STATISTICAL EDUCATION IN SOCIAL SCIENCES

Nora Moscoloni

Introduction

The statistician's work is usually seen as "that of one that deals with the numbers" and by such a task is totally out of context else than their numeric manipulations.

Much has been written on the role of the statistician in scientific research, and more (against and/or in favor of) about his role in social research.

According to Méndez Ramírez[1] "Statistics becomes an aid to the process of scientific research; however, in order to be effective differences between what is statistics and the science on which it is applied must be cleared. That is to say, the approaches of assumptions, hypothesis, specific research methods and ways to measure and evaluate results, etc. must be done combining the concepts and methods of the area of study with the statistics, without a clear division. Statistics must not become only the way to validate qualitative results nor the one that completely determinates the research design"

This line of ideas aims to emphasize the importance of the specialization of the statistician in the application areas. Moreover, it is desirable a true commitment of the statistician with the investigation subject, being part of an interdisciplinary team where the borders between the implied areas of knowledge are lost.

Conclusions loose comprehensive power when this compromise does not take place. From this starting point the education of the statistics would have to be considered.

563

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

Resistance to quantitative techniques

One of the departures points of the constructionist didactical model, focused on the construction of the knowledge by the student, is to recognize and test his conceptions in order to improve them, modify them, or build new ones. In this sense, to teach implies to change magic or common sense conceptions and to build the scientific concepts.

In reference to teach quantitative methods in social science this means overcome the resistance offered by the persistent concepts, transpose the rejection or fear that produces the discipline.

This topic is being studied from psychology and under the title of statistical reasoning or attitudes toward the statistics and the mathematical didactics (for an overview of the research in this field see: Estrada Roca, 2003 [2])

From a sociological perspective, the causes of this refusal (sometimes takes the form of indifference and extends not only to students but to the general context of social researchers) can be searched in the very history of the developments of statistical methods that have been accompanying those of different social disciplines (2008 Desrosières [3])

There is no shortage of reasons to explain such resistance: the quantitative eagerness has been too often associated with hegemonic ideas in research. These positions though invoking scientific ideals, they advocate indeed for racist ideas in anthropology, or discriminatory positions in education. They were associated, consequently, to the more blameful of positivism.

As well Stephen Gould (1984)[4] develops it, from the craneometry theory until mental tests via the weight and size of the brains, the theory of measurements was in many cases dedicated to service for the discrimination and marginalization of the weakest.

The use of figures was generalized in research in the first half of 20th century resulting in the development of the most powerful methods of mathematical statistics by means of probabilistic inference, which were extended to the practice in social disciplines and then to the public in general. This phenomena caused considerable progress for research methodology, but also the so called 'use and abuse of statistics '.

The harder opposition to the classic version of quantitative sociology came from ethnomethodology, due to the main feature of this sociological perspective which takes account of the methods and practices a particular socio-cultural group employs in its everyday activities. Ethnomethodologic studies are applied fundamentally in an interpretative way and regularly make use of methods such as the interview, ethnographic recording and registration.
It's easy then to understand that in the USA climate of the 60's and 70's, criticisms of the ethnomethodologists against statistical sociologists reflected a perceptible deep separation in the group of sociologists, even noticed in a geographically way (Desrosières, Ob.cit). This separation moved to our region by means of the Anglo-Saxon literature.

In France this division was lessened, and sociologists as Bourdieu[5] developed complementary approaches with both positions. It is within this perspective that emerges the school of "analyse des données" in the 1970s, starting from J.P.Benzécri developments.

564

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

Quantitative vs. qualitative

Although there is consensus about the uselessness of this controversy, the differences between approaches are not always clear. It is desirable then that the teacher of statistics would take a position so as to point and enlighten possible confusions.

Some authors state that the expressions "quantitative methods" and "qualitative methods" includes a wider conceptual universe than the techniques for design studies, collect data and interpret them, so justify the application of the term paradigms. Others prefer to talk about methods, techniques and others still about approaches, styles, conceptual and analytical strategies.

A common confusion arises from the association of the quantitative approach with the positivist paradigm and the qualitative approach with the interpretative paradigm.

For some authors engaged in a positivist tradition, quantitative methods look forward to reach to general explanations, to articulate laws. Others, sheltered by phenomenalism advocate for the preponderance of qualitative methods directed to the understanding of development of processes.

Differences between these theoretical perspectives are translated into opposition in the use of methods, the nature of reality, the purpose of science and research, the aim of knowledge, the research process, the relationship subject - object (Meza Cascante, 2002) [6].

