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TEACHING STATISTICS IN SOCIOLOGY A CURRICULAR ANALYSIS

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Abstract: Statistics plays a central role in the different areas of social sciences and especially in sociology. Therefore, in the university training of these professionals, attention must be paid to training activities that provide them with the essential knowledge and skills required for their work performance. This article analyzes the curriculum of the Bachelor's Degree in Sociology at a Mexican public university. The Theory of Mathematics in the Context of Science (TMCC) is considered as a theoretical and methodological reference. A documentary analysis was made considering the five dimensions of this theory (curricular, epistemological, didactic, teaching and cognitive). As the most relevant results, the elements of the curriculum or syllabus that define the type of statistical training expected in this profession are presented, as well as its scientific and professional scope valued from the TMCC. The possible obstacles to achieving the expected statistical training were also identified.
Keywords: Statistical Education, Higher Education, Vocational Training, Mathematics in the Context of Science, Statistical Reasoning

INTRODUCTION

Statistics has many contributions to the social sciences. Different theories and methodological frameworks of the social sciences are based on statistical models that allow us to address the problems that are commonly faced in professional practice. As an example, we can mention the planning, monitoring and evaluation of social programs (Cortés and Vargas, 2011), studies on various social problems, such as poverty (Boltvinik, 2012), economic inequality (Cortés, 2012), surveys and elections, social stability, sustainability and adequate use of resources (Ruiz and Padilla, 2012), impunity (Le Clercq et al., 2016), social mobility (Cortés and Solís, 2006); as well as opinion studies and political analysis (Carrillo, 2000), among others.

However, in contrast to the variety of models and techniques derived from statistics that are used in the various social sciences, we have a diversity of theoretical and methodological approaches that do not take mathematics and statistics into account. Within the social sciences, and particularly in the context of university education, we have opposing positions regarding the role that the processes of quantification of reality must or can have. The differences cover a wide spectrum that includes the epistemological foundations, the nature and scope of the theories, the methods and techniques, and even reaches ideological and political assessments. Over time, this has led, at some points in the recent history of Mexico and Latin America, to traditions of university education that are reluctant to use statistics (Cortés, 2008).

Despite the many theoretical, methodological and epistemological positions existing in the social sciences, many of which are in open conflict, professional demands increasingly require a solid and flexible statistical understanding. This is partly favoured by the generalisation of Information and Communication Technologies in academic and work environments, as well as the increasing ease of having databases on different social problems, which are very accessible and contain information on multiple variables, with very large samples, and even with census data (Ridgway, 2016).

However, there are many challenges to overcome in teaching statistics at the higher level, especially in professions that are not traditionally associated with mathematics. A widespread problem is that many students do not find meaning in this discipline in the field of their professions. In part, this is due to the fact that statistics courses work with fictitious data and from contexts very different from that of the social sciences, emphasizing

the use of formulas and the calculation of statistical measures, without promoting the search for meaning in the data (Carter et al., 2017; Eudave, 2019).

We also found that many of the contents that are usually included in statistics courses do not address all the aspects (statistical techniques, research methods, statistical software, among others) that are required in and for professional life (Carver et al., 2016; Harraway and Barker, 2005). There is even a risk that the learning achieved contributes little to the needs of daily life, as occurs with the teaching of statistics at other educational levels (Batanero et al., 2013). It must also be mentioned that it is common to find a lack or deficiency in basic mathematical knowledge and elementary statistical skills (known as statistical literacy) in students, as well as the anxiety caused by mathematical and statistical concepts (Tishkovskaya and Lancaster, 2012).

Taking up these concerns and focusing on our immediate environment, we start from the following questions: How is the statistical training of Sociologists defined at the Autonomous University of Aguascalientes (UAA), Mexico? What type of quantitative training is proposed for these professionals? And what type of integration is proposed within the framework of the departmental system of the institution? We focus these questions on a particular professional field and a Mexican public university, but we are aware that this educational program shares many of the problems of other degrees and other institutions, so we consider that this case can help understand similar situations in other latitudes.

THEORETICAL REFERENCES

In this article, in order to address the complexity of statistical training in the field of Sociology, we start from the basic approaches of the Theory of Mathematics in the Context of Science (TMCC) proposed by Patricia Camarena and collaborators (Camarena, 2009, 2013, 2014; Trejo and Camarena, 2011; Gibert and Camarena, 2010; Camarena and Herrera, 2003; Camarena and Muro, 2002), and we reread them from the needs, conditions and foundations of the social sciences.

