

## FROM KINDERGARTEN TO ELDERLY PEOPLE. A MACRO VIEW OF THE TEACHING OF STATISTICS

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*The purpose of this paper is to show how we can teach Statistics at all levels of life. Applying the qualitative method of participative observation I will present the outcomes obtained in many years of teaching. When the education law was implemented, statistics was incorporated into the math programs, but the teachers, as in their curriculum did not have statistics, had no knowledge about it; they need training and that was a great challenge. So, professors of statistics from the university were called to capacitate teachers. I was one of them. I taught statistics to kindergarten teachers and the results were amazing, then to teachers of initial and secondary level. I will present some papers done by the students since the practice was the feed-back with the students in the classrooms. As a university professor I am in charge of Biostatistics at the Faculty of Veterinary Sciences of the National University of Rosario. I also teach on postgraduate courses of Statistics and to elderly people as extension function. This macro vision of teaching statistics and the results show how the teaching of statistics has no age limits.*

Once I graduated as Statistician I started teaching in the secondary level Mathematics. Statistics were not included in the curriculum. Between the years 1985 to 1988 the Pedagogical Congress was developed where teachers of all the levels discussed on the incorporation of Statistics in Math Programs. I began also to teach Statistics at the Faculty of Veterinary Science.

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### EXPERIENCE WITH TEACHERS OF INITIAL LEVEL

When I started to teach teachers at this level I was disoriented as to what to teach and how, but in the first class when explaining the definition of statistics and its scope, there were the same teachers who guided me in the applications that they could implement in their classes. So each class I taught them and they worked in their classrooms what they learned. There were forms of collecting information through drawings and sticks, such as at the beginning of the day the teacher drew figures of a baby and a girl and wrote down how many were missing or at the end of the month looked at their notebooks and counted sunny days, cloudy days, rainy days and even made after a visit to a farm a double entry table.

This table made with feathers, and hairs and sticks in the case of the feet was used by the children who drew in each box the animals that fulfilled with the indicated characteristics. It was an experience that allowed me to understand how statistics with different ways of teaching can be incorporated from the first levels of teaching and this fact is the starting point to be teaching in an increasingly complex way the basic concepts.

In elementary school, the statistics classes were simpler, each topic developed was worked in the classroom and as the students between 6 and 12 years old were motivated to gather information, doing surveys, calculating easy descriptive measures. The teachers learned the basic notions with great enthusiasm since those students who had difficulties in mathematics found in statistics a way of meeting and motivation.

At this level the students carried out surveys for example, on the need to incorporate the milk cup for the entire primary level, collected information, tabulated, made tables and graphs and presented a report that the teacher raised to the authorities and after several formalities the cup of milk in that school spread to the whole level. This fact represented a valuation towards the

Statistics that was commented in the classes with the other teachers and motivated them to apply the subjects taught in their classes, and to carry out another surveys at their schools.

When I started working with Mathematics teachers at the secondary level, I noted with concern that they had no interest in learning Statistics since in their curricula they did not have Statistics and many of them forced to do the courses considered that the change in the curriculum removed Mathematics contents.

The teachers with many years working at schools attended the classes without interest in the content, the youngest came to really learn.

When I developed the project method changed the situation, all the teachers changed their attitude and began to apply this method in their classes. They presented projects on water pollution, on the use of public libraries, the need to incorporate folkloric dances in schools, on recreational violence, bulimia, and drugs. They began to have a different way of communication with their students, and they said Statistics was the change!

The students became participants of their own learning and when I went to observe classes a student said: "The experience in math classes applying statistics through the project is what I will never forget, what I learned was great".

In 2000, to strengthen the teaching of Statistics in the middle school, the University through agreements with the Ministry of Education implemented Postgraduates courses. The National University of Rosario incorporated a special course of Specialization on Math and Statistics at the Faculty of Economic Science and Statistics in Rosario. I was invited to dictate Didactics of Statistics. There was no program, so I had to prepare one, and I organized it guided by the works of Dr. Batanero and Dr. Godino. So, I began my classes with all the theories about didactics of Mathematics and then I explain the role of variability one of the most principles of Statistics.

Based on Batanero's works I introduced the project method in the Math classes. Working the project method with the student-teachers who were professors of Math's and putting it into practice made the didactic classes enjoyable. I presented the theory and then the professors used these contents in their own classes. The next working day they came to explain the experience in teaching what they learned to their students.

So, the next step was a workshop where professors explain what they did in their classroom work and then a discussion between all the professors was generated to arrive to a common point between all the experiences presented.

This experience was enriching because professors explain that the students were motivated and presented to their teachers subjects that really interested them, so they presented Projects about bulimia, lack of motivation in math classes, assistance in public libraries, incorporation of a breakfast in schools, Use of computers in the classroom, group meetings organized at recess, creation of student centers, among others. The works were similar to those presented in the updating course for teachers of Mathematics.

The National University of Rosario together with the Faculty of Humans and Arts signed in 1998 an agreement of pedagogical assistance to incorporate the career of Professor in Statistics, for this matter they took into account the subjects of the Degree in Statistics and they were due to attend the corresponding pedagogical subjects.