In practice the paradigms have not been overcome nor replaced each by a better one, but they all coexist and give basis to a large variety of methodologies and research strategies. Flexibility and adaptability of methods is the most appropriate solution. As long as possible, and sometimes desirable, it is suitable to use jointly the two perspectives [7].

As evidenced by Forni (1993)[8] quantitative and qualitative methodologies have coexisted virtually from their respective birth and since the last century "crystallizes the squabbles on the method" (…) "Today we share a more ecumenical vision of theoretical and methodological pluralism and we set ourselves not only the positive on many occasions of coexistence, but also the possibility of integrating the perspectives in specific instances of triangulation"

Data analysis in the French style lies between both perspectives, regarding said Benzécri (1988)[9] "Data analysis can operate but on mathematical descriptions. These descriptions generally constitute a system of relations, expressed if necessary, from primary data by means of an appropriate code. By factorial analysis we reduce the number of dimensions; by the automatic classification, infinity is reduced to a finite number of types. So one goes from the qualitative to quantitative, from what cannot be perceived rather than as similar; to what is susceptible to equality. Building space, one surrounds the substance".

A point to consider is the terminology difference of specialists from different disciplines. Especially in social sciences, where the language is constituent of the object of study, the lack of a consensual language leads to misunderstandings and sterile polemics. We sometimes encounter the confusion that a procedure is considered as qualitative work only because there are involved in it the so called qualitative variables.

Benzécri (1988, ob.cit.) states in the study carried out about the usage of qualitative and quantitative terms since ancient times until consideration in the analysis of data: "to oppose quantity to quality as continuous to discrete (or discontinuous) is an abuse of the statisticians' language; they did not ever treat directly objects with their qualities, but mathematical descriptions which are no more than quantities different in shape; also they transposed in the domain of quantities the exterior distinction between quality and quantity"

On the other hand there are social scientists that use mathematical concepts to perform analogies or comparisons with the purpose of formalizing or outline relations. However, the mathematical concept has a precise meaning not always reducible to simplifications proper to other languages.

565

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

The construction of the data

For Desrosières, the statistical methodology used by quantitative social science generally is presented in two parts well differentiated and rarely connected between them: one hand, the construction of the data and the other hand, their treatment and interpretation. To detect this split just make a tour on programs of Statistics in social careers of different universities.

The construction of the data can be approached from conception that proposes the system of data matrix (Samaja, 1994) [10]. While departs from the quantitative tradition of Lazarsfeld and Galtung, allows referencing the various components, stages, and moments of the research process to the dialectical game of constituent elements of the data matrix.

The research process, in a general or panoramic vision, is presented as a non-linear journey with progress and setbacks that departs from an object or realization conditions to reach, by means of procedures or method, an objective or product.

In this process the construction of the object of study or data matrix system design becomes of fundamental importance[11]

This notion of system can be related to data matrix. In this respect each data matrix may constitute a part of a system but at the same time, at a lower integration level, itself can be a system being its elements the components.
By this way an internal dialectic: system / suprasystem / subsystem can be established, making the object model by means of a data matrix system, such as minimum three:

- A central data matrix, also called "level of anchorage" or "focal level"; that could be identify with the target matrix of the research
- A supraunitarian matrix, constituted by the contexts of the units of the level of anchorage
- A matrix of subunitarian level, consisting of units of analysis of the level of anchorage. Refers to an indicator function (or operational) since all focal level indicators come from this subunitarian one.

To make this scheme work it's necessary to be understood that every individual can be conceived as a collective and a whole group can be thought of as an individual. Any variable can also be analyzed from the perspective of its indicators, which refer to procedures by which a concept is linked with a "status quo" of the external world, through observation of one or more dimensions of the concept.

The model includes a series of operations or procedures of relationship between concepts. Samaja consider four basic operations as intrinsic to the scientific work which relates primarily to the election procedures of the units of analysis, variables, values and indicators. The data matrix is the basic tool to attempt a description of that phase of scientific behaviour that consists in designing ways to collect, process, analyze and interpret the empirical data to compare the theoretical frameworks, whether these acts are carried out successively or simultaneously.

Didactical experiences

Masters and doctorates

Experience in postgraduate level courses, recommend us to avoid the relatively brief courses exposure-based on techniques of traditional statistics. These programs, similar to those of research methodology, used to be a list of techniques beyond the interest and understanding of the audience, who usually feel frustrated by having employed a significant number of hours worked in the acquisition of disjointed concepts.