The purpose of the TMCC is to offer theoretical foundations and inputs that support teaching practice, especially in higher education (Camarena, 2013). This theory arises in the context of the training of engineers, but has been extended to other fields and educational levels, moving towards the Theory of Sciences in Context. The TMCC proposes an explanatory model of the complex interactions between the knowledge that make up a professional field and offers guidelines for the construction of curricular and instructional strategies so that mathematics and statistics achieve meaning and functionality in the context of the professional practice of fields where mathematics is not the main object of study (Camarena, 2009, 2013, 2014).

Among the problems faced by the TMCC, Camarena (2013) highlights the following:

- Learning knowledge that is isolated and has no meaning for the student.

- The difficulty in establishing links between mathematics and the fields of application.

- The difficulty in training in and for interdisciplinarity and the integration of knowledge.

This theory places us in an environment in which different conceptions of what knowledge is, as well as the way to validate and communicate it, and, therefore, what learning implies, will be integrated, but also confronted (Camarena, 2013).

Therefore, it is inferred that the role played by statistics in the body of knowledge of each profession in the social sciences has to be explicit, as well as the reasoning methods they provide and their scope (considering that all professionals have or must have different methods for reflection and attention to their areas of interest, some of which are naturally quantitative in nature).

The TMCC includes five dimensions: curricular, epistemological, didactic, teaching and cognitive. Below is a description of each of the dimensions that make up the TMCC. This description is at the same time a reworking based on the characteristics and difficulties faced in the social sciences, considering the contributions of studies that can complement and reinforce these approaches. The order in which these dimensions were configured over three decades is followed (Camarena, 2013), although they could be shown in another way, since there is an interdependence between them and no one predominates. In this work, the curricular dimension is taken as the axis of analysis, as it is the purpose of the study, and based on this dimension, the reflection of the remaining ones will be made, as explained in the methodological section.

CURRICULUM DIMENSION

The design and analysis of an undergraduate program must take into account the mathematical training offered to students at the high school level and must anticipate job applications, as well as the requirements for graduate school, thus ensuring that the curriculum is an efficient and effective bridge. Therefore, the curriculum involves three stages: central, preceding, and consequent (Camarena, 2013, 2009). In the central stage, the explicit and implicit statistical content present in the curriculum of an undergraduate program is analyzed, and which may be present as a subject or set of subjects, or as theoretical or procedural content of other subjects. The preceding stage consists of the assessment of the mathematical and statistical knowledge that students have upon entering the higher level. This is a widespread problem, due in part to the mistaken belief among students that they will not encounter mathematics in social science professions (Carver et al., 2016). The subsequent stage consists of knowing the uses of mathematics and statistics in the professional field of interest.

This implies a conceptual analysis of particular professional tasks, where from practice, a task configures its conceptual meaning, which is in turn directed, to a certain extent, by certain disciplinary notions that are recognized and used by a group of reference specialists, such as a professional guild (Eudave, 2014).

The design and redesign of study plans and programs must consider the epistemological foundations (explicit the role of statistics in the whole of professional training and consider the way to address interdisciplinarity), cognitive (take into account how students learn, what their motivations are), teaching (define the type of teacher that this training approach requires and the strategies to follow to train and update them), and make room for didactic designs consistent with this set. These points are considered by the four remaining dimensions.

EPISTEMOLOGICAL DIMENSION

In the epistemological dimension of TMCC, the statistical concepts and models used or potentially useful in professional practice are defined, as well as their links with specific social problems and their interdisciplinary interactions. The epistemological dimension opens the doors to reflection, analysis and debate on the foundations of statistics in the social sciences, rather than attempting to provide a quick and easy solution to an extremely complex problem. Identifying, distinguishing, clarifying and explaining statistical content must be a process to be worked on throughout a university career. The ideal is to know the disciplines that make up a professional profile, but also to have the ability to identify the possibilities of interaction between them, in such a way that they allow the formation of inter and transdisciplinary knowledge, which helps to understand specific professional problems and establish possible avenues for attention (Wagner et al., 2014). In addition to theoretical knowledge, professional practice requires different methods and techniques, some of which may be in apparent or frank confrontation, as often happens with qualitative methods versus quantitative methods. We must not forget the ideological and political clash underlying the different epistemological positions of the social sciences (Cortés, 2015).

