relevant to the local situation. The course consists of several modules, each one forming a pedagogical entity on its own and giving the student the necessary practical skills and insight in the subject matter. Examples are: the description of a health problem, the predictive value of a screening test, sampling procedures, community survey etc. There is a natural sequence of the modules with a gradual building up of knowledge and an increase of the prerequisites as the student works towards the last modules. After an introduction explaining the health problem(s) and the teaching methods the student can choose any

of the modules. Each module is divided into sections and each section can again be studied separately. After the student has made his or her choice the dialogue with the computer starts. Several possibilities to present the material are built in such as multiple choice questions, true/false questions, questions with fill-ins, scanning of the student's answer,... The further the student is advanced in the material, the fewer the intermediate steps he or she has to take to achieve the right answer. At the student's request certain answers to questions can be elaborated in more detail. At the computer's request the student has to argument the answer given to a certain question. All this is taken care of by the computer. The dialogue with the computer is kept as lively as possible. Each screen can also be illustrated with graphics such as bar-charts, pie-charts, plots or drawings. One of the big advantages of interacting constantly with the teacher-program, is the fact that the student receives immediate feedback whereas in a traditional system such feedback is only given after weeks of ex-cathedra teaching. At each moment the student can decide to quit the program and stop the computer assisted learning. Before leaving the terminal he or she gets an evaluation of the achieved knowledge. The student's final impression of his or her efforts will be more positive since all passive participation in the course is excluded.

To use this program no knowledge of computer science is required. The first version was developed for IBM-compatible personal computers and completed with a user's manual and a documentation file. The software package consists of two main parts: the program that controls the flow through the course material and the input files that contain all questions, answers, comments and aside information. Some of these input files contain the material relevant to the particular real life situation. Other input files are only consulted if the user wants to freshen up his knowledge about the methods and techniques that are indispensable to solve the problems. So the student makes up his own course: depending on his background he includes more practical or more theoretical material. It is also possible to include several real life situations and then the matching inputfiles are selected by a simple command to the computer.

Physicians from the third world countries were very enthusiastic about this new approach and insisted on further development. Both the teams that have worked on this project, the staff of the Department of Tropical Epidemiology and the computer scientists involved share the opinion that similar computer aided teaching programs should be developed so as to provide developing countries with easily accessible training packages.

Received for publication on February 12, 1987.

REFERENCES

1. Morrow R, Buck C: Clinical epidemiology for developing countries, Int. J. Epidemiology, 1983; **12**: 3-4.

2. De Muynck A: Epistat in Belgium. Teaching of Statistics in the Health Sciences, 1986; **40**: 2-3.

3. Radonvanovic Z, Djordjevic-Gledovic Z: Attitudes of medical students in Belgrade, Yugoslavia, toward preventive medicine in epidemiology, Soc. Sci. Med., 1983; **17**: 1873-1875.

4. Rimm A: Biostatistics and epidemiology should be taught as Epistat, Teaching of Statistics in the Health Sciences, 1985; **40**: 2.