

USING INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT'S) TO INTRODUCE IN THE STATISTIC

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Currently, Information and Communication Technologies (ICT's) play a significant role in teaching processes more in those areas where the lecture class does not invite students to keep alive the interest in the subject matter. Introducing students to statistics requires teaching and learning models that allow the student to interact quickly with the data and facilitate understanding and knowledge of their environment. Implementing ICT's to introduce in the Statistics allows the student to explore, know and analyze data in a dynamic and collaborative way.

INTRODUCTION

Teaching statistics has multiple challenges, mainly with non-math students. Information and Communication Technologies (ICT's) play a significant role in this process because it allows the student to explore, know and analyze data in a dynamic and collaborative way.

ICT's were applied in three courses Introduction to Statistics (Human Sciences Students), Applied Statistics (Engineering Students) and Seminar on Deepening in Econometrics (Economics Students) with the objective to compare it in different levels of formation. This document is about the results of a practical experience in the courses directed by the author. It is a pilot study.

COMMON PROBLEMS

To introduce a student to Statistics is a hard work. Meanly if the student is non-math. In many cases, problem refers to collective imaginariun about what is the use of statistics (only averages, only frequencies), what is the calculations necessary and what graphics need to show. Below is shown, some problems identified by the non-math students:

- Statistics, in many cases, seems to be abstract for the student.
- It is believed that statistics are only averages and frequencies.
- Starting, only calculations.
- There is not an interesting way to practice statistics for non-math students.
- The study cases are written and not interactive.

In each case, it is necessary to search a better way to introduce the students to statistics and ICT's. meet some requirements.

WHY ICT'S?

Fantini (2008) says that the construction of knowledge should be sought and, in this context, ICTs facilitate the interaction of process actors: teachers and students, using various information channels:

- Forums and debates on-line
- Collaborative working
- Interactive apps, etc.

USING NOTEBOOKS AND OTHER VISUALIZATIONS

Another problem not expressed by students, but observed in practice, is the use of software. Several free programs use intuitive interfaces that, in some cases, do not allow the student to appropriate the concepts. On the other hand, less intuitive free software (as in the case of R) allows for the appropriation of concepts, but it learning curve hinders its use. Furthermore, any software, offers only processing and visualization of data.

Introduce to statistics requires more than processing and visualizing data, it requires to help the students inside-outside classroom. Notebooks are a good tool for this because students can

process data and to do an interactive work. Also, a bookwork allows better understand the algorithms of programs like R or Phyton and add explanatory text in the same visualization.

In the practice, it has been observed the usefulness of some Notebooks:

- Jupyter: for R, RStudio and Phyton.
- Knitr: for R or RStudio
- Github: really is not a notebook but it is possible to use markdowns for any software.

These Notebooks were used in all courses (Introduction to Statistics, Applied Statistics and Deepening Seminary in Econometrics). Figure 1 shows results about the survey used to test it. Students were rated from 1 to 5 the following aspects: usability, ease of access, interaction with other subjects and understanding of the algorithm combining applications. In general, the rated was 4/5. Rated about the notebooks in each group was similar. Human sciences students considered the ease of access with better punctuation, engineering students rated better the interaction with other subjects and economics students rated better the understanding of the algorithm using notebooks.

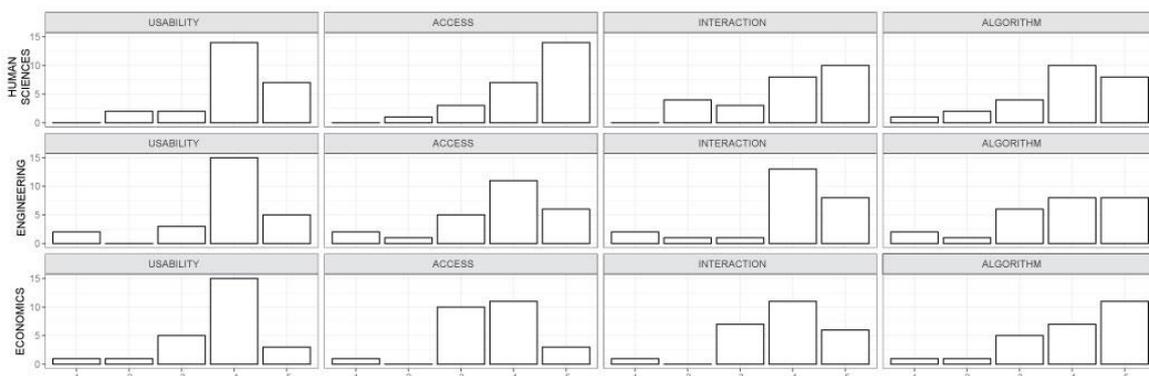


Figure 1: Survey Results, students rated this aspects in Notebooks: usability, ease of access, interaction with other subjects and understanding of the algorithm

Special Visualizations

Power BI is a software for Business Intelligence with free and professional licenses. It is a good tool for study cases because teachers and students can use concepts from statistics and to build any visual interactive app.