DIDACTIC DIMENSION

The didactic dimension focuses on the design, implementation and evaluation of learning experiences that are based on contextualized mathematics and statistics. Ideally, learning experiences must reproduce in the classroom situations typical of professional practice (Camarena, 2009, 2013). In this regard, Régnier suggests that a didactic approach to teaching statistics must consider, in addition to the three vertices of the didactic triangle (the student, the teacher and knowledge), the professional social practices of reference, which: "represent the integration of a social, cultural and professional environment different from that of the teachers, among the elements to be taken into account in a theory of didactic statistical situations" (Régnier, 2012, p. 28).

TEACHING DIMENSION

In this dimension, the ideal characteristics of university professors are required: their professional training; their knowledge of the professional field in which they will teach; their mathematical or statistical training. The challenge is to have teachers who know the professional fields, the statistical models and tools necessary for each field, who are aware of the cognitive processes of their students and who have knowledge of the epistemological foundations of professional training and, in a very special way, who have the ability to work interdisciplinarily.

COGNITIVE DIMENSION

According to the TMCC, knowledge is considered to be born integrated: we can consider statistical knowledge integrated with other knowledge (interdisciplinarity), as well as integrated into practice (Carter et al., 2017). If students achieve articulated learning in an interdisciplinary situation, their permanence and adaptation when facing the tasks of professional life are more likely, which will no longer seem so foreign to them.

The cognitive dimension must guide the instruction process, giving guidelines for the design of learning experiences according to the characteristics and needs of students and statistics in the context of each profession (Camarena, 2009).

There is a natural interrelationship between the five dimensions of the TMCC, and between these and the institutional

context and the teaching staff that materialises them, with the curricular dimension being in the first instance the one that brings together the others in a general plan of action. It is towards the curricular dimension that we are addressing in a special way in this study, but without neglecting the others.

METHODOLOGY

A curricular analysis was carried out on the 2017 Study Plan for the Bachelor's Degree in Sociology at a Mexican public university (UAA, 2017). Lahanier-Reuter (2012) recommends for the curricular analysis: exploring the organization of the contents, the aims and objectives of the teaching, the scientific references of these contents, the devices, the tasks and exercises from which the generic principles are extracted. This implies an analysis of the internal consistency of the curriculum:

> To determine the degree of internal consistency, it is important to characterize the congruence between the learning objectives, content, learning activities and assessment methods presented by both the plan and its respective study programs. Although this analysis may seem like a mere technical review, the important thing here is to determine how the curricular structure and the programmatic components it articulates reflect the academic, political and social intentions held by the group in charge of designing the study plan (Ruiz, 2009, p. 74).)

Following Camarena (2013) in what he calls the central stage of curricular analysis, the following activities were carried out:

1) Recognition of the curricular structure: semesters, total number of subjects, areas in which it is structured, type of training activities, etc.

2) Identification of the statistical contents that run through the entire curriculum. These correspond to the statistics subjects, as well as the theoretical or procedural contents of statistics but that appear as contents of other subjects. Likewise, the description and justification of the statistical contents and their connection with some of the curricular areas are considered.

3) Identification of implicit statistical content. The contents of quantitative methodology and those related to disciplines that are based on statistical methods, such as demography, evaluation of social programs, etc., are considered.

4) Assessment of the elements of the curriculum and their congruence and integration, based on the dimensions of the TMCC (see table 1).

The analyzed curriculum (UAA, 2017), in addition to the curriculum, includes the social and theoretical foundation of the educational program, the profile of entry and exit of the student (knowledge, skills and attitudes), didactic orientations (recommended study methods and techniques), and the expected profile of the teachers. These elements are taken up and explained in more detail in the programs or descriptive letters of each subject, which are a complement to the curriculum or syllabus.

Dimensions	Elements of analysis
Curriculum	• Statistics subjects. • Subjects directly linked to statistics. • Subjects indirectly linked to statistics. • Statistical content in other subjects. • Purpose and objective of statistics (this is expanded in the epistemological dimension).
Epistemo-logical	• Purpose and objectives of statistical training. • Explicit presentation of the foundations of statistical training and quantitative methods. • Way of conceiving interdisciplinarity. • Characterization of the contextualization of knowledge. • Definition of the role of activity and practice in the generation of knowledge.
Didactics	• Didactic guidelines and their congruence with the curricular, epistemological and cognitive postulates.
Teaching	• The ideal profile of teachers and their way of working to guarantee the implementation of the curricular, didactic, epistemological and cognitive postulates.
Cognitive	• Type of knowledge and learning processes expected from students (is learning of formulas and calculation procedures expected or, on the contrary, situated, contextualized learning, based on practice and in interdisciplinarity?).