I was a student of the first promotion and then I was appointed to dictate Curriculum and Didactics and Residency in Statistics. In these years I have analyzed the teaching methods and incorporated the need to teach the use of statistical software and its interpretations so that professors of Statistics are able to provide students of all careers with the use of statistics in their instrumental character so they will be able to solve problematic situations of each professional area where they work.

In these courses students study the epistemology of Statistics, its history, how it is incorporated into curriculum design, how it is planned and how it is taught.

In addition, classes are observed at both the middle and upper levels where the statisticians must present methodological strategies to be evaluated in their own teaching practices not only from the contents but also from the pedagogical way to teach.

Residence in the middle level is often difficult for the statisticians because as the adolescents know that the teacher who teaches them is just passing through the classroom and will

not evaluate them, they are predisposed not pay attention because they have no commitment of learning, but it is the communication between the teacher in charge of the course and the students that allows to be able to realize these practices in classroom.

In the upper level the situation is different since the statistician teacher will give certain subjects which will not be repeated by the managers of the course. This fact benefits our statisticians as they can develop the topics in a friendly and respectful climate.

At the end of the pedagogical subjects that include history of education, psychology, among others the statistician is graduated as Professor in Statistics, which gives him a score to enter secondary and university teaching.

From my beginning in university life I have developed the teaching in the Faculty of Veterinary Sciences, as I have explained at the beginning. I started just when I graduated as a Biostatistics teacher when a new Faculty of Veterinary Sciences was opened depending of the National University of Rosario, I prepared the program, organized the activities and in this place I have being working for more than 40 years.

I was appointed in all teaching stages that are generated in the teaching career; I have given the respective competitions until becoming the maximum title at the University of Titular Professor of Biostatistics.

During these 40 years of university teaching in Biostatistics I have compiled data from different professorships, analyzed research projects, carried out the statistical part of the work of many colleagues. The fact of provider of all this information of empirical experiences and works allowed to my colleague and me to write a book on Statistics Descriptive and another on Inferential Statistics.

These books allow students to have all the pedagogical resources for the course to achieve meaningful learning because in them there are all the necessary material for the course.

These books consist of an introduction in each chapter with a problematic situation motivating on the subject, then the corresponding theory together with applications in the field of Veterinary Medicine, also explain how to approach the problems using the statistical software available at the Faculty and a proposed exercise based on problems and papers to analyze and solve.

Working in this way allows students in class to listen, understand and ask, as the books provide the necessary theoretical contents that can be deepened with the bibliography proposed by the chair.

In order for students to participate in their own learning and be aware of this process, the exercises set out in the book are incorporated in the Campus of the Faculty, and dynamic self-assessments are proposed where, when solving them, they know their progress or regression in the comprehension of the themes of the course.

The use of statistical software is a tool that allows them to be intelligent users of statistics, emphasizing interpretations in context.

During all my life as teacher, the way of teaching statistics has evolved and currently the goal of teaching is that, faced with a problematic situation, students can understand it, position themselves in the subject, be able to use the computer through some of the proposed software, achieve the correct output and interpret the conclusions in terms of the context of the problem.

At the moment this methodology has motivated students who, in general, show reluctance towards Statistics and our challenge has been, is and will be to show the importance of the Statistics in the instrumental role in his career.

For several years I have taught in the "Master's Degree in Politic and Food Safety Management" the subject "Thesis Workshop" where the importance of Statistics in the research presented by students is very important. Quantitative Methods are included in this Workshop and the most used Qualitative methods used when conducting surveys, interviews, participant and non-participant observations, with their internal and external validity through Statistical analysis.

At this stage the students are aware of the need to apply Statistical techniques and the contents depend on their proposals. The Workshops are enriching since in them each student presents his problem and his proposal to apply the Statistical techniques already known in his degree careers. The Statistical topics that are needed are deepened and at the end of the course in an

integrating Workshop each student presents the Statistical methods used and how they contribute to their thesis work.

In addition I am in charge of a course of Postgraduate that gives score for different doctorates, in this course I dictate the module “Descriptive Statistics and Basic Probability” for those students who in their degree careers do not have Statistics, or have had it in the beginning of the careers and had not grasped the basic knowledge necessary to apply in their respective projects in their doctorates. In this course the students are aware of the need to apply statistical knowledge in their respective theses, so they are motivated to learn to achieve the goal of graduating.

As a community work at the Faculty, one of the most rewarding moments of my career has being the extension courses on Statistical Literacy for elderly adults.

Teach to interpret the results of a survey, see if the information is statistically sustainable, as a sample can be malicious, as interpreted averages. The elderly adult’s workshops allowed them to feel useful; they can analyze simple information, and strengthen their self-esteem.

The final workshop was one of the most sensational moments of my career, to feel the affection received by trying to incorporate Statistical reasoning into them, even if it was elementary was a return that I never imagined.

## CONCLUSION

It is amazing to observe how the little ones can assimilate the basic concepts and the notion of variability and from the perspective of the elderly people, how statistics gives them possibilities of overcoming and of self-esteem that allows them to reflect and obtain critical spirit many times forgotten.

The importance of this work reflects the need of Statistics in everyday life and the significative role of the statisticians who must strengthen these concepts in the changing society in which we live.

This road traveled from the most different levels and spaces has strengthened my great challenge of teaching statistics from kindergarten to elderly people.

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