PARALLELS, SIMILARITIES AND DIFFERENCES IN TEACHING STATISTICS DURING THE 20TH CENTURY IN COLOMBIA AND MEXICO

Roberto Behar Gutiérrez
Universidad del Valle - Cali, Colombia
Mario Miguel Ojeda
Universidad Veracruzana, México
robehar@yahoo.com

The evolution of teaching Statistics in the past century in México and Colombia is presented, emphasizing the parallels and differences. Two stories are told, pointing out common events and similarities, in order to show the exogenous forces and the local contributions to the development of statistics in these countries. The main local contributions to the teaching of statistics in higher education in the 20th century are identified. Finally, several strategic ways of improving the teaching of Statistics for non-statisticians in Latin-American countries are summarized, considering the particular historic context. We propose an approach considering the global and the local historic arguments to promote the value of statistics in the development of modern society.

INTRODUCTION

The history of Statistics in each country has an interesting lesson useful for understanding its current situation and for identifying ways and strategies for to planning and programming its future development. History is not only for celebrating the past greatness, but also to identify the autochthonous (local) contributions to the global development of Statistics in order to construct explanations of the present as a path for building the future. In this sense, Scheuren (2003) says: "What is past is prologue but many valuable prologues have yet to be fully played out," referring to Shakespeare and George Bernard Shaw well known expressions.

Colombia and México are two developing countries with many parallels and similarities in the economical and social development during the 20th Century. In the historic events of statistics in each country these commonalities are evident; but it is necessary to say that many of such events are explained for the exogenous forces in the worldwide evolution of the statistics discipline (Cansado, 1993). Others events are particularities that are explained for autochthonous expressions directly related to the local needs in the social and economical context (Guerrero, 1997; Valencia, 1975). We present important historic events during the 20th Century in these countries, identifying the foregoing in the past. Particularly, we emphasize on educational determinants such as schools foundations, program implementations, national meetings, etc. We have used a guideline that explains the developments in Statistics in order to apply the techniques and methods on demand arising out of need in other fields (Bhagwandas, 1990). We begin with a brief description of pre-Hispanic and colonial contributions, followed by a series of interesting events in the past centuries in both countries. Our main contributions are the two stories, in which we point out the common events and similarities, and we identify the main local elements which have led to the teaching of statistics in higher education for non statisticians, but also considering the determinants in training statisticians. In the last paragraph, a general proposal for promoting the development of statistical education in Latin-American countries is introduced; the proposal derives from the communalities of Colombia and México.

TWO POOLED SHORT STORIES

Although these are two stories, the commonality is the main component. Statistics as a discipline has the same origin: theory was developed in order to apply statistical techniques on demand arising out of need in other fields, mainly in relation to business, industry and governments. Since the beginning, in both countries the local conditions and the external influences work in defining the events for the development.

Statistics was present in many ways in economical and political organization in pre-Hispanic cultures in Colombia and Mexico. Pre-Hispanic society of Mexican cultures was based on the assumption that the individual counted for a little against the community. The political

organization was dedicated to the conservation of the establishment. During the Classic period, Mexico was divided into various political groups, closely interrelated and integrated into greater or lesser political units. Great metropolises such as Teothihuacan and Palenque testify the efficient centralized organization in the local area. The organization requirements for the government and the empire maintaining generated needs such as counting, and the census was a natural activity. The payment of fees ("tributes") for services from many communities implied a precise system for numbering and dating. Aztec Calendar and Maya system of numbering and dating, which includes in the first time the zero, are two Mexican contributions. Figure 1, adapted from Peterson (1959, p. 184) shows the Aztec numerical system, taken from Codex Mendocino. Aztecs numerical system essentially is an elaborated "pictogram system" that uses dots for the integers from one to nineteen, the sign of a flag for twenty, a feather for four hundred, and a bag with tassels for eight thousand.