In practice, this app has been used to explain regression models, descriptive statistics, spatial data, time series, fixed and random effects, etc., using dashboards like in Figure 2. The Students are showed growing interest in statistics applications using the app. They can use it inside-outside classroom using cellphones, tablets or PC.

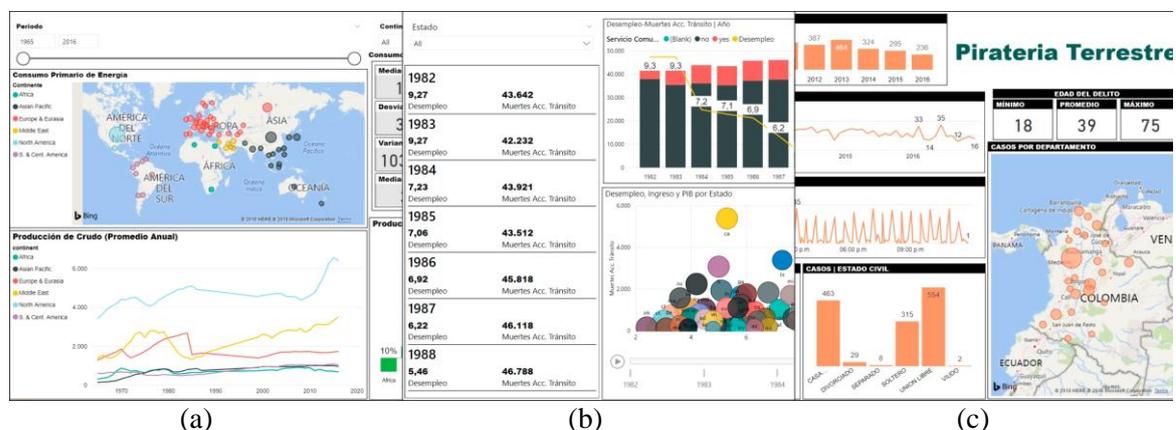


Figure 2: Different dashboards from Power BI used to explore data in study cases; (a) Consumption – Production Oil and Energy; (b) GNP – Traffic Accidents; (c) highway robbery

Using Power BI, students could discuss every case study combining scenarios, changing variables, moving the data and/or focuses the case. Impressions about this item is not tested yet.

COLLABORATIVE WORKING

Notebooks have promoted the use of collaborative working inside-outside classroom. Especially, those spaces where the student can share the results of their tasks. Some of the advantages of implementing collaborative work to introduce statistics are:

- Discussions rich in the convenience of applying statistics.
- Increasingly complex and deep case studies of your specific area of knowledge.
- Appropriation of the correct use of statistics.

RESULTS

In this study, ICT's were implemented and tested using Moodle, the learning platform used in Universidad Industrial de Santander (Industrial University of Santander). Three courses with 25 students in total with different areas and levels of formation: Introductory (Human Sciences), Applied (Engineering) and Deepening (Economics).

Previous experience in the courses of applied and deepening levels (without ICT's experience) was evaluated and it was compared with the course of introductory level to end of period. Students answered three questions: Statistics focuses on issues that interest me, Statistics is important for my professional practice, and Statistics contributes to my professional training. They should rate their assessment in five categories: Never, Hardly Ever, Sometimes, Almost Always and Always. Table 1 shows results. The incidence in the category "Never" was 0.0 in each case. Note that incidence in "Hardly Ever" and "Sometimes" was higher, in more cases, when students not had experience with TIC's that in the group that was exposed to use to ICT's. When students were exposed to ICT's their assessment about statistics was positive; incidence in "Almost Always" and "Always" was higher in this case.

Table 1: Assessment about Statistic with prior experience (applied and deepening without ICT's) and post experience (introductory with ICT's)

	Statistics focuses on issues that interest me		
	Applied and Deepening	Introductory	
Never	0,0000	0,0000	0,0000
Hardly Ever	0,1538	0,0000	0,0800
Sometimes	0,0769	0,0833	0,0800
Almost Always	0,5385	0,5833	0,5600
Always	0,2308	0,3333	0,2800
	Statistics is important for my professional practice		
	Applied and Deepening	Introductory	
Never	0,0000	0,0000	0,0000
Hardly Ever	0,0769	0,0000	0,0400
Sometimes	0,2308	0,0000	0,1200
Almost Always	0,3846	0,1667	0,2800
Always	0,3077	0,8333	0,5600
	Statistics contributes to my professional training		
	Applied and Deepening	Introductory	
Never	0,0000	0,0000	0,0000
Hardly Ever	0,2308	0,0833	0,1600
Sometimes	0,2308	0,0000	0,1200
Almost Always	0,3846	0,2500	0,3200
Always	0,1538	0,6667	0,4000

CONCLUSION

Implementing TIC's to introduce statistics allows the student to explore, know and analyze data in a dynamic and collaborative way. Students need help inside-outside classroom and ICTs facilitate the interaction of process actors: teachers and students, using various information channels.

REFERENCES

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