I HAVE SOME DATA, WHAT CAN I DO WITH THEM?

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This paper is motivated by the need of a methodological change for Statistics teaching in experimental degree courses. We try the students fell the need of statistic knowledge, they can be able to establish a relation between the reality and their studies and they can use the Statistic like a indispensable tool to handle some data. With these objectives we start this project using real data to teach Statistic to our students. We work with students of the University of Granada, Spain, in third course of Environment Sciences.

INTRODUCTION

During the years that we have been teaching, a lot of questions have appeared about the better way to teach Statistic.

By means of the actual education system, with the division between theory credits and practice credits, Statistics teaching could be limited to a ordinary transmission theoretic contents and their practice application. But, do the student understand the basic results? Do they know how to apply statistic?

How can we achieve that the students feel the need of learning? How can we achieve that the students understand the need of Statistics in their future works?

To solve these questions, a group of teachers want to check and to improve the methodology that has been applied until now. We want to propose a change to get a better application of concepts and statistics methods and an improvement in learning process.

We want that the students get to elaborate the statistics concepts by themselves. For this reason, the teacher will have to work with real situations that let to abstract the knowledge. This system will let to promote and to increase the students interest to investigate and to experiment with new concepts and this type of education will give some tools to the students and the necessary techniques to face up solving real problems

In the last decades a great quantity of technical advances have been produced. We can stand out: a great development of statistical programs; a wide availability of resources in the classroom, as the possibility of use of the computers and the access to Internet... This allows us to confront a new methodology of learning in order to obtain an improvement of university teaching quality. Nevertheless this process is at an initial stage in the majority of the licentiates that do not centre specifically on the didactics. We think that it is necessary to think to advance in this process and to make it extensive to the major possible number of subjects and licentiates.

At present, a increasingly number of professionals of different areas are facing a great quantity of information that they need to organize, to analyze and to interpret. Even in some occasions they have to raise the previous phase of data capture. It is necessary a suitable instrument to be able to carry out this process and that the extracted conclusions are worth. The Statistics is the tool that it makes possible to carry out the process of planning, accomplishment and interpretation of an research based on set of information. It is necessary, therefore, a knowledge of this tool that allows us to apply Statistics like the most effective and objective possible form.

The formation needs that the labour world demands, need that subjects of experimental character, as the Statistics, are presented in a new way. It is necessary to confront this renovation of the contents and methodology in the education of the statistics with the help of the available resources at present. The project that we propose is orientated to cause a better comprehension and assimilation of the concepts and statistical methods. For it, we propose the utilization of real databases, doing a special support in the design of the study, in the accomplishment of the analysis and the interpretation of results provided by computer programs.

From the beginning of the course, the students have access to all the information relating to the process of data capture, the variables with which one works and the aims that we want to reach. We want that our own students deduce tools the Statistics provides to them. In view of a set

of information, what is it necessary to know about them? How to handle big volumes of information?, how to obtain results from analysis? With this project, we want to join the contents explained in class to the reality and to establish a narrow relation between theory and practice. The classic distinction between theory hours and practice hours turns into analysis of real suppositions. The practice forces to the development of the theory and the theory allows the development of the practice and the students are who observe this narrow relation.

Our offer of methodology has centred on the Licentiate of Environmental Sciences, with students who have studied Mathematics but not Statistics. We consider to introduce the concepts and statistical technologies corresponding to the contents of the subject "Statistics." We'll work with information yielded by the Department of Ecology of the University of Granada. We manage different measures realized on the leaves of the oaks in five zones different from the province of Granada.

METHODOLOGY

How to achieve that the student wants to learn? What to do in order that the students consider important what it's explained in class? How to transfer the acquired knowledges and to apply them in real life? We feel the need of a change of methodology in the sense of getting that the students elaborate the concepts and knowledges that they have to learn, using situations created by the teacher in order to wake their interest up. It is necessary to introduce learning strategies to facilitate and to allow that the students learn to learn.

The first step is going to be that the students will work with a set of real information since the beginning of the course. We will describe the information, the form in which they have been gathered and the variables with which one works. The students are induced to work with the information. The following step is to allow that the Statistics is born as a fruit of the questions that are asked in classroom by the teachers. Our aim is to motivate the students to demand the theoretical concepts that could solve a situation.

