EDUCATION STATISTICS FOR PROFESSIONAL SPECIALIZATION: USE OF KNOWLEDGE AT THE WORKPLACE OF POSTGRADUATE IN STATISTICS

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The need to analyze the results of training and development programs in Statistics -by government agencies- around the world has led to a research in the following field "Training in Official Statistics". This research pretends to show the professional development relationship at the workplace of agencies´ employees which are specialized with graduate level education (Techniques and Methodologies) for the generation, analysis and dissemination of official statistics. This research intends to show evidence of the relationship between their academic background and their work activities (statistical knowledge perspective) as well as its application in the workplace. It proposes a series of activities that demonstrate the continuity of the study, along with some observed discussions that must be carried out during the research process. All of this supported by means of a statistically educational framework at a workplace scenario.

PROBLEM DEFINITION

Study Difficulty

The study of the results of training programs (Official Statistics) in postgraduate courses is necessary to ensure that, from the linkage analysis obtained with the graduate professional practice it might be possible implementing or enriching the procedures affecting the development of the obtaining process, analysis and data presentation, as well as the statistical information quality. Based on this, new lines and training or professional updating strategies can be defined. The current research refers to the use of mathematics knowledge and specifically, to the statistics knowledge within the Official Statistics field. Right here, such training options (postgraduate level) is trying to make impact on. In order to contextualize how this professional request is attended, it is necessary revising the formal education experiences implemented by organisms which generate Official Statistics as of the official statistician current role and professional profile. Let´s proceed to a discussion about mathematics researches in the workplace.

Statistics in the Workplace

One of the factors that contextualize this research is the one related to mathematics in the workplace, which contributes to the situation that the employers and organizations are facing in relation to the use of statistics knowledge, required by the employees for performing the work and the skills of education institutions graduates once they have been hired.

The workplace is represented by the areas appertaining to the *Instituto Nacional de Estadística y Geografía de México* (INEGI from now on) where graduates of the *Maestría en Ciencias con orientación en Estadística Oficial* (MCEO from now on) program are currently working. Our purpose is to observe what characterizes their statistics knowledge activities in the areas where such graduates perform professional activity. Now, let´s discuss about the places and learning modalities for achieving basic and specialized statistics knowledge and skills.

Statistics Education

For locating our research, studies about statistics education have been considered in relation to their importance (current professional activity and discipline). In accordance to Carlson (2002), the role of statistics, training and statistical reasoning has been emphasized on two different occasions: 1) from the point of view of increasing the statistics knowledge within work and 2) as a tool that is used to understand the skills market required in the XXI century.

Revising the available literature related to the Official Statistics teaching in one of the natural application fields (National Statistics Organisms) we were able to found some elements that broaden the research context in relation to the social subjects profile identification: the professional statistician in the national statistical agencies.

In K. Makar, B. de Sousa, & R. Gould (Eds.), *Sustainability in statistics education. Proceedings of the Ninth International Conference on Teaching Statistics (ICOTS9, July, 2014), Flagstaff, Arizona, USA.* Voorburg, The Netherlands: International Statistical Institute. iase-web.org

Martín-Guzmán & Cervera (2002) mention that: a) official statisticians only represent a fraction of the statistics community; b) the institution where they mainly perform their activities is represented by the State, c) the information that they supply acts as a "pathway" over the one other professionals might "drive" while performing their work.

One of the changes that official statisticians might present is the idea of their basic role in statistical offices. The different training and continuous formation experiences in Official Statistics within national statistics offices lead us to understand the problematic of its implementation and the didactic resources that organizations currently require.

The implementation of the statistics calculation based on the new information and communication technologies influences in the way that official statisticians currently apply the statistics knowledge. It is important to highlight that, in the research context, the importance of basic conditions needed to offer the required statistics training and information technologies and communications for Statistics teaching and learning has been denominated as "Statistics teaching and learning infrastructure".

In the educational mathematics field, some research aspects were analyzed in accordance to the last context. These aspects are mainly grouped in two different kinds of fields: *mathematics in the workplace and statistics education*, with the purpose of evaluating the official statistician professional development, taking as case study the one implemented at INEGI.

In the following section we are going to talk about such professional figure development.

Official Statistician Professional Development

In relation to the work (Statistics) for statistical agencies, Pike (2002) mentions that; a statistician needs technical competence to be effective.

In 2002, INEGI took the decision of promoting personnel training (master´s degree level) in order to achieve a better professional profile. A postgraduate program was designed with the purpose of training specialists in the Statistics field, capable of *developing generation projects, analysis and information systematization through design diagrams, processes control and the application of new techniques supported in the theoretical and methodological knowledge*.

A non conventional program was designed in collaboration with the academic area of *Centro de Investigación en Matemáticas* (CIMAT from now on). In 2004, a program denominated as "MCEO" was formally implemented with such Mexican institution which designed the study plan supplying the teacher's staff in order to impart courses and certify the graduates.

Thus, this research project emerges from a training program specialized in Official Statistics regarding INEGI employees as well as the relation with the current professional practice, presenting an adequate profile in order to perform generation activities, analysis and statistics dissemination, officially produced for the country.

Now, let´s move to the discussion of the problem and the research questions deriving from such problematic.