The programs developed in the various courses focused instead on the problems of measurement and analysis of variable characteristics of the social sciences by proposing a development with special reference to the dynamics of data matrix, organized into units based on the following conceptual lines:

- Problems surrounding the use of qualitative and quantitative methods.
- The construction of the data
- Data collection
- Data description
- Decision on probabilistic base
- The structure of the data as multidimensional complex phenomenon

Once explained the role of the construction of the model object in the research process, the presentation of the different units showed not much difficulty, taking into account two fundamental requirements: the submission of statistical techniques by means of software demonstrations and the analysis of scientific papers where it is possible to reconstruct the system of data matrix and to assess the application of statistical techniques. This activity in particular is highly appreciated by participants.

567

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

Quantitative methodological training for teachers of Social Sciences

In educational research, in particular the proposals providing frameworks for action, it becomes necessary to resort to evaluation techniques of different species to be supplemented in order to produce an integrated analysis that respects both scientific rigor and adaptability to the needs of educational processes on the field.

In the case of the research on teacher training that we conduct, the purpose was to play a direct action consisting of an advance course for teachers of Social Sciences [12].

The demand for teacher training detected covered three main axes or problems of teachers about the organization of the practical application of the constructionist model which involves, among other things: the internalization of investigative practice, the adjustment to the social science discipline and the integration in an educational proposal that respects the particular characteristics of the new educational system of Argentina.

The analysis of the coordinated motion of all activities involved the design of various tools for diagnosis, monitoring and evaluation of teachers. In some cases it was possible to use quantitative techniques; in others it was necessary to use qualitative ones. In proceedings of methodological triangulation, the compatibility of different techniques can be used to check each other, however is a hard task to bring up the advantages of complementary instruments and at the same time do not overlap their weaknesses.

The evaluation of this course resulted from an integrated analysis of diverse materials combining multidimensional exploratory analysis in the French way with qualitative case analysis. It included also survey analysis of closed and open responses with processing lexical materials and constructing typologies. The latter were constructed on the basis of nominal variables constituting five groups with 180 teachers, who were described by evaluation notes and other tracking variables of categorical type.

However, these indicators were not sufficient to characterize the performance in the learning process, thus it was necessary to deep in the analysis with other materials. The techniques used could guide the qualitative analysis by selecting the individuals most characteristic of each group. Analysis of recorded history of most characteristic teachers in each class during the course, provided the necessary information about the problems and patterns that might be related to the performance reached by them.

Teaching at degree courses

The Chair of quantitative methods in social research of social communication career proposal arose from an objective: rescue quantitative techniques for research in social sciences at the National University of Rosario, from a different approach to traditional statistical value [13].

Beyond of ideological or paradigmatic discussions, such career curriculum reflected the lack of a quantitative training.

The need to disseminate and improve the teaching of quantitative techniques, comes being recognized among social researchers especially due to the increasingly use of statistics by the media in a manner such that a problem aroused from the low quality of interpretations.

In addition, students show great interest about the area of survey techniques that enable them to access to other labor spaces. So it is necessary to know the basics of the employment of such tools, either for the design processing and analysis of their own investigations involving numeric data or for a proper and honest critical interpretation of published research results.

The emphasis on the curriculum of this subject is placed on the problems of measurement of characteristics variables of the social sciences, paying special attention to the consideration of the corresponding scales. Therefore distance is taken from traditional statistical models closely linked to the positivist tradition, which accepts to force the scale of measurement in order to use the hypothetical deductive method proper to the natural sciences.

Arises as a basic objective to achieve understanding on the methodological problems, to develop criteria and to acquire expertise for the design and implementation of projects involving the construction, processing, analysis and interpretation of numerical data in the field of social sciences. The orientation proposed involves a number of instances:

- Theoretical classes where it is made explicit the most important components of a process of research with special emphasis on the subject of study design phase. The fundamentals of quantitative techniques exemplifying on real situations, avoiding the excessive development of mathematical formulas are exposed. Troubleshooting is favored instead of the presentation of a large number of techniques.
- Complementary activities are offered at the construction of the problem of research and state-of-the-art phases such as:
    1. Reading and interpretation of quantitative data from publications in graphics media. This instance moves to exercise the process of

569

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

reconstruction of the possible original data matrix (in its operative meaning)

2. The systematization, summary and presentation of data from secondary sources, as an exercise that allows the differentiation between the concept of data matrix to other similar design schemes

- Work in computer via the workshop where begins the learning in the use of a statistical software of application in social sciences. In particular the principle of operation of the program using the classic design of payroll calculation, analogous to the schema of the data matrix makes the understanding of statistical techniques see very provided.

