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Building bridges between the academic and real worlds /



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RT-MAE-8208

BUILDING BRIDGES BETWEEN THE ACADEMIC AND
REAL WORLDS - SOME OBSERVATIONS FROM SOUTH
AMERICA.

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Palavras Chaves: Statistical education, training,
(Key words) consulting course.

Classificação AMS: 6206
(AMS Classification)

Invited Paper, First International Conference on
Teaching Statistics, Sheffield, 9-13 August 1982.

- Julho de 1982 -

BUILDING BRIDGES BETWEEN THE ACADEMIC AND REAL WORLDS -
SOME OBSERVATIONS FROM SOUTH AMERICA.

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1. Introduction

The purpose of this paper is to summarize the present state of the statistical education and profession in South America, with special emphasis on Brazil. We analyze the problems of statistical education, training and research and indicate who the main users of the statistical methodology are.

In recent years some attention has been devoted to the problem of closing the existing gap between the academic statisticians and the professional statisticians working in government agencies, industries, etc. We refer in particular to the Conference on Transfer of Methodology Between Academic and Government Statisticians (1978), sponsored by the American Statistical Association (which will be referred briefly as CTM).

Concerning especially with Latin America we mention the SELENES (Latin-American Seminar on the Teaching of Statistics) (1978) and a Meeting of the Working Group to Study the Status of the Statistical Profession in Western Hemisphere (1980), supported by the Inter-American Statistical Institute (IASI) (referred as WG for brevity).

We conclude by discussing an experience at the University of São Paulo, showing how a consulting course, that is taught for undergraduate students, can help as one means of closing this gap between the academic and real worlds.

2. Education and Training of Statistical Personnel

In this section we try to summarize some sparse information, available from different sources, on the stage of the development of the education and training of statisticians in South America.

By education we mean that an academic degree is granted, at the undergraduate or graduate level. By training it is meant that special courses are offered in order to supply limited knowledge for special tasks (see Gura, 1980). Usually, this training is an in-service training, that is, given after the employee is employed by the organization. See CTM, Chapter IV.

Murthy (1978) states that the objectives of education are "to develop a statistical sense with a view to understanding socio-economic situations and natural and physical phenomena through statistics and teaching the methodology appropriate to produce statistics economically and to analyze and use them meaningfully", while the objective of training is "to impart special skills required to plan and undertake statistical operations necessary in producing and analyzing statistics".

Concerning undergraduate education in South America, thirteen countries have programs in Statistics; in Brazil, seventeen schools have such programs. At the graduate level, seven countries have programs leading to a master's degree, and none to a doctoral degree. In the case of Brazil, seven centers offer graduate study at master's level. See Appendix A and B.

Two main conclusions were drawn in WG referring to education and training:

(a) "The principal limiting factor for the establishment of appro-

the needs of industry or government offices.

Most of the countries try to provide "ad hoc" training facilities, generally through National Statistical Offices, in order to prepare the personnel for their needs. The exception, perhaps unique in South America, is a course offered by CIENES, called "Program in Statistical Techniques", which is intended to train those persons who will work in statistical offices in government.

In some countries the needs vary from one region to another. In any event, as we mentioned above, the government seems to be the main source of jobs for statisticians coming out the universities.

In this connection it is very important that the curriculum of statistical programs at the universities should be composed of disciplines relevant to the immediate applications of the region. For example, if the principal needs are statisticians for statistical offices, a curriculum centered in economics seems to be the adequate answer, with courses including principles of sampling and survey design, survey methods, construction of tables, graphical methods, data analysis, etc (CTM, Chapter III). If industry is a major source of jobs, the emphasis should be on regression analysis, design of experiments, response surfaces, quality control, time series, etc (Marquardt, 1979).

A way to balance the statistical education of future statisticians is suggested in Appendix C. The idea is to use a flexible structure of modules in order that the students acquire a substantial subject-matter content from other fields, as social sciences, economics, biology, etc. In one semester the students receive the basic formation in the field (Economics, Epidemiology,

university personnel. It follows that most of the professionals working in industry, government offices and other places besides universities, have only the BS in Statistics, while those who pursued some graduate program, usually work in universities.