Table 1: TMCC categories used for curriculum analysis

Source: own elaboration.

RESULTS

CURRICULUM STRUCTURE

The Bachelor's Degree in Sociology was founded at the Autonomous University of Aguascalientes (UAA) in 1976, in what is currently the Center for Social Sciences and Humanities. Over the course of 48 years, several revisions and updates have been made to the Study Plan; this article analyzes the 2017 plan. Since its inception, this degree has been oriented toward the training of social researchers who can contribute their knowledge and skills to the diagnosis and formulation of social projects and public policies, as well as to their implementation, monitoring and evaluation. The general objective of this profession is:

> To train the Bachelor of Sociology as a researcher and professional capable of applying sociological concepts and perspectives in the analysis of various social problems, in different social contexts and in collaboration with other disciplines; to identify and diagnose social phenomena and predict their impacts on society; to design research projects, in the development of social policy programs, as well as in the analysis of institutions and organizations, which can be applied in academic practice, in public and private institutions or in independent professional consulting, with a high sense of commitment and social responsibility. (UAA, 2017, p. 44)

The curriculum is structured into five curricular areas: theoretical-historical, social problems, methodological-technical, research workshops and complementary. The curriculum has 42 subjects distributed over 8 semesters, totaling 372 academic credits (108 theoretical hours and 113 practical hours). The distribution of the subjects in each semester, and throughout them, seeks to provide theoretical and methodological continuity, making explicit the link that is expected to be achieved between the subjects. The area of research workshops, with seven workshops (one per semester starting in the 2nd), is the main articulating axis of theoretical and practical knowledge. The curriculum considers two subjects taught by the Department of Statistics (which corresponds to the Center for Basic Sciences): Descriptive Statistics (3rd semester) and Basic Statistical Methods (4th semester) (See Table 2). Their contents and orientation are analyzed in the following section.

BASIC STATISTICAL TRAINING

The objectives of the two statistics courses describe the knowledge, know-how and multidisciplinarity that is expected to be achieved. The first of them contemplates basic concepts such as: sampling, variable, central tendency and dispersion, normal distribution; some procedures are also mentioned, such as the analysis and treatment of categorical variables, the exploratory approach, bivariate and correlation analysis. The second of the courses focuses on the study of the most common probabilistic models (binominal and normal), as well as some procedures such as interval estimation, hypothesis tests, group comparisons and regression analysis (See Table 2).

In the description of these two subjects, no context of the profession is mentioned that would allow for a meaning to be given to statistical concepts and procedures, nor are the phases of statistical research considered as a context for the development of statistical reasoning (Wild and Pfannkuch, 1999), which would allow a link with the methodological-technical area of the study plan (See Table 2). Of the five phases of the research cycle considered by these authors (problem statement, definition of a plan, obtaining and processing of data, data analysis, presentation of conclusions), Statistics courses seem to focus solely on the data analysis phase. This suggests that the presentation of statistical notions can be limited to a theoretical explanation and the practice of some algorithms or procedures (unless the teacher carries out a didactic planning that recovers the meaning of sociological research, which seems difficult considering that these courses are not taught by sociologists).

In the description of each subject in the Study Plan (UAA, 2017), the subjects that are their direct antecedents and their consequences are mentioned. It is worth highlighting that in the two Statistics courses only the relationship between the two and with the Research Workshops is mentioned, and that no other subject explicitly indicates its relationship with these.

However, the links of the Statistics subjects with other subjects in the study plan are varied, although some of them are implicit. For example, there are two subjects taught by the Department of Sociology and Anthropology that (although not explicitly mentioned), due to their content and orientation, are directly related to the statistics courses: Quantitative Data Collection Techniques (2nd semester) and Data Systematization and Analysis (4th semester).

