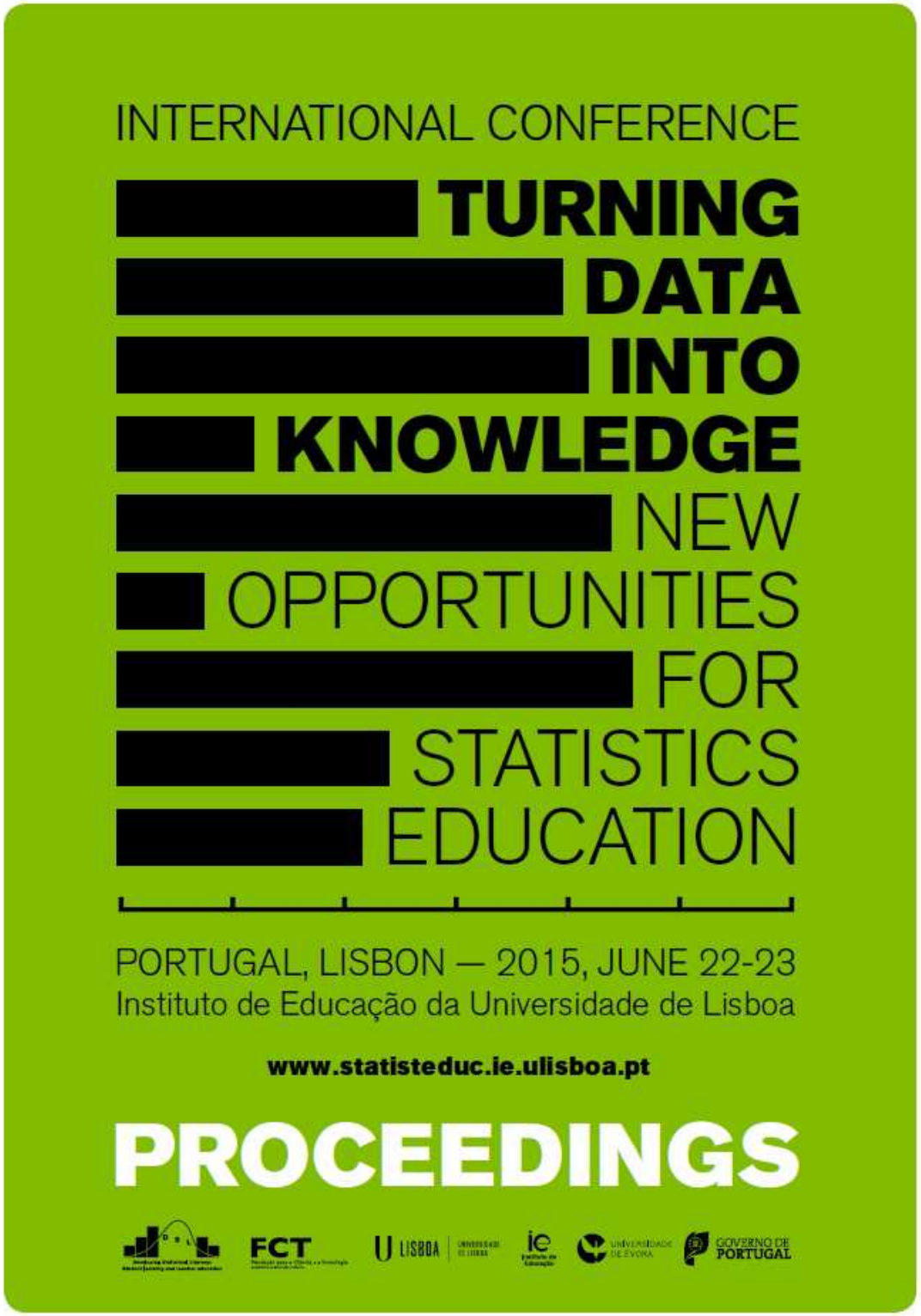

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE TURNING DATA INTO KNOWLEDGE: NEW OPPORTUNITIES FOR STATISTICS EDUCATION