It is a fact that some universities in the USA, Europe and other countries are trying to reformulate their master programs in Statistics, in order to prepare the graduate students to attack real world problems. That means that the master's program usually has a more "applied" character. Even if these students did not have an undergraduate degree in Statistics, they will have a greater maturity than those students who had an undergraduate program in Statistics and immediately, after coming out the university, find a job in industry or government.

In this connection, to try to remedy the situation caused by this regulation, an experience was introduced in the Statistics undergraduate program at the University of São Paulo, which we discuss in the next section.

4. A Suggestion for Building the Bridge Between the Academic and Real Worlds.

The undergraduate program leading to a BS degree in Statistics, at the University of São Paulo, is a four-years program, the first year being a basic one for all mathematical science students (see Appendix C).

A two-semester course in consulting was introduced in 1978, in the last year of the program. We describe now how this course was designed and make some comments on its results.

Two members of the staff of the Statistics Department are

responsible for the course, each year, although every professor can supervise the statistical analysis of some project. The course is composed of three parts.

Part I - Design and analysis of research projects developed in several areas of the University;

Part II- Training period in some firm or government office;

Part III- Development of statistical methodologies used frequently in Part I and II and not included in the undergraduate curriculum (complementary subject).

The Statistics Department has a Statistical Laboratory, where Part I takes place.

Description of Part I

- i) A researcher (for now on called simply a "user") comes to the Statistical Laboratory and fill in appropriate forms information about himself, the objective of the research and the research itself;
- ii) each project is supervised by one member of the staff of the Statistics Department and performed by two students. An appropriate statistical methodology is chosen, after an interview with the user;
- iii) the supervisor and the students make an outline of the project to all students of the consulting course. The user and the professors responsible for the course attend to the exposition. During the discussion the students usually make many questions and the user plays an important role in the discussion;
- iv) after the statistical analysis is completed, the students have to write a report (always in close contact with the supervi-

sor), which is submitted to the appreciation of the user before it is typed;

v) a copy of the original data and a copy of the report (in the form of an "Applied Statistics Report") is kept in the files of the Statistical Laboratory. Usually they can be used as "case studies" in classes of several disciplines.

The report does not have a fixed structure, in order to incentivate the creativity of the students. But usually they contain the description of the experiment, the statistical analysis, a summary of the conclusions and a reference list. In Appendix D we present a table listing the projects concluded in 1981.

Description of Part II

Since Statistics is a professional career in Brazil, the undergraduate program must contain a minimum of disciplines regulated by federal law. This includes a training period during two semesters. Most of the students do this training period in government offices, private banks and a few in industries. At the end of each semester we send questionnaires to these places with the purpose of evaluate the performance of the students.

Description of Part III

Part of the working load of the consulting course (2 hours) is devoted to lectures covering statistical methodologies not covered during the normal academic program. For example, this year, the lectures include topics as categorical data analysis and cluster analysis.

We remark that the time spent in the training period is

extra the class period. The final grade of the student in each course is an average in all three activities discussed above.

5. Final Comments

It is a fact (WG, p.5) that statistical activities in South America are basically carried out at the academic and government level, and to close the gap between the objectives of each one, it is recommended that a greater number of subject matters useful in the governmental area should be included in the academic curricula. Moreover, in those areas where industry, banking, commerce, market research may be sources of jobs, a balanced curricula should be thought.

It is fundamental that the statistical profession be promoted adequately, and one appropriate tool for this purpose is the establishment of national statistical societies, holding regular scientific meetings and providing a substantial coverage of all sectors of the profession. Publications on the national or regional level are also of great importance.

The curricula of the university level statistical training should offer an appropriate balance of theory and methodology, together with practical work, carried out either in agencies that generate official statistics or in other sectors of society that use statistical techniques.

A suggestion is made of a consulting course which has shown to be of great value in order to achieve the goals mentioned above.