The general objective of the Quantitative Data Collection Techniques course states that: "Upon completion of the course, the student will be able to adapt and design a structured questionnaire that allows for obtaining empirical information that will be processed with the different quantitative analysis techniques for the analysis of social phenomena" (UAA, 2017, p. 65). The course description mentions its theoretical-practical orientation "where the student will have a complete experience in designing a structured questionnaire that has gone through the different tests necessary for this purpose. (…) The subject provides the curriculum with knowledge and skills in the design and development of research projects" (UAA, 2017, p. 65). It is mentioned that this course is a continuation of the so-called Research Designs course and that it is the basis for the Data Systematization and Analysis courses and the Research Workshops. Furthermore, it is based on a context (survey-type research) and practical situations (developing a survey-type research project), and has an explicitly quantitative approach, however, it does not indicate how it is expected to achieve its connection with the two Statistics courses

Statistics courses for the Bachelor's Degree in Sociology	
Descriptive statistics (3rd semester)	Basic statistical methods (4th semester)
General objective: At the end of the course, students will acquire the necessary skills to describe, using numerical and graphical summaries, information related to the phenomena in their field of study. They will also be able to evaluate, interpret and communicate the results obtained. The subject will foster an attitude of openness to multidisciplinary work with a sense of quality and innovation in social research.	**General objective:** At the end of the course, the student will understand the importance of probability in the assessment of random phenomena related to his/her area of study and will demonstrate skills to apply statistical methodology in inference procedures, both for estimation and significance tests, as well as to evaluate and communicate the results obtained. The subject will stimulate a favorable attitude to share and disseminate knowledge and will foster a sense of quality and innovation in social analysis.
Learning content: • Importance and use of Statistics. • Basic sampling designs. • Concept of variable. • Analysis and Treatment of categorical variables. • Summary measures: Center and Dispersion. • Exploratory Approach. • The Normal Curve. • Bivariate data. • Correlation Coefficient.	**Learning content:** • Concept of probability. • Probability distributions: Binomial and Normal. • Sampling distributions. • Interval estimate for a mean and a proportion. • Parametric and non-parametric hypothesis testing. • A mean and difference of means. • Chi square tests. • Simple and Multiple Linear Regression Analysis.

Table 2: *Objectives and contents of the Statistics Courses in the 2017 Study Plan of the Bachelor's Degree in Sociology*

Source: Prepared by the authors based on the 2017 Study Plan for the Bachelor of Sociology (UAA, 2017, p. 71-77).

(what each course contributes to the others, what theoretical and practical knowledge is recovered).

For its part, the course Systematization and Data Analysis (which is taught in the same semester as Basic Statistical Methods) is described as:

> Theoretical-practical course, where the student will develop skills for the analysis of empirical information used in research projects, from a methodological and technical perspective.
>
> The purpose will be to introduce the student to the study of techniques for processing empirical information, both quantitatively and qualitatively and, eventually, mixed studies; from its epistemological and methodological foundation, processing with the use of appropriate techniques and packaging, interpretation and presentation of results. During the semester, some practical activities will be carried out that have the purpose of enabling the student to systematize empirical information obtained directly or derived from official databases. (UAA, 2017, p. 73-74)

Its conceptual contents are mostly statistical:

- Introduction to the analysis of quantitative information: Epistemological foundations. Operationalization of concepts.

- Notion of measurement of social phenomena.

- Notion of reliability and validity.

- Univariate descriptive analysis: Organization of data: frequency tables, percentages; ratios and proportions. Measures of central tendency, dispersion and graphical representation. Description of results.

- Bivariate descriptive analysis: Construction of contingency tables: visual examination and calculation of percentages. Correlation coefficients of variables. Interpretation of results.

- Multivariate descriptive analysis.

- Preparation of three-dimensional contingency tables and graphical representations.

- Calculation of correlation coefficients in three-dimensional tables.

- The Lazarsfeld Elaboration model. The logic of multivariate analysis.

- Calculation of partial and semipartial correlation coefficients for three or more variables.

- The interpretation of multivariate analysis.

- Computer-assisted quantitative analysis: Excel, SPSS, Statistics, Open access packages. (UAA, 2017, p. 74)

This course takes up, or even repeats, several of the contents of the Descriptive Statistics course, but considering an analytical logic that starts with the operationalization of the concepts, continues with the measurement process, and then proceeds to the univariate, bivariate and multivariate analysis. The course is complemented with some coefficients for correlation and multivariate analysis. Presenting the statistical contents as a methodological sequence, which starts from a purpose and aims to reach a conclusion, offers a context that can help to recognize the meaning of statistical notions and procedures. In principle, it would be expected that this analytical logic (which is similar to that followed in the Quantitative Data Collection Techniques course) would be taken up and applied in the Research Workshops, as long as the students' projects take a quantitative approach. However, it is not clear how the probabilistic models presented in the Basic Statistical Methods course will be taken up or integrated in this course.

