ISLP Newsletter
Newsletter of the International Statistical Literacy Project
2 (9) December 2017

Reija Helenius

Statistics in my life

This ISLP Newsletter will tell, amongst other things, great life stories that interlace with statistics. John Harraway, Teresita Terán and David Stern open the doors to their interesting lives. These articles are equally complemented by an article from the 'mathematics teacher of the year' in Finland- Kalle Vähä-Heikkilä tells how enthusiasm for statistics shows in a teacher's work and how it is conveyed to young students. These stories could and can, for their part, work as marketing speeches for the field of statistics and its opportunities.

Complementing this, statistical competitions have, for their part, the goal of also generating enthusiasm for statistics among young people. Peter Howley – the winner of ISLP's Best Cooperative Project award from 2017 – provides a model example of someone inspiring young students in Australia. In the last poster competition over 12,000 young students felt that important first spark of enthusiasm for statistics.

Also presented in the Newsletter are the ISLP Advisory Board, the ISLP Executive and the new President of IASE, Gail Burrill. These presentations tell the 'story of statistics in my life'. The newly appointmented ISLP Executive from Argentina is Adriana D´Amelio who works as a conduit to the Spanish speaking world. Bienvenida al comité ejecutivo de ISLP Adriana!

It's time to thank all of our ISLP countries for your continued support and commitment. Our country coordinator group is strong, over 170 members from 91 countries. We have also a new partner, JMP from SAS, which is the main sponsor of the 2018–2019 international poster competition.

From my part and on behalf of ISLP Executive, I wish you a peaceful New Year and vigour and energy for 2018. Let's welcome the New Year with the power of statistics. ■

Reija Helenius
ISLP Director
Head of Development
Statistics Finland
reija.helenius@stat.fi

ISLP Newsletter
in brief.. ▶▶

ISLP Newsletter is the newsletter of the International Statistical Literacy Project of the IASE – the International Association for Statistical Education.
Editors: Reija Helenius (Finland) reija.helenius@stat.fi; Pedro Campos (Portugal), pcampos@fep.up.pt; Steve MacFeely; (Ireland) steve.Macfeely@unctad.org; visit us at: http://iase-web.org/islp/ Layout: Riikka Turunen (Statistics Finland)

in brief...

Shu Wei Chou-Chen
and Oscar Hernández

Teaching basic statistics to blind students

Understanding statistics has become extremely important not only for researchers but also for the general public in order to understand publications that include statistical analysis. Having in mind promoting statistical literacy, teaching statistics to students not pursuing a career in statistics is a great challenge for any teacher. However, it is a much greater challenge when some of those students have visual impairment.

This challenge was undertaken by the first author while teaching two statistics courses to Henry Martínez-Hernández, a totally blind student doing a biology major at the University of Costa Rica (UCR), in the second semester of 2014 and the first semester of 2015. We describe this experience and give some recommendations based on what we learned after evaluating the results.

In 1995, the UCR established policies with the objective of promoting the participation of disabled persons in activities such as teaching, research and social action, and in addition, projecting this principle of involving disabled persons to the national community.

To implement these policies involving disabled students, the UCR created the Center of Aid and Services to Students with Disabilities *(Centro de Asesoría y Servicios a Estudiantes con Discapacidad, CASED).* CASED is the operative unit responsible for providing the necessary aid instruments to guarantee the access and equality of opportunities to the student population with disabilities, and for implementing projects, aid services, information and training directed to the university community. All these services are offered by an interdisciplinary team in coordination with other institutional units.

The introductory statistics courses in the biology major

There are two statistics courses: Statistics for Biologists I and II. The first course has Calculus I as a requisite.

Formal teaching in both courses covers sixteen weeks. Each week has three hours of theoretical contents and two hours of laboratory session for practical applications with R and Rstudio.

The first course covers descriptive and inferential statistical techniques and it aims to develop critical and statistical reasoning for solving biological problems. The second one provides advanced statistical tools, such as experimental designs, regression analysis and multivariate analysis, to aid students with their research projects in the biological field.

The evaluation of students in the two courses are slightly different, but both courses include theoretical exams (concepts and calculations), practical exams in the computing laboratory using R, quizzes, homework (solving problems by hand and with R), and a research work involving sampling, data analysis, and a final report. The second course, unlike the first one, requires calculations carried out with R only due to the complexity of model estimation.

Teaching strategies and aids offered to the student

Since learning statistics is heavily based on visual and logical abilities, much of the content requires the use of graphs (histograms, box plots, probability distributions, scatter diagrams, regression line, principal components, etc.), especially when faculty relies on visually-based teaching material. This leads to some teaching disadvantages for visually impaired students.