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APPENDIX A - Schools with a Statistical Program in Brazil, Under-graduate Level (by state)

1. São Paulo - University of São Paulo
Federal University of São Carlos
State University of Campinas
Faculdade Paes de Barros
2. Rio de Janeiro - National School of Statistics
Federal University of Rio de Janeiro
State University of Rio de Janeiro
Catholic University at Rio de Janeiro
3. Pernambuco - Federal University of Pernambuco
Catholic University at Recife
4. Ceará - Federal University of Ceará
5. Rio Grande do Norte - Federal University of Rio Grande do Norte
6. Minas Gerais - Federal University of Minas Gerais
7. Paraná - Federal University of Paraná
8. Bahia - School of Statistics of Bahia
9. Rio Grande do Sul - Federal University of Rio Grande do Sul
10. Brasília - University of Brasília
11. Paraíba - Federal University of Paraíba

APPENDIX B - Schools With a Master Program in Statistics (by state)

1. São Paulo - University of São Paulo

University of São Paulo at São Carlos

University of São Paulo at Ribeirão Preto (Biostatistics)

University of São Paulo at Piracicaba (Agriculture)

State University of Campinas

2. Rio de Janeiro - Federal University of Rio de Janeiro

Institute of Pure and Applied Mathematics,

IMPA (National Research Council)

3. Pernambuco - Federal University of Pernambuco

4. Brasília - University of Brasília

APPENDIX C - Suggestion of a Curriculum for an Undergraduate Course
in Statistics (where the main demands are for statisticians
working in industry and government)

- Basic for all students in Mathematical Sciences

1st SEMESTER - Calculus I

Vector and Geometry

Introduction to Computer Science I

Introduction to Statistics I

Physics I

2nd SEMESTER - Calculus II

Linear Algebra I

Introduction to Statistics II

Introduction to Computer Science II

Physics II

- BS in Statistics

3rd SEMESTER - Calculus III

Linear Algebra II

Computer Programming

Statistical Inference I

4th SEMESTER - Calculus IV

Complex Variables

Exploratory Data Analysis

Probability

Statistical Inference II

5th SEMESTER - Introduction to Stochastic Processes

Nonparametrics

Sampling Techniques

Design of Experiments I

6th SEMESTER - Design of Experiments II

Regression Analysis

Multivariate Analysis

Applied Stochastic Processes

7th SEMESTER - Statistical Consulting I

Modulus I

Modulus II

Modulus III

8th SEMESTER - Time Series Analysis

Statistical Consulting II

Modulus I

Modulus II

Modulus III

The disciplines in the modules may vary from one year to another. An example follows:

Module I (subject-matter discipline allied to a discipline with a statistical character)

Microeconomics and Econometrics

Epidemiology and Biometry

Vital Statistics and Demography

Psicology and Psicometrics

Biology and Biometry

Module II (Quantitative especialization)