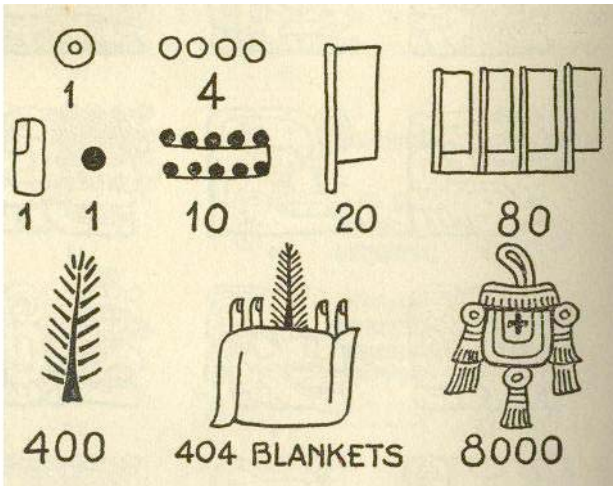

Figure 1: The Aztec numerical system

During the colonial era were realized seven general census in México, but the results were considered top secret for the authorities. In 1831 was founded the office for national statistics, and 2 years later the Institute of Geography and Statistics. In Colombia the Departamento Nacional de Estadística (DANE) was founded in 1953. The Mexican government created a special office for official statistics (Dirección General de Estadística) in 1882. That office conducted the first Mexican general census in 1895. The second was realized in 1900, and since then the census is conducted each ten years. In Colombia, ten censuses were realized in irregular periods from 1905 to 1993; an important fact for the tradition of official statistics in this country was a special law, promulgated in 1914, defining a series of process for a local, provincial and national system of information (Vidales, 1975; Mayor, 2002). In both countries several economic studies and many official statistics activities, mainly census and surveys, promoted the development of the official statistics. Parallelisms and several divergences appear in the comparative development, but currently both countries have a consolidated system of official statistics. Statistics in industry is a recent phenomenon in both countries after 1960. In particular, it is necessary to mention the important contribution of statistical works and courses realized in Escuela de Minas, in Antioquia, Colombia. Important contributors of the Colombian statistics were associated with courses and programs depending on this engineering school (Mayor, 2002). On the other side, in México the industrial development in the 60´s influenced the statistics in engineering schools and promoted master programs in statistics. The first master program in statistics was established in 1960, while in Colombia, the first was created in 1978. The first person from México that obtained a Ph D in Statistics is Basilio Rojas, at Iowa State University in 1959; while the first Ph D in Statistics earned by a Colombian citizen was in 1976. Other programs were created by well trained statisticians from Universidad Nacional Autónoma de México, (UNAM), and the El Colegio de México. The first Mexican bachelor program in statistics was founded in Universidad Veracruzana in 1968. On the other side, in Universidad

Nacional de Colombia, Luis Thorin Casas founded the Instituto de Estadística in 1958, which is the base for offering the first bachelor program in statistics in 1959. Two other derived programs are offered in Universidad del Valle, founded in 1978, and in Universidad Nacional at Medellin. In 1998 the Universidad Nacional de Colombia establishes a Ph D program in Statistics. Since then many other programs have been established in several places in both countries, however the need of statisticians and statistics teachers is several times bigger than the number of places currently offered by those programs.

In an interesting longitudinal study of the development of mathematics in México (Jiménez, 1992), which includes statistics, several tendencies were identified in the last decade of the past century: (1) the predominant orientation of mathematics programs is moving to applied; (2) private education are educating practicing mathematicians and public education is more oriented to pure mathematicians; (3) statistics and applied mathematics master programs have approximately 25% of the Mexican graduates; and (4) the coverage of the graduate programs is growing in province.

In conclusion, the statistical academia yet has to be consolidated in Mexico and Colombia. Each year both countries have several meetings, the Foro Nacional de Estadística, an annual meeting promoted and organized since 1986 by the Asociación Mexicana de Estadística (AME). This conference has an important role for explaining the development of Statistics in México (Guerrero, 1997). In Colombia, one national meeting of Statistics was realized in 1984; however the Universidad Nacional de Colombia celebrates an annual symposium of statistics, which is a very important conference in Latin-America (Martínez, 2005). Mexico and Colombia also have their national statistical societies which contribute to collaborative work in promoting statistics.

