ARE WE PREPARING TEACHERS AND PUPILS IN STATISTICS FOR THE NEXT CENTURY?

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In this period of changes, statistical education must also change. It's necessary to prepare teachers giving not only the contents but also the methodology that they need to give interesting classes. The points to take in account to teach statistics to teachers and students are motivation, working in groups and "learning doing", using computational tools.

In this period of changes, statistical education must also change. It's necessary to prepare all the teachers at the primary school level (E.G.B.), and in my country, Argentina, we're doing this very slowly. While changes are occurring rapidly throughout the world, we're not always giving them the necessary priority.

We have to prepare all the teachers of General Basic Education (E.G.B.) both in content and the methodology that they need to give interesting classes.

What characteristics would we like teachers to have?

- They must be creative.
- They must have critical spirit.
- They must apply strategies, resources or different methods to solve problematic situations that can be presented in whichever moment of the daily life.

We introduce the changes that are taking place in teaching statistics. With the Federal Law of Education, statistics is introduced in Mathematics in a block named "Basic Knowledge of Statistics and Probability" (Block 6) in the E.G.B. (from 5 years of age to 14 years, obligatory).

We present the conceptual and procedure contents giving by the Ministry of Education.

BASIC KNOWLEDGE OF STATISTICS AND PROBABILITY

FIRST STAGE	**SECOND STAGE**	**THIRD STAGE**
CONCEPTUALCONTENTS	**CONCEPTUAL CONTENTS**	**CONCEPTUAL CONTENTS**
Ways of experience data collection and simple surveys		

Tables, graphics and diagrams to organise the information	Basic knowledge of Statistics Data collection, tabulation, grouping and representation. Pictograms. Bar and circular diagrams	Basic knowledge of Statistics: Population, samples, representatively. Measurement scales. Frequency tables. Histograms. Statistic parameters, arithmetic mean, mode, standard deviation (meaning and use of simple examples). Abuses in the use of Statistics.
Basic knowledge of probability: basic knowledge of event. Sure and impossible event. Compatible and incompatible events.	Basic knowledge of probability: Random experiments. Regularities in the obtained results. Prediction on the probability of an event.	Random phenomena. Probability assignment to an event. Classical definition of Probability. Random variables. Frequency and probability of an event.
	Combinatorial. Problems of counting. Tree diagram	Combinatorial. Strategies for the re-count of cases. Permutations, variations and combinations
PROCEDURE CONTENTS	**PROCEDURE CONTENTS**	**PROCEDURE CONTENTS**
Different ways of data collection. Organisation and analysis of simple information. Description and interpretation of the information given by tables, diagrams and simple graphics.	Interpretation of the information in illustrations, tables, bills, tickets, graphics, etc., taken from the media and everyday life.	Interpretation of indexes, rates, reasons and proportions taken as a summary of a data set.
	Elaboration of surveys and simple experiences. Collection, registration and classification of information. Interpretation and elaboration of simple statistic graphics	Choice of the appropriate measurement scale to each studied phenomenon.
		Calculation and interpretation in representative statistic values graphics (medium, mean, mode, dispersion)
		Discussion and

		discrimination of statistic information from different sources.
Exploration of random situations in games.		
Research of constants in the results. Systematic re-counts.		
Discrimination of types of events		Elaboration of strategies to guarantee the exhaustively in the treatment of enumeration problems.
	Formulation and verification of conjectures on the behaviour of simple random phenomena.	
		Description of relationships among data sets.
		Investigation of the best curve related to the obtained data (correlation).
		Making of decisions according to the obtained results.

This block of statistics have vinculum with other chapters of the General Basic Contents of the E.G.B., that are presented in this table:

Natural Sciences	**Social Sciences**	**Technology**	**Physical Educat.**	**Ethic Educat.**
1- Life and its properties 2-Physical World 3-Matter structure and changes 4- The Earth and its changes	1- Societies and the geographical spaces 2- Societies through time. Changes, continuity and cultural diversity 3-Human activities and social organisation	3- Information and communication technologies 4-Technology, natural environment, history and society 5- Technology-related procedures: product analysis and technological projects	1- Motive games 2- Sports 3- Gymnastics 5- Swimming	1- Person 2- Values

There is not a common basic content of basic knowledge on statistics and probability for the first stage.

For the first and second stages of E.G.B., the contents of these blocks are very simple.

In Descriptive Statistics, we pay attention to the organisation and interpretation of data and obtaining measures which summarise characteristics of them. Because of the complexity of the methods of Inferential Statistics, we will not work these items, rather it will be possible to start to train teachers in data analysis and in the extraction of consequences, so to recognise the value of these procedures to make decisions.

We will present simple situations where teachers need to gather data and were it is necessary to organise, describe and interpret, to answer to questions like these:

- Which is the rainiest month?
- Can we distinguish a language with the frequency of the use of the vowels?

When we train teachers it is very important to present situations of the daily life such as the following one:

The last 10 days of June, the “Tren de la Costa” has arrived x minutes late, as it is seen in the following table: (a negative number means that it has arrived x minutes early)

3 / 6 / 4 / 10 / -4 / 124 / 2 / -1 / 4 / 1

a) If the train company hires a Statistics specialist to demonstrate that the train offers a good service. Which are some of the ways he would use to prove it?

b) If a TV station makes a report showing that the train offers a bad service. Which are the ways it would use?

c) If you want to be objective and equitable in evaluating the train performance. which ways would you use?

This is the hardest part, since you cannot answer without making additional suppositions considering the costs related to the delays. Decision theory field attends what happens when these costs are considered in an explicit way.

We see that it is presented the use of statistics not only as an instrument to understand contents and solve specific problems of other areas of knowledge as social sciences, biology, economics, etc., but also in situations of the daily life.

The objective of teaching probability in E.G.B. is to work the notion of randomness, possibility, impossibility and degrees of probability. Using games the

students can explore relations between empirical and theoretical probability.

To introduce probability a very interesting game is:

In an ancient Hindu game TONG, two players show each other their right hands simultaneously, with one, two or three extended fingers. If it were equally probable that each player would extend one, two or three fingers: which is the probability that the number of extended fingers would be an even number?

Another problem is:

There are three stones (I, II and III) in a pond. There is a toad on stone I. Each second, the toad jumps from one stone to another, without choosing one or another stone specially. Which is the probability of being back to stone I after 4 jumps?

The general objectives to teach Statistics are:

- To know and understand the most usual statistic techniques in order to obtain, present and analyse a set of data.
- To use statistics technical language properly.
- To assume a critical attitude towards statistics techniques used in the analysis of results of an investigation.

The hopes of outcomes of statistics at the end of the E.G.B. are :

- know how to collect, organise, process and interpret data using statistics and to understand , estimate and use probabilities valuing these procedures for making decisions.

The necessary points to take in account to teach statistics to teachers and students are: motivation, working in groups and “learning doing” using computational tools.

Teachers must go deep into their former education, basically renewing teaching contents, their auto-evaluation criteria and their way of acting.

And doing this, students will be prepared to solve problems of every kind in the daily life.

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