- Along the course, the students must be developing a work of implementation of inquiry involving the election of a thematic interest and to consider where possible contact with companies and institutions so that the work have an anchor in the reality and can be placed into the world of work

- As assessment arises the presentation of a final working that is exposed in a symposium should integrate the phases of construction, processing, analysis and interpretation of data. The Symposium is organized in way envisaged the participation of other groups articulating an instance of criticism and defense. Some final works have been presented in conferences[1] or published in the Yearbook of the faculty[2]. Others led themes for degree dissertations[3]

---

[1]

[2] Robert C. y Santoro V (2002) *Momento metodológico de la construcción del dato* en La Trama de la Comunicación, Anuario del Dpto. de Ciencias de la Comunicación, UNR. Laborde, Rosario

[3]Dallazuana V *Las consultoras de opinión en época de elecciones*, tesina de Licenciado en Comunicación Social, defendida en marzo de 2005. Calificación: 10

570

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

Multidimensional data analysis courses

The articulation between qualitative and quantitative methods leads to a growing demand, especially among social researchers, for the knowledge of the techniques of multidimensional data analysis and in particular the techniques of textual analysis more compatible with its own paradigms.

In the various courses we try to separate us from merely expository classic style of the different techniques, where the underlying scientific theories are not stated. For Jesús Ibáñez[14]: "the technique is blind, and if left alone destroys what she plays''. We consider it important to locate the analysis of data in a historical perspective considering how a terminological difference may respond to different scientific theories.

Also a same technique can lead to uses that respond to different paradigms and interpretation can be guided according to the software applied. The experience of the workshops[15] was raised with the objective of achieving:

a) understanding the fundamental principle of the methods of data analysis from a simple presentation based on geometric and intuitive reasoning.
b) the appropriation of statistical processing strategies to understand the structure of data
c) the acquisition of skills in the operation of the SPAD software [16]

The programme included an introductory part raised the fundamental principles of classical statistics and its comparison with the French school of data analysis. The study mode was based on the presentation and discussion of different schools authors texts. The second part was devoted to the presentation of the principles of operation of the factorial analysis techniques supplemented with classification on factor axes.

Special attention was paid to the consideration of the scale of measurement for the technical corresponding factorial selection and choice of active and additional variables.

Methods were raised on the basis of the general principles of construction of the data characteristic of the social science research methodology, rescuing and privileging the schema of the matrix data. As result we could see how we could confirm the dimensions and categories initially proposed or build others unexpected which enriches the original classic proposal construction of one-dimensional indexes.

An important condition for the approval of the course was to carry out a final work with an own database, i.e. that each participant entered the implementation of new techniques from a known issue. This requirement is fundamental to the interpretation of the factorial graphics and description of typology classes.

Alongside theoretical classes, the practice of workshop was carried out using the operation of the corresponding program, this allowed the introduction of the

571

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

different stages of processing simultaneously with the development of statistical procedures. Thus, the reading of the programme outputs translated into interpretation of results.

Despite the fact that the data provided by the participants were processed with an elementary level of complexity, analyses allowed the discovery of new relationships, oppositions or approaches; elements that are of priceless value to mobilize real learning.

Skilled participants in the use of the classical statistical tools found new elements for the revaluation of their scales, topic that should more often lead to reconsideration of the above-mentioned words of Benzécri's about that we don't treat with objects but only with the mathematical representations of them.
Voluntary study meetings to discuss work sessions had been taking place organized by a group who attended one of the courses. In some cases dimensions found in some fields provided starting point for other themes.

Experience in the teaching of AMD and the fact that much of the reference bibliography is not translated from French, motivated the production of didactic material in the form of a suitable book for users of social sciences[17].
The objectives of the publication were: describe the fundamental principles of statistics and multidimensional analysis of data and display greater relevance of this in relation to investigations of social sciences, producing a simple presentation based on geometric and intuitive methods, of AMD techniques for their understanding by users of social sciences.

From the above exposure I consider the following remarks for the teaching of statistics in social sciences:

- Algorithms are not valid in themselves, respond in valid way when the construction of the data has been cared
- The clarification of the quantitative data construction is a nexus of fundamental importance among the research methodology and statistics
- The analysis of data must respect the scale of measurement defined in the design of the object of study
- AMD techniques are a suitable option for measurement scales used in social sciences.
- Workshops of computing, or failing software demonstrations constitute an important prerequisite for good learning
- To depart from research problems instead of the exposure of techniques

572

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar

References

(1) MÉNDEZ RAMÍREZ, Y. Valoración estadística en al investigación, Monografías, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, Universidad Nacional Autónoma de México, 1992, Vol. 2, Nº 10, pp. -