In order to overcome these disadvantages, graphs were made by a Braille printer. They were very useful for understanding concepts like histograms, probability distribution and several others. For instance, by touching the points in a scatter graph, the student could differentiate positive from negative correlations, strong from weak correlations, and 'feel' the regression line (Graph 1). In less formal situations, with the cooperation of non-visual impaired students and of an assistant student, graphs were drawn in foam paper to produce tactile displays.

One week before each theoretical class, the student received a copy of the teacher's class presentation and other documents, in digital form, together with graphics in Braille made by CASED. With the help of an assistant, mathematical and statistical formulas were converted to oral form to allow the student to use JAWS (Job Access With Speech)–a screen reader which cannot read mathematical notation–and to help him study the material without any assistance. The teacher also helped by explaining verbally each one of the mathematical expressions written on the blackboard. This helped him take notes and understand statistical formulas easily.

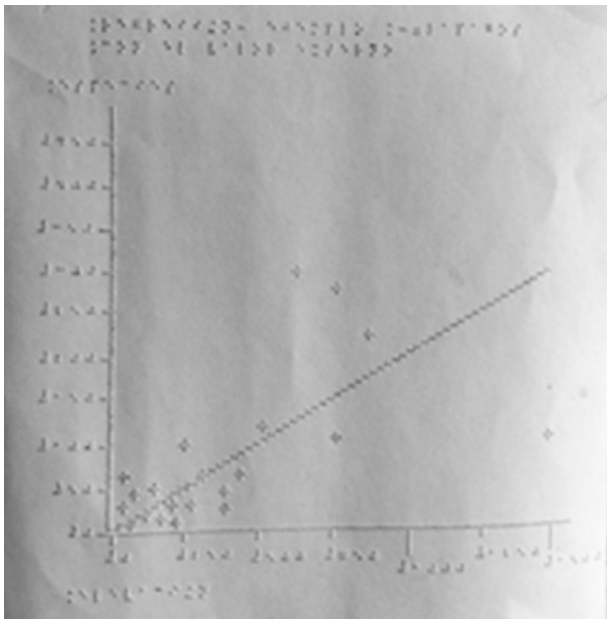
The theoretical exams were provided to the student as a Word file. Using JAWS, he was able to solve the exams

by himself, requiring only half an hour of extra time. Any graph included in a problem was provided in Braille code.

The performance of the student in the written theoretical exams was very satisfactory. According to him, he had no problems in understanding the theoretical classes. Group work and research work were particularly beneficial to him by enhancing interaction with other students and reinforcing the comprehension of fundamental statistical concepts and methods.

For the laboratory exams, JAWS screen reader can convert text in audio for common programs like Microsoft Word, Excel and PDF documents. However, JAWS cannot read R codes and outputs, and this caused some problems with laboratory work involving R.

Some of the difficulties dealing with R affected the overall performance of the student in the practical exams. In the first course, he was in the upper 10% of the class, while in the second course he was in the upper 30% of the class.



Graph 1. Scatter graph and regression line in braille characters.

An evaluation by the student of the teaching strategy

Concerning the courses related to mathematics like calculus and statistics, the opinion of Henry was that they meant more than an academic requisite, they also became a personal challenge. The challenge was not only cognitive, but also with ways of adapting to the use of teaching materials, converting contents to other languages, and using new teaching aids different to the blackboard and the video beam projector. He emphasized that the cooperation of teacher and other students was primordial for obtaining positive results.

The student also stressed the constant effort and compromise demanded from him, and the benefits he received from the personal attention offered by his instructor in solving problems, and from the class experience of listening to general explanations given to all students concerning the conventional approach for solving problems and applying it to his particular needs. He concludes that: "The experience was valuable and successful because it was participative; it was not based on recipes on how to do things; all parts involved offered their best disposition, and also because creativity and wit to face situations were part of the strategy." (Martínez Hernández, Henry, personal communication).

Recommendations and conclusions

There is a lack of appropriate software to aid totally blind students in the quantitative field. A computer program such as JAWS provides them the possibility of reading textbooks and documents by themselves, but it does not include mathematical notation. Most of the statistical software programs are not designed for blind people. It is necessary to create statistical software that allow interaction with screen readers such as JAWS, to help blind students to perform statistical analysis by themselves.

It is very important to establish an effective communication between the teacher and blind students, especially when the former has not received any training in teaching visually impaired students. Concerning exams, multiple-choice items may be a better option or oral examinations. Specifically, oral tests focused on interpretations of basic statistical concepts and results may be more useful for blind students.

Acknowledgements

The authors acknowledge the great cooperation provided by Henry Martínez Hernández, who not only offered valuable recollections of his experience while attending courses, but also his personal written evaluation of the teaching strategy applied to him. ■

Shu Wei Chou-Chen
PhD student at Institute of Mathematics and Statistics, University of São Paulo
email: shuchou@ime.usp.br

Oscar Hernández
Retired Professor, School of Statistics
University of Costa Rica, San José, Costa Rica
email: oscar.hernandezrodriguez@ucr.ac.cr