BEGININGS AND THE STATUS OF THE STATISTICAL EDUCATION

Quetelet´s idea of statistics as a science and the concept of statistical method had an important influence in the first statistics courses in Colombia and Mexico. Contributions of the Italian and French schools are evident in course contents and approaches. The main objective of those courses was training for the use of statistics in government agencies. In México the first book of statistics was published by Pérez-Hernández (1874), with a clear influence of Professor Conrado Gini. In Colombia, Alejandro López introduced in 1912 statistics into the Escuela de Minas de Medellín. The statistics course originally was inspired in a french book by Fernand Freire, from Universitie de Paris, translated by López in 1917. Jorge Rodríguez-Lalinde wrote the first national Colombian book of statistics in 1931, and Posada-Gaviria the second in 1934 (Mayor, 2002). In all of those Mexican and Colombian books of statistics the concepts are presented with formulas. The use of differential calculus and algebra appears in the strategy for presenting statistical procedures. This fact is a constant in the development of teaching statistics in both countries. In summary, it can be said that statistical training in higher education has been mostly mathematically oriented; no real life data is provided, although the graduates are regularly absorbed into government and business contexts where they are supposed to use their knowledge to solve applied problems. No important pedagogical movements are identified in any of both countries, but many isolated actions and participations in conferences allow us to identify the current problem of contents and approaches of introductory statistics courses (Biehler, 1990; Behar, 2001; Ojeda and Sahai, 2005). On the other hand, traditional graduate-level programs (MS or PhD) are normally designed for undergraduate majors from various fields, but those have a strong mathematical and theoretical component oriented to produce statisticians with leadership for teaching and research in statistical science. Currently, in both countries is very urgent to prepare well qualified users of statistical methodology oriented to decision making, planning, administrative tasks, and implementing improvement process in industry, government and research institutions (Ojeda and Sahai, 2003). Several efforts can be identified for solving this common problem, including diploma programs, seminars and workshops. However the problem requires more cooperative efforts to promote good practice in teaching statistics for statistical and non statistical audiences. This fact is reported in several statistical teachers meetings in both countries. The AME reported in a 1990 diagnostics on teaching statistics in México that the problem is very similar in other developing countries, Camacho (1997). Currently there are two

bachelor programs in México and three in Colombia, six master programs and three PhD programs in México and one PhD program in Colombia. Universidad Veracruzana, in México, is the only one that offers a master program in applied statistics considering research in statistical education. This fact shows that there are many needs to attend in the context of statistical education.

FINAL CONSIDERATIONS

The teachers of statistics are living in an era of accelerated change with a growing number of information and training sources for students, who increasingly demand for permanent actualization of technological skills and knowledge. The contents and approaches of statistical courses should be robust to changes so that it is very important to identify basic competences and key concepts for the so called statistical thinking (Utts, 2003). It is not possible to use the course time, always limited, for transmitting information, practicing algorithms or deducing formulas. The role of the statistical method should be in emphasizing and demonstrating how statistics works in solving problems: collecting organizing and interpreting numerical facts. Each real statistical educator can contribute to citizen's learning in critically reading data and with understanding; to produce and to collect data that provide clear answers to important questions; and to draw trustworthy conclusions based on data. It is clear that statistics concerns matters of calculations, but in order to asses, to criticize those numbers, we also need to appreciate issues of construction. We agree with Best (2005) when he/she mentions: "Statistical literacy ought to help people assess such competing claims, but that requires more than teaching them how to calculate and warning them to watch out for liars. It would help to also understand something about to place of statistics in contemporary policy rhetoric, about process by which numbers get produced and circulated and so on. But who's going to teach these lessons?" The response is obvious: statistical educators and teachers of statistics thinking globally and considering the local conditions; i.e., the students and their economical and social context. For this goal it is necessary to train teachers of statistics, who are in general non statisticians, and also to train statisticians to appreciate this approach for our discipline. It is necessary to train researchers and to promote the statistical thinking between the researchers, between the managers, between the politicians, etc. These needs require consolidation and important changes in the statistical academy with statisticians having a more open mind attitude. We need changes in our bachelor programs, in our graduate statistics programs, in the activities of our societies, etc. All of these will be possible if we assume a collaborative approach, if we participate in an international network for a modernization of statistical education. This simple formula for improving the statistical education in our developing countries is challenging to implement.