Therefore, we have two courses that are explicitly oriented towards statistical training and two courses that, although they are in the methodological area, also explicitly use statistical concepts and techniques. Are these courses related to other courses in the curriculum? And if so, how are these relationships established? This is analyzed in the following section.

STATISTICAL KNOWLEDGE IN CONTEXT

If we take as a reference the Methodological-Technical area, the subjects that comprise it and their sequence, the training path for the Quantitative Methods seems clear and explicit and at least the intention of achieving its link with the Qualitative Methods, as well as that of both with the Research Workshops (See Table 3).

The Methodological-Technical area is structured following the logic of the research cycle, in a similar way to that indicated by Wild and Pfannkuch (1999), a logic that is taken up again in the area of Research Workshops, especially in the 7th and 8th semesters with the subjects of Terminal Research Workshop I and II. However, the relationship with the Statistics courses, which are located in the Complementary area, is not made explicit.

If the Statistics courses are outside the research cycle that runs through the study plan, or are weakly related, they run the risk of being left as a kind of bag of tools that could be used at a given time or ignored.

Wild and Pfannkuch (1999) consider that statistical criteria must be taken into account throughout the entire research process. Thus, when posing the research problem, one must keep in mind that the reality to be studied can be approached as a phenomenon or situation susceptible to measurement and therefore think about how, based on numerical information, the arguments that will account for the social reality of interest will be constructed, whether it is to be described or explained (which in turn implies different strategies for obtaining and processing information).

Methodologically, a plan must be established to carry out research, which defines what information is obtained, of what nature, from which informants, with

Semester	Subjects by Curricular Areas		
	Methodological-Technical	Research Workshops	Complementary
1°	3. Research Designs 4. Demographics		5. Analysis of the Economic Context of Society
2°	9.Techniques for Obtaining Quantitative Data	10. Documentary Research Workshop	
3°	14. Qualitative Data Collection Techniques	15. Research Workshop: Regional Development	16. Descriptive Statistics
4°	20. Systematization and Data Analysis	21. Research Workshop: Cultural Studies	23. Basic Statistical Methods
5°		29. Research Workshop: Industrial and Labor Sociology	
6°		33. Action Research Workshop	
7°	38. Integration and Management of Development Programs	39. Terminal Research Workshop I	
8°		41. Terminal II Research Workshop	

Table 3: *Subjects of statistics and related areas*

Source: Own elaboration based on the 2017 Study Plan of the Sociology Degree (UAA, 2017, p. 47-48).

what techniques, so here it is also necessary to consider statistical criteria in the case of quantitative studies, since a population must be identified and a type of sampling and a measurement procedure chosen. In this sequence, care must be taken throughout the process of obtaining and processing the data, to avoid biases that could be attributed to the sampling or the measurement process, or to poor data processing. In the data analysis phase, use is made of the most convenient statistical techniques and methods for the defined study problem and the expected scope, so it is not expected to use the entire arsenal of techniques that are usually seen in statistics courses. Finally, there is the phase of presenting conclusions, which in the case of social science professions is also complemented by the need to disseminate them to the participants in said project (Eudave, 2014).

This is why statistical concepts and procedures allow for a greater and better understanding of the entire research cycle, and help to make pertinent decisions that guarantee a corpus of data that is useful and sufficient for the established purposes, and that is also reliable and valid. But in the same way, when statistical notions are linked to each phase of the research cycle, they can acquire greater meaning for users. With good reason, Pfannkuch and Wild (2000) mention that many professional statisticians regret that their support and advice is sought only in the data analysis phase, when it is often no longer possible to correct errors in the data that must have been foreseen in the first phases of the research. For all of the above reasons, statistical reasoning is configured throughout the entire research cycle and not only in the analysis phase.

Looking superficially at the contribution of Statistics courses (as described in the previous section and shown in Table 3), it would seem to be limited to the data analysis phase. But if we make a more detailed analysis of the implicit relationships between courses, if we trace the statistical concepts and procedures in different courses and their relative value, we will have another view.

To identify the contexts in which statistical ideas become relevant, we return to the categories proposed by Pfannkuch (2011) for the contextualization of statistical knowledge: the learning experiences suggested in the

courses potentially most related to Statistics; and the context of the data, in this case the social problems studied throughout the degree and the way they are defined or characterized (whether or not they are done with numerical and statistical criteria).