(2) ESTRADA ROCA, A. Actitudes hacia la Estadística y su evaluación Revista de Educación de la Universidad de Granada (España), 2003, Vol. 16, pp. 227-245

(3) DESROSIÈRES A   Entre réalisme métrologique et conventions d'équivalence : les ambiguïtés de la sociologie quantitative. La revue MODULAD, París, 2008, Nº 38, pp.36-50. Disponible de World Wide Web: http://www.modulad.fr/

(4) GOULD S. La falsa medida del hombre, Barcelona: Antoni Bosch Editor, pp. 61-62, 1984

(5) BOURDIEU P. El oficio de sociólogo, México: Siglo XXI, pp. - , 1999

(6) MEZA CASCANTE L.E. Metodología de la investigación educativa: posibilidades de integración, Revista Comunicación, Instituto Tecnológico de Costa Rica, Julio-Diciembre 2002, Vol.12, Año 23, Nº 1. Disponible de World Wide Web: http://www.itcr.ac.cr/revistacomunicacion/Vol_12_num1/metodologia_de_la_investig acion.htm

(7) MOSCOLONI N. Complementación metodológica para el análisis de datos cuantitativos y cualitativos en evaluación educativa, Revista Electrónica de Metodología Aplicada, Universidad de Oviedo, 2005, Vol.10 Nº 2, pp.1-10. Disponible de World Wide Web: http://www.psico.uniovi.es/REMA/v10n2/

(8) FORNI, F. Estrategias de recolección y estrategias de análisis en la investigación social. En: Forni, Vasilachis de Gialdino. Métodos Cualitativos II. La Práctica de la investigación. Colección Los Fundamentos de las Ciencias del Hombre, Buenos Aires: Centro Editor de América Latina, 1993.- 210 p.-

(9) BENZÉCRI, J.P. Cualidad y cantidad en la tradición de los filósofos y en análisis de datos. Les Cahiers de l'Analyse des Données, 1988, Vol XIII, Nº 1, pp.131-152. Traducción de N.Moscoloni, Rosario: IRICE Ed., 1993.

(10) SAMAJA, J. Epistemología y Metodología, Edición ampliada, Buenos Aires: EUDEBA, 1994

(11) MOSCOLONI N., SATRIANO C. Construcción y Tratamiento del Dato en un Estudio sobre Desnutrición Infantil. Revista Electrónica de Epistemología de Ciencias Sociales, de la Facultad de Ciencias Sociales de la Universidad de Chile, Marzo 2002, Nº 13. Disponible de World Wide Web: http://www.moebio.uchile.cl/13/frames08.htm/

(12) MOSCOLONI N Evaluación de un curso de formación metodológica para docentes de Ciencias Sociales Enseñanza de la Metodología de la Investigación en Ciencias Sociales, Encuentro de la Comisión de Metodología y Epistemología de las Ciencias Sociales de la Asociación Latinoamericana de Sociología (ALAS), Río Ceballos, Córdoba, setiembre 2002

(13) MOSCOLONI N. Acerca de cifras y datos en la investigación y en la acción social. En: Anuario del Departamento de Ciencias de la Comunicación. Escuela de Comunicación Social, Facultad de Ciencia política y Relaciones Internacionales, UNR. Año 1999/00, Vol. 5. Rosario: Arca Sur Editora, 2000. pp. 225-235. Resumen citado en: Statistics Education Research Journal, Volume 1, Number 1, May 2002, International Association for Statistical Education. Disponible de World Wide Web: http://www.cbs.nl/isi/iase.htm/

(14) IBÁÑEZ J. Editorial de la revista Anthropos, 1990, Barcelona, pp.113

(15) MOSCOLONI, N. Reflexiones sobre una experiencia didáctica multidisciplinaria en Análisis de Datos, IVº International Meeting of Multidimensional Data Analysis, Bilbao, España, 1997

(16) LEBART, L, MORINEAU,A et al (2000) Système SPAD, Versión 4.51,©CISIA-CERESTA

(17) MOSCOLONI N. Las Nubes de Datos. Métodos para analizar la complejidad, UNR Editora, Rosario, 2005; 253 pags. Reseñado en: Hipótesis Alternativa, Boletín del Internacional Association for Statistical Education para España, México y Venezuela. Disponible de World Wide Web:http://www.ugr.es/~iase/Hipotesis.htm/, Vol.6 Nº2, Setiembre 2005, pp. 8-10

573

e-universitas | **U.N.R. Journal** // Year 02// Volume 01 // Nov. 2009.

www.e-universitas.edu.ar