(Math.) Mathematical Analysis I and Mathematical Analysis II

(Bus. & Econ) Operations Research I and Operations Research II

Accounting I and Accounting II

(Eng.) Industrial Organization I and Industrial Organization II

(Comp. Sci.) Mathematical Programming and Simulation

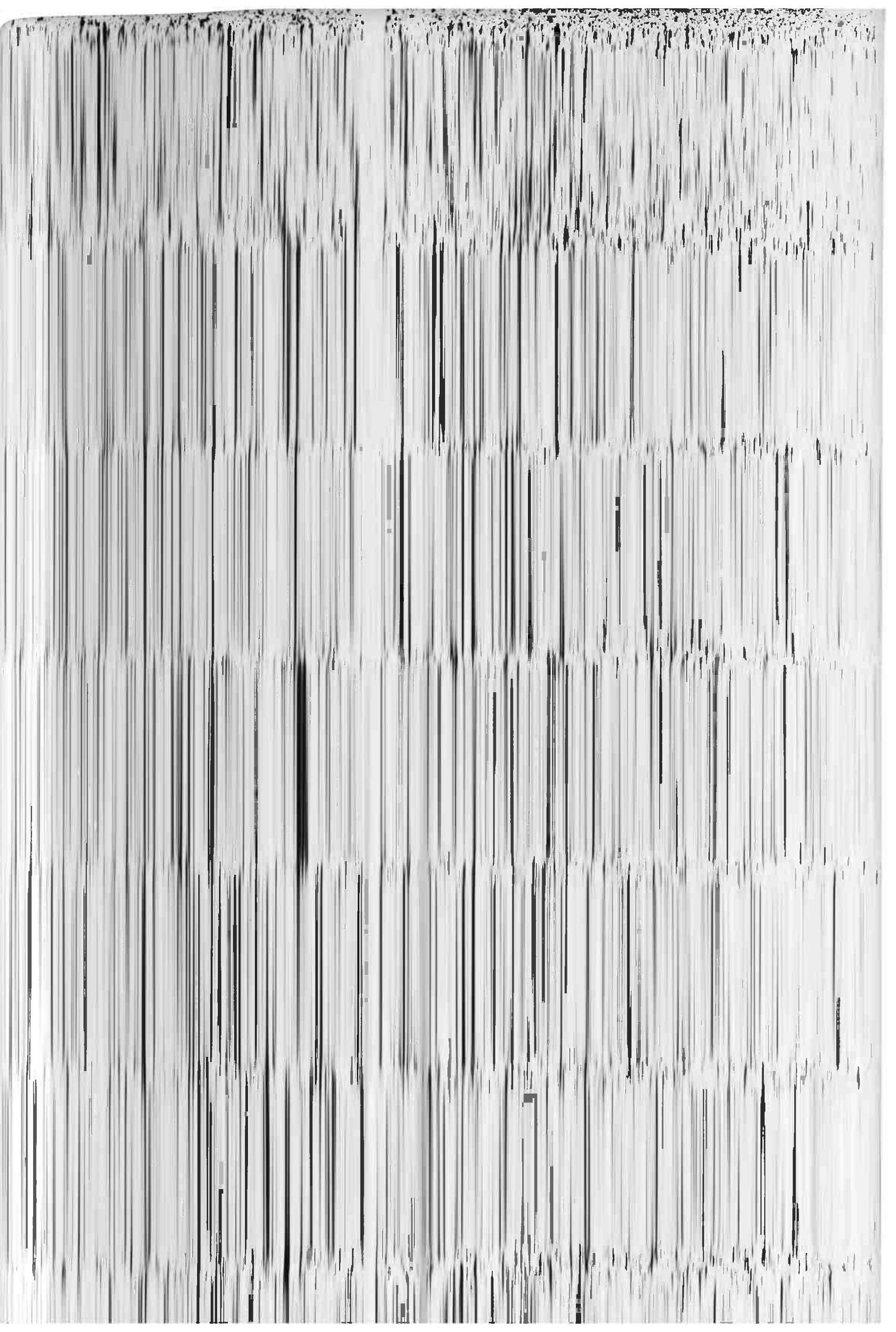
Mathematical Programming and Graph Theory

(Physics) Statistical Mechanics and Statistical Methods in

Experimental Physics

Module III (Disciplines in the Statistics Area)

Game Theory, Information Theory, Decision Theory, Statistics in Market-Research, Categorical Data Analysis, etc.



APPENDIX D - Research Projects, 1981 - Statistical Laboratory,
University of São Paulo

AREA	PURPOSE	Research Leading to			TOTAL
		Doctor Degree	Master Degree	Publication	
Architecture	-	-	-	1	1
Marine Biology	-	-	-	1	1
Biosciences	2	3	-	1	6
Botanics	1	-	-	-	1
Biomedical Sciences	2	-	-	1	3
Pharmaceutical Sc.	2	2	-	-	4
Education	-	-	-	1	1
Nursing	-	2	-	1	3
Engineering	-	-	-	1	1
Social Sciences	1	-	-	1	2
Medicine	4	3	-	4	11
Dentistry	-	2	-	1	3
Psychology	1	5	-	1	7
Public Health	1	-	-	-	1
TOTAL		14	20	14	48

RELATÓRIO TÉCNICO

DO

DEPARTAMENTO DE ESTATÍSTICA

TÍTULOS PUBLICADOS

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