The learning experiences that could serve as a context for the development of statistical reasoning are found mainly in the Methodological-Technical areas and in the Research Workshops. Thus, for example, in the subject of Research Designs of the first semester, it is stated in its general objective that: "at the end of the course, the student will apply the logic of sociological research and its types (quantitative, qualitative and mixed) to prepare a research project proposal" (UAA, 2017, p. 60). This course proposes a first approach to sociological research, and considers as procedural content some tasks such as: elaboration of the research design (guide questions, hypothesis and variables), application of the techniques of information collection and analysis, contrasting the theory with the data and generating theory from them. It is striking that the "false qualitative-quantitative dichotomy" is mentioned as content, without any other epistemological or methodological reference, except "establishing the limitations and advantages of each of the research designs" (UAA, 2017, p. 61).

The 1st semester Demography subject, which also corresponds to the Methodological-Technical area, has the following description:

> Theoretical-practical subject, which promotes in the student the knowledge about the behavior and characteristics of the population in constant transformation and enables the student in the analysis of their social context to support the implementation of public or private programs, delving into the strategies of social planning. It contributes to the professional profile in the training of a competent researcher in the systematization of data and information. (UAA, 2017, p. 61)

Among the conceptual contents of this subject, the following stand out for their relationship with statistical knowledge: object of study of demography and the main concepts and indicators that are used to favor a correct interpretation in the management of demographic information; basic definitions of indicators, sources of information and parameters related to the structure of the population. Among the procedural contents mentioned for this subject we have: measures in demography and their use as basic elements of demographic analysis; construction of indicators such as rates, ratios and indices of demographic components and processes (birth, mortality and migration); use of national statistical products such as surveys, censuses and counts to relate the population issue with environmental and social issues (UAA, 2017, pp. 61-62). A double contextualization is evident in this subject, both methodological (on a know-how) and disciplinary (from demographic science).

The subject of Integration and Management of Development Programs (7th semester), of a theoretical-practical nature, is oriented to the field of programming, management and social planning. The course description mentions that: The subject aims to "train a researcher of social problems and a competent analyst in the systematization of data and information" for the development of public or private programs (UAA, 2017, p. 88). The training activities focus on the integration and interpretation of diagnoses that define the characteristics and the situation that prevails in a certain unit of analysis, according to the social problem that is considered.

In the Terminal Research Workshops I and II (of the 7th and 8th semesters, respectively), continuing with the previous workshops and as a synthesis, an individual research is carried out that covers the two semesters and that has as a final product a thesis or thesis.

Students have the opportunity to select a topic and a methodological approach, in common agreement with the assigned tutor. In case of opting for a quantitative methodological framework, the student has the opportunity to apply the research cycle indicated by Wild and Pfannkuch (1999). A potentially valuable feature is that in these two workshops the hours of professional practice (240 hours) that the institution establishes as obligatory for all undergraduate students must be covered, since this can favor the link with institutions that make systematic use of statistical information.

We therefore have a series of learning experiences included in these courses, linked to the research cycle, but with the following ones standing out: elaboration of research designs; use of national statistics databases; collection, processing and analysis of data. These learning experiences are suggested to present students with the basic uses and procedures of quantitative methodology, but they are also a source of meaning for statistical notions and other theoretical notions linked to them.

The potential contextualization of statistical notions and procedures based on the social problems analyzed throughout the degree could occur in several areas, but mainly in those corresponding to the area called Social Problems. However, in the description of subjects presented in the 2017 Plan (UAA, 2017), the quantitative perspective was detected mainly in the following subjects: Analysis of the economic context of society (1st semester), which includes macroeconomic indicators (income distribution, poverty and marginalization indicators, Gini coefficient, Lorenz curve, etc.); Regional Development (2nd semester), in which students are expected to "acquire the ability to analyze and interpret socioeconomic and demographic processes, their impact and trends and mutual relationships with other social phenomena and processes" (UAA, 2017: 64), as well as "the ability to analyze quantitative and qualitative information derived from different sources of information" (UAA, 2017: 64); Poverty and Social Inequality (7th semester), in which "both theoretical discussions and the different forms of measurement and their implications will be known, plus their reference in the development of research and intervention skills in a specific field of reality" (UAA, 2017, p. 85), specifically on situations of poverty and inequality; Society and Sustainable Development (7th semester), which supports the management of tools necessary to manage and evaluate social projects and programs for care and promotion of development, with the support of different data and information.

DISCUSSION

Considering the Curricular Dimension of the TMCC, we have that the 2017 Study Plan of the Bachelor's Degree in Sociology (UAA, 2017) proposes a series of subjects that in principle offer a space to account for the richness and complexity of the interaction of statistics with the rest of the areas of sociology and related sciences.