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Institute of Education of the University of Lisbon

Portugal

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Developing Statistical Literacy: Student learning and teacher education

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INTRODUCTION

WELCOME TO LISBON, WELCOME TO THE CONFERENCE

"Over seven hills, which are as many points of observation whence the most magnificent panoramas may be enjoyed, the vast irregular and many-coloured mass of houses that constitute Lisbon is scattered. For the traveler who comes in from the sea, Lisbon, even from afar, rises like a fair vision in a dream, clear-cut against a bright blue sky which the sun gladdens with its gold. And the domes, the monuments, the old castles jut up above the mass of houses, like far-off heralds of this delightful seat, of this blessed region. The tourist's wonder begins when the ship approaches the bar, and, after passing the Bugio lighthouse – that little guardian-tower at the mouth of the river built three centuries ago on the plan of Friar João Turriano –, the castled Torre de Belém appears, a magnificent specimen of sixteenth century military architecture, in the Romantic-Gothic-Moorish style. As the ship moves forward the river grows narrower, soon to widen again, forming one of the largest natural harbours in the world with ample anchorage for the greatest of fleets. Then, on the left, the masses of houses cluster brightly over the hills. That is Lisbon.

Fernando Pessoa in "Lisbon, what the tourist should see"
(1925) http://lisbon.pessoa.free.fr/InteractiveBook.php

Lisbon's description by the famous Portuguese poet Fernando Pessoa introduces you to some of the many beautiful types of scenery in this city, with the almost constant presence of sunshine and the River Tagus. It is a city whose history spans back thousands of years, which you can discover walking through its seven hills. There are innumerous experiences that can be lived in Lisbon: walking through characteristic neighborhoods, visiting streets filled with heritage monuments and museums, relaxing in one of the many gardens, belvederes and esplanades, and enjoying the pleasure of its gastronomy.

We are delighted to welcome you to Lisbon and particularly to the International Conference *Turning data into knowledge: New opportunities for statistics education*, being held at the University of Lisbon. This public university has eighteen faculties and institutes throughout the city of Lisbon and surrounding municipalities. It was the first university created in Portugal, in 1288. The university was later transferred to the Portuguese city of Coimbra, in 1537. In the late eighteenth century, it was reestablished in Lisbon. Recently, in 2013, the University of Lisbon merged with the Technical University of Lisbon, forming the ULisboa that is now the largest university in Portugal with more than 48 000 students.

This conference has been an initiative of the Portuguese research project DSL – *Developing statistical literacy: Student learning and teacher education* – involving the Institute of Education of the University of Lisbon and the University of Évora,

and supported by a group of leading international researchers in statistics education who took part in the Scientific Committee to whom we are deeply grateful.

The Conference was sought to be an opportunity to gather researchers, teacher educators and teachers interested in statistics education, to exchange experiences, and to present and discuss recent research and current projects. Therefore we invite all participants to contribute actively to the debate throughout the conference sessions and to meet different people at the lunch and coffee breaks to share ideas and experiences.

The Scientific Programme

Currently, statistics education takes place in a new social and cultural context and faces a global challenge of meeting the calls for statistically literate and informed citizens who are able to **turn data into knowledge**. Such a challenge provides new opportunities to rethink both what statistics we teach and how we teach statistics. Doing so is imperative in order to develop students' ability to reason about data and to use them effective and critically, in their daily life, for prediction and decision-making.

It is well known by both researchers and practitioners in school that statistical literacy and reasoning, which call for critical, investigative and communicative skills, prove to be difficult to students. Thus, current international curriculum recommendations suggest data-orientated approaches for teaching statistics, at all levels of schooling, using real data and taking advantage of available technology. Furthermore, to develop their statistical literacy and reasoning, students are expected to deal with data in significant and authentic contexts. This conference addresses these challenges and opportunities for statistics education, for all school levels.