At the same time that the students are acquiring new concepts we are introducing them to handle some statistical package that will allow them a better manipulation and analysis of big masses of information. The management of a package is an important aim since the use of the statistical technologies is tied to the computers. A traditional problem in the education of the Statistics has been the existence of a lack of coordination between the comprehension of the concepts and the technical application.

When the students know the data, the teacher would help to organize a table of frequencies, making them to see its utility to summarize the information. Some questions could be proposed to cause that the students obtain a visualization of the information, graphical representations and measures that represent them. At this point, the students will understand the need of introducing and identifying the new concepts to allow to continue the analysis of the information.

Later, we could question if there are relations between the variables. The students could try to find some function that establish functional relation between the variables, but how do the student know if the function has been chosen correctly? Which will be the function that explain the information in the better way?...

The diverse statistical techniques are applied by means of the package SPSS and later the students will repeat the process on a sample. It is possible that the obtained results are compared in the population and in the sample. It would be suitable to organize students in equipments and every equipment selects one sample. They will obtain different results for the same objectives. In this moment, it is possible to raise the question, are valid for whole of the population the conclusions that we have obtained for the sample? The need of the statistical inference arises in a natural way.

In the problems and "traditional" exercises we are centered in one only concept. When we work with real information, we have to work with various contents simultaneously, this fact helps us to relate different concepts. In this way, the process of statistical reasoning is emphasized an at the same time, the students know all the statistical concepts and procedures.

The development of the course consists of presenting the different phases of a statistical investigation: approach of a problem, decision on the information to gather, data capture of the

information to the designed plan and analysis of the information with the statistical appropriate technologies. Finally, the conclusions are obtained.

This philosophy consists of the study of the information from all possible perspectives and with all possible tools. The intention is to extract all the information to generate new hypotheses. Unquestionably, this one is an advanced curricular offer. We propose to join a major variety and quantity of statistical contents and a change in the way of teaching. We propose to centre the statistics on the applications and showing its usefulness from diverse areas.

OBJECTIVES

The objectives that we want to reach applying this methodological change are the next:

- We try that the learning for these students is effective and stimulant, that they perceive the need and utility of the concepts and statistical methods. The student has to want learn Statistics.
- We propose that the students should understand the narrow relation between the theory and the practice. The students connect with real problems and try to look for solutions and interpretations using different statistical procedures from the first day of class.
- We claim that the students notice the relation between different matters of their "curriculum". The utilization of information gathered in other knowledge areas allows us the transmission of an interdisciplinary knowledge.
- We want to promote the training of creative, innovative and critical professionals that know how to react to different situations in agreement with their formation.

WHY A STATISTIC BASED ON A DATA SET?

We think that the introduction of this methodology can improve the teaching quality for several motives:

- The classic distinction between hours of theory and hours of practices turns into analysis of real suppositions. The practice forces the development of the theory and the theory allows the development of the practice and the students are who observe this narrow relation.
- The students know a Statistics focused on the applications, the need of this subject and its usefulness appears in diverse areas.
- With this methodology the students have to comment and debate between them the aims of the work, the statistical procedures that they have to use and the conclusions that are obtained after analyzing the information. With this teaching system, a creative and critical spirit of work is fomented between the students. And these values will serve them in their personal formation and in their professional future.

FINAL COMMENTARIES

The study of the Statistics using real information predisposes the students to form their opinions in agreement with the evidence provided by the information. The students notice the complexities of the treated topics and they can see the need of using a suitable tool. The study of real events lets them to notice that there are a lot of aspects in life that are immersed in the uncertainty. The Statistics turns in the instrument which lets to analyze the situations that the students will find in their labour future. We try to integrate the statistics into the general investigation process: planning, data capture, organization of the information, analysis and interpretation of the results.

We are conscious that the project that we propose contains a series of difficulties that we will have to resolve progressively. The project has to be realist, opened to changes in its development and adapted at the level of the students. In the development of the course, we have to give priority to the autonomous search of solution by the students. It is necessary to debate, to propose, to solve or simply think about the analyses which are going to be done.

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