Although the detailed analysis of the description of the subjects and their training objectives, make us assume that the statistics subjects are not the articulating axis. We could ask ourselves: what comes first, statistics or methodology? How to integrate them in the most optimal and productive way, from a training point of view? How does each subject contribute to the development or implementation of the other?

In the analyzed curriculum we find different aspects of the Epistemological Dimension stipulated in the TMCC: the interdisciplinary vision of knowledge (although somewhat implicit), which considers that this knowledge is constituted from the interaction between theoretical-disciplinary knowledge and practical-methodological knowledge; the

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contexts of different sciences that give meaning and significance to statistics (demography, methodology), reconceptualizing them (Camarena and Muro, 2002).

Regarding the Didactic Dimension of TMCC, the curriculum proposes "student-centered methodologies that allow both self-learning and an adequate integration and connection of their learning with real life, between theory and practice, which is essential for meaningful learning. These methodologies include: collaborative work, problem solving, case studies, and project development" (UAA, 2017, p. 94). For the teaching of statistics, these didactic approaches seem to occur or be suggested, but outside of statistics courses, since it is in methodological subjects and research workshops where problem- and project-based instruction is most feasible, taking into account real-life social and professional issues.

As regards the Teaching Dimension, all teachers of this degree are expected to know Sociology, its scope, methods, professional uses and, very emphatically, to work as a team (among themselves and with the students). Specifically, in the case of Statistics teachers, it is ideal that they know what this discipline is used for in sociology, and that sociology teachers (at least those in the Methodological-Technical and Research Workshop areas) have a basic statistical training. Camarena (2013) points out that an alternative for teaching action is the implementation of research projects, in which teachers from different areas participate (naturally including statistics specialists).

This necessarily implies teamwork, which is rare in many institutions, but which would help in the design and implementation of pertinent teaching proposals and, above all, would also help teachers to better understand the area of professional development of each educational program and the complexities and richness of interdisciplinary work.

As for the Cognitive Dimension of TMCC, the curriculum infers a progression of knowledge, based on the transition through the two types of contexts (learning experiences and the context of data), and with the gradual appropriation of all the elements of the research cycle (working with real-life data, learning to obtain, process, analyze, communicate them, which implies learning statistics, doing statistics). Although it would be necessary to investigate whether this really happens in practice, and this would be the subject of another study.

In summary, we have that the analyzed study plan offers a situated and contextualized training proposal but that, by focusing on methodological knowledge, could limit the formal understanding necessary especially for the development of more elaborate methods, which will be required both for professional life and for the completion of postgraduate studies (Cortes, 2008; Eudave, 2014).

CONCLUSIONS

The 2017 Study Plan for the Bachelor's Degree in Sociology takes on the challenge of combining in a single educational program the training of qualitative and quantitative approaches, meeting the demands of interdisciplinarity, achieving adequate levels of theoretical training and at the same time providing the necessary knowledge to deal with specific work situations, such as the planning and evaluation of social programs and projects of different kinds. However, a structural problem that must be faced is the curricular model by subjects that can potentially offer a fragmented view of scientific knowledge.

University professions are mostly, and in all fields, interdisciplinary, so the main challenge is to avoid the isolation of the scientific and technical disciplines that support them. As

Fernando Cortés (2015, p. 184) rightly points out: Reality has not yet realized that in order to study it we have divided it into disciplines. The study plans must clearly express the interactions between subjects, making the interdisciplinary profile of these professionals operational.

Statistics teachers must be aware of the training needs of each professional, such as in social sciences, and the demands that each field of work requires, so that they can adapt the content and purposes of their courses, while taking care of their disciplinary essence. They must take into account the students' prior knowledge (what they really have and what they need to master to access the essential professional knowledge). Teachers of methodological subjects and of disciplinary subjects more closely linked to statistics must know or recognize the links between their subjects and statistics and design activities that allow them to establish bridges between them (conceptual, methodological, operational, which together must configure the didactic designs).

Professional training requires interdisciplinary training, with statistical knowledge contextualized in the realities and situations that concern each professional area, which is oriented towards the formation of knowledge and know-how, which responds to the requirements of professional and social life, rather than to merely school demands, which makes explicit the relationships between classroom ↔ social environment ↔ work environment, and allows the necessary bridges to be built. This is the challenge, and we consider that proposals such as the Theory of Mathematics in the Context of Science can bring us closer to possible solutions.

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