Two strands have been defined for the conference – Statistical literacy and Statistical reasoning – and these are the broad themes of the two Plenary Talks, presented by Janet Ainley and Dani Ben-Zvi, respectively. These two strands encompass a diversity of topics of research and projects, such as technology-enhanced learning and teaching practice with technology, as well as research in teacher education and in professional development, namely teachers' systematic research about their own practice. More broadly the programme also intends to add to the discussion about statistics education, namely in what concerns its aims and diverse curriculum issues through the Plenary Panel that will take place in the last part of the conference.

This 2-day Conference includes also other types of sessions: Research Papers, Short Oral Communications, Posters presentations and Workshops. All the received contributions as Research Papers (RP), Short Oral Communications (SO) and Posters were submitted to a blind review process and the final contributions are now collected on these proceedings. We would like to thank the reviewers, whose names

KNOWLEDGE ABOUT ARITHMETIC MEAN: A STUDY WITH FUTURE TEACHERS

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ABSTRACT

Throughout their school years students experience different trainings and teaching processes which influence their learning of statistic concepts and procedures, taking for granted that, especially for future teachers, these concepts should be well clarified and consolidated. This analysis has as basis a study undertaken with 40 future teachers in the 1st year of the License Degree in Basic Education. The aim was (i) to identify students' statistical knowledge at the beginning of their degree, and (ii) to assess the influence of the intervention of the curricular unit *Numbers and Statistics* in the progression of this knowledge (Martins, Pires, & Barros, 2009). An investigation methodology of a qualitative kind has been followed, in which the collection of data has been conducted using a questionnaire applied at the study's beginning, participant observation during the classes and a summative test at the end. For this presentation we selected the data related to the arithmetic mean.

Knowledge of the students about the concept of mean

At the start of the curricular unit the students presented considerable difficulties in dealing with the concept of arithmetic mean. When asked to write down what they mean by "mean" almost half of them did not answer and 30% only associated it with the algorithm used for its calculation. When "calculating" the mean of a qualitative variable there were no correct answers and 43% of the students did not answer. In the case of a quantitative continuous variable, only 8% of the students performed the correct calculation and half of them did not answer. In the calculation of the mean for a quantitative discrete variable there were higher performance indexes, although 40% of the students did not answer or provided an incorrect answer.

As the curricular unit progressed, difficulties were still felt when qualitative variables (calculating the mean of the absolute frequencies was a common mistake) or continuous quantitative variables were at stake. An evolution in the understanding of the concept of arithmetic mean was noticed, with one third of the students associating it with an equilibrium value in the data.

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STATISTICAL THINKING ABOUT VARIATION IN DATA: A STUDY WITH YOUTH AND ADULT STUDENTS

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ABSTRACT

In Brazil, the teaching modality called Youth and Adult Education (EJA) aims to serve those people who did not complete their studies at the time set by the regular curriculum. Curriculum guidelines for EJA emphasize that mathematical and statistical knowledge are important for those who are returning to school, because such knowledge can help them exercise their citizenship. Statistical thinking can be defined as the ability to make appropriate use of statistical tools to solve problems, to understand the essence of the data, to make inferences, and to recognize and understand the value of statistics (Cazorla, 2002). This poster draws from a research project that will investigate aspects of students' statistical thinking who are enrolled in EJA while they respond to questions related to data variation in statistical media graphs. The data collected will be analysed from the perspective that *variability* is the characteristic of the entity that is observable, and *variation* is related to describing or measuring that characteristic (Reading & Shaughnessy, 2004). The participants will be students from an EJA group at a public school in Pernambuco, Brazil. Initially, we will apply a diagnosis instrument composed of four graph interpretation tasks. It is expected that important aspects to be analysed from students' responses will be related to their ability to identify high and low points on the graphs, as well as the identification of the intervals of increase and decrease. To further investigate the participants' interpretative processes, we will also interview some of them. We will use the SPSS software for categorizing the participants' interpretations. The qualitative analysis of our research will focus on the data from interviews. The analytical categories will be based on types of answers to the questions of graph comprehension (Friel, Curcio, & Bright, 2001).

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