We express our gratitude to the authors of notes, conferences texts, papers and other published and unpublished materials that provided the basis for the development of this work. We recognize to the painstaking work of Guillermo Cruz, for his assistance in finding sources and obtaining materials for this project. We are especially thankful to Sergio Juárez-Cerrillo for his support in improving the manuscript.

REFERENCES

Best, J. (2005). Lies, calculations and constructions: Beyond how to lie with statistics. *Statistical Science*, 20(3), 210-214.

Behar, R. (2001). *Aportaciones para la Mejora del Proceso de Enseñanza-aprendizaje de la Estadística*. Tesis Doctoral, Departament D´Estadística I Investigació Operativa, Universitat Politécnica de Catalunya, Barcelona, España.

Biehler, R. (1990). Changing conceptions of statistics: A problem area for teacher education. In Hawkins (Ed.), *Training Teachers to Teach Statistics*, (pp. 20-38). The Netherlands: International Statistical Institute.

Bhagwandas, V. (1990). The problem of training teachers of statistics in developing countries. In Hawkins (Ed.), *Traning Teachers to Teach Statistics*, (pp. 204-212). The Netherlands: International Statistical Institute.

Cansado, E. (1993). Sobre el desarrollo estadístico en españa y América Latina. Argentina: Instituto Nacional de Estadística y Censos.

Camacho, S. J. (1997). Biometrical education: Problems, experiences and solutions. Universidad Nacional de Costa Rica, Heredia.

Guerrero, V. M. (1997). Una breve semblanza de la estadística en México. *Datos*, 14, 6-14.

Jiménez, J. (1992). Estudio longitudinal de las matemáticas en México: Resultados preliminares. Reporte Preliminar. Instituto de Investigaciones en Matemáticas Aplicadas y Sistemas, Universidad Nacional. México.

Mayor, M. A. (2002). La escuela nacional de minas de medellín y los orígenes de la estadística en Colombia, 1900-1940. Conferencia ofrecida en el marco de la Inauguración de la Escuela de Estadística de la Universidad Nacional de Colombia con sede en Medellín.

Martínez, C. J. (2005). El simposio de Estadística de la Universidad Nacional: Una historia de 15 años. *Memorias del simposio de Estadística de la Universidad Nacional*. Paipa, Colombia.

Ojeda, M. M. and Sahai, H. (2003). A multidisciplinary graduate level programme in applied statistics. *International Journal of Mathematical Education in Science and Technology*, 34(1), 57-63.

Ojeda, M. M. and Sahai, H. (2005). *Disseminating Significant Learning in Statistics Service Courses.* Unpublished manuscript, available from the authors.

Scheuren, F. (2003). Looking back so we can look forward. *The American Statistician*, 57(2), 94 96.

Peterson, F. A. (1959). *Ancient Mexico*. Ruskin House, London.

Utts, J. (2003). What educated citizens should know about statistics and probability. *The American Statistician*, 57(2), 74-79.

Valencia-Restrepo, D. (2002). *La Facultad de Minas y los Origenes de la Estadística en Colombia*. Unpublised Manuscript, available from the authors.

Vidales, L. (1975). *Historia de la Estadística en Colombia*. Departamento Nacional de Estadística, DANE, Bogota, Colombia.

Yañez-Canal, S. (2005). 35 años de la carrera de Matemáticas. *Lecturas Matemáticas*, 26, 115-118.