RESEARCH PROBLEM AND QUESTIONS

Problem

The current research emerges from the aforementioned problematic regarding specialized training in Official Statistics among INEGI employees, as well as its relation with the current professional practice in generation activities, analysis and statistics dissemination, officially produced for the country. It is necessary for INEGI and CIMAT to count with the results of a formal study in order to have the information that might support, among other things, the postgraduate efficiency and continuity, as well as the strengthening and consolidation actions possessing institutional and academic interest.

Research questions are set out as a way for identifying the role that the knowledge obtained during a masters degree might play. For instance, use of statistical methods and techniques in the statistic activities that they perform (Cumming, 2010) or their capacity of elaborating efficient statistical models for thinking and communicating in a more efficient way. All this is about the complex phenomena that are being studied, just as Fischbein suggests it (1987) and as quoted by Pfannkuch and Wild, 2002.

Research Questions

Some research questions have been developed with the purpose of developing this study: *Regarding training programs graduates, specialized in Official Statistics at INEGI: - Which characteristics demonstrate the link of its current labor scenario in relation to statistical thinking, knowledge and wisdom statistics use, with the specialized training process that they went through?;* and four adjuncts: - *How are wisdom statistics employed in the Official Statistics field, among MCEO graduates?- Which statistical techniques or methods are used in the statistics activities that they perform and why do they use it? - In which labor activities do they use the acquired wisdom statistics? - How has wisdom statistics been used among MCEO graduates in the labor scenario and in the projects that they perform for obtaining the academic degree?*

Now, we are going to lay out the analysis over its theoretical foundation, since the problem and research question.

THEORETICAL FOUNDATION

The current purpose is to pronounce a particular theoretical foundation since the theoretical constructs application. There are similarities between the Anthropological Theory of Didactics (ATD from now on) and the social epistemological approach (Castela & Elguero, 2013). It seems to correspond the *Social Practice* to the notion of *Institution*. It is all about focusing the anthropoepistemologist attention, in the necessity of investigating the legitimation-institutionalization processes of praxelogy in those processes that are developed at the exterior of the knowledge field in the user institution. The theory is used to establish a language for the characterization that such research pretends. The institutional approach to anthropologic and didactic fields justifies a specialization of the researches and theories which do not pretend modeling all the didactic phenomena, but delving its approach into a particular field, developing adapted and conceptual tools (Castela, 2012).

The theoretical foundation is established through an example, in order to question the "wisdom statistics". It is necessary to define which knowledges are going to be used in the workplace and how they are going to be manifested in the professional practice. At first sight, the ATD praxelogy construct would be adequate for organizing the information concerning work concepts uses and methods in every social subject that has been researched. Construct knowledge in relation to the social epistemological perspective, will help us observing some other details: from troublesome conceptualization, until arguments construction which always refer to specific pieces or moments of the involved mathematics knowledge.

RESEARCH METHODOLOGY

The ethnographic research method used throughout this research is being strictly understood as the one consisting in the production of analytic- descriptive studies (habits, beliefs, social practices, knowledge and behavior) of a particular culture, generally of primitive towns or tribes (Martínez, 2004). In broad sense, many qualitative researches are considered as ethnographic researches (social, educational or psychological) cases study, field researches, anthropologic, ethnographies and many others where participative observation survives. We reaffirm that, in relation to this research, our point of interest is mathematics employed in professional and specialized practices.

Research Stages

A preliminary draft of the general stages is presented as follows (Goetz and LeCompte, 1988): a) Descriptive stage. The field observation is going to be performed; then, we will proceed to focused observation and finally we are going to move to the interviews. B) Analytical stage. Conjectures, inferences and categorizations are going to be made in order to form the thematic diagram. c) Interpretative stage. Categories are going to be concentrated by register. A general concentrated will be elaborated; these are going to be selected and systematized. Finally, we are going to produce a thematic diagram (index). In order to arrive to the essay of the thesis draft and its revisions, empiric content cards and bibliographic models will be selected and made with the purpose of arriving to the draft thesis essay and its revisions.

Data Obtaining and Organization

The process of obtaining and organizing data is going to be defined by the most adequate or pertinent techniques used for studying mathematics in the workplace, for instance; Hahn´s work (2011). Mainly, the results will be focused to the statistics professional practice characterization in the workplace, and the study of wisdom statistics uses among MCEO program graduates.

CONCLUSIONS AND RESEARCH DIRECTION

The problematic leading to the definition of the research problem is basically nourished by the necessity of knowing if a postgraduate fulfills the demand of becoming determined professional profile. In the current research, graduates must constitute the social subjects of study. We offer an approach to the research problem in the education statistics field, relating Statistics in the workplace (labor scenario) with the context elements (Official Statistics field training scenario).

The research proposes a study about the use and application of wisdom statistics among master´s degree graduates. Through this, we will be able to know if the program has been accomplished or not, dealing with the demand of specializing graduates in statistics skills, contributing to their professional development in the workplace. In relation to the data analysis method and research results approach, we pretend to pronounce it since the Social epistemological perspective (theoretical constructs) and ATD, in order to explain the relations between the establishedand observed variables. Basically, the research will use the ethnographic method for acceding and observing the MCEO program graduates at their own workplace.

The main activities that will continue the research path are: delving into the selected theoretical perspectives and its comprehension for pronouncing the proposed theoretical foundation; revising new similar researches (wisdom statistics usage or mathematics) employing the social epistemological approach or ATD, which partially contributes to the research; and selecting and implementing ethnographic tools in order to obtain information about the social subjects of study.

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