Overview of the IASE Roundtable Conference, Berlin July 2016: *Promoting Understanding of Statistics about Society*

Preface

From July 19 to 22, 2016, sixty delegates from twenty different countries met at the Max-Planck-Institute for Human Development in Berlin (MPIB) for an invitational Roundtable conference on the theme: "Promoting Understanding of Statistics about Society". The conference was organized by the International Association for Statistical Education (IASE) in collaboration with the ProCivicStat project (PCS) which is funded by the European Union under its Erasmus+ program. The Conference was sponsored by the Max-Planck-Institute and several other organizations, listed later below. The four-day conference included 34 refereed paper presentations, 5 extended workshops, special presentations by ProCivicStat, a general discussion session, a poster session, intense general discussions, and social activities. An additional and special highlight was the plenary lecture by Prof. Ralph Hertwig, director of the Max-Planck-Institute.

Why focus on statistics about society? Data on important societal topics are becoming increasingly accessible to the general public and to individual citizens or social action groups, on a huge range of topics such as migration, employment, social (in)equality, demographic changes, crime, poverty, access to services, energy usage, living conditions, health and nutrition, education, human rights, and many others. Understanding of such issues is essential for civic engagement in modern societies, but *involves statistics that often are open, official, multivariate in nature, and where patterns in data can change over short time periods* – such data are usually not at the core of regular statistics instruction. Making sense of these statistics requires the ability to explore, understand, and reason about complex multivariate data, because social phenomena do not happen in a vacuum, and their understanding requires awareness of how variables co-vary, or affect each other, or are situated in a network of causal factors that may change over time in complex ways. However, in many countries, the statistics curriculum at high school and university does not prepare students to reason from such data or to deal with statistical ideas and methods that are used to analyse or report about such data.

Given the above, the goal of the Roundtable was to contribute to the development of conceptual frameworks, teaching methods, technology solutions, and curricular materials (especially for learners at the tertiary/college and high-school/secondary levels) that can support and promote learning and understanding of statistics about such social phenomena. Our declared ambition was to promote curriculum reform in statistics education that will broaden the skills that students acquire, in order to make them not only better as statisticians or in understanding statistics (if they are non-majors and only taking an introductory course), but also more empowered citizens who can take an active or more informed role in civic life.

The Roundtable brought together people from diverse backgrounds to map out new core skills, share teaching experiences using large data sets, explore pedagogical issues, examine emerging technologies for data exploration and display, and address challenges faced by any educational innovation. Delegates represented a wide spectrum of expertise, ranging from statisticians in academia, mathematics educators, cognitive scientists, political and social scientists, representatives from OECD and Official Statistics Offices to journalists and school teachers.

Conference Goal and Themes

Under the general theme "Promoting Understanding of Statistics about Society", the Roundtable addressed the following four sub-themes:

1. Key Concepts and issues related to understanding statistics about society

Understanding multivariate statistics about society requires skills and modes of thinking that are different from statistical analyses of uni- or bi- variate small sample experimental data. Analysis of multivariate data involves, among other things, dealing with: measurement issues and operationalization of variables; metadata and data provenance; non-linearity; understanding interactions; correlations; understanding Simpson's paradox; conditional probability; learning to read and critique novel complex graphs and visualisations. Several papers explored big statistical ideas pertaining to the knowledge and concepts needed to understand social statistics. Which knowledge bases, skills, and other enabling processes are needed to understand and engage with statistics about society? A conceptual framework is needed to inform the development of teaching methods, teaching materials and educational resources, technology solutions and datasets that can be used to promote understanding of statistics about trends in society by young adults and citizens in general, with the ultimate goal of helping civic engagement. A proposed conceptual framework was presented in a workshop organized by ProCivicStat, with illustrations from various public and media sources. Besides addressing cognitive knowledge elements (mathematical and statistical skills, socio-historical awareness and knowledge) some papers focused on how introducing issues of statistics about society provides opportunities to engage students in evaluating what social justice means to them through the lens of quantitative analytics. Thus, some papers investigated issues beyond cognitive skills, and addressed topics of beliefs, attitudes and values inherently involved when investigating social data. Beyond the presentation of papers, two workshops invited participants to explore core issues involved and conceptual knowledge needed for understanding data and decision making related to society.

2. Constructions and misuse of evidence and statistics about society in the public domain

If we expect our students to become active citizens who can understand the statistics published in the public sphere (by the media, official statistics producers, etc.), they need, among other skills, a sound knowledge base that includes context knowledge, basic mathematics, familiarity with (at least) elementary statistics and appropriate graphical and numerical ways of data representation, along with a capacity for critical thinking and a disposition to engage with evidence.

With the rise of a political culture in which public debate is framed by appeals to emotion disconnected from the details of policy – so called post-truth or post-factual politics (Oxford English Dictionary) - it is ever more important for citizens to be critical consumers of media reports, being aware of misuse of statistics and knowing effective ways to overcome them. Fortunately, official providers of statistical information are increasingly aware of their responsibility not only to disseminate data to stakeholders in government and business, but also to engage with (and educate) civic society. This theme focused on understanding and critical reception of social statistics in the media, and critiquing media accounts. It also addressed efforts by National Statistics Offices, OECD and EuroStat to increase statistical literacy with respect to understanding social data.

3. Concepts and reflective reports engaging social data in college and high school teaching

Under this topic we shared and discussed the creation and experiences of lessons and teaching modules that rely on open/official data, either using raw datasets or "public use" data files from an official statistics agency or an open source, or aggregate statistics (e.g., a collection of tables and/or graphs), taken from an external source, involving data that relate to civic phenomena or social trends. Some relevant teaching materials based on social data have been developed, e.g. by Statistics Canada, Gapminder Foundation, and the SMART Centre at Durham. Other materials have been published in journals for teachers. What are the challenges, obstacles and proven benefits in using such materials? Participants and presenters shared and discussed reflective reports on their concepts and teaching experiences at the tertiary/college and high school levels using rich and authentic data or large datasets that are relevant to understanding of social topics and civic phenomena.

4. Engaging social data with technology: Teaching and visualizing aggregated data and microdata

Accessing and managing open data and big data in the classroom requires capabilities to employ digital technology in an educationally accessible framework. New data visualisation and other technology-based tools are essential to improving the understanding of data and statistics about social phenomena. A great deal of information can be accessed from government resources and other institutions at the national and supra-national level (UN, Eurostat, World Bank, etc.), by NGOs (Gapminder, etc.) and interactive media websites. These include publicly available microdata as well as aggregated macrodata. Powerful tools are available for data visualization that allow users to engage with data in ways that are impossible using static displays. Several contributions focused on reporting experiences in accessing, managing and presenting large data sets in educational contexts, and on analysing the pedagogical and technological requirements to make these tools more accessible to learners and the general public. In this area, three workshops provided hands-on experiences with innovative software for data visualisation and analysis tools such as JMP, CODAP and Tuva, and demonstrated how to take advantage of the IPUMS platform for retrieving harmonized and documented social and economic data from around the world.

Organization, Support, Committees, and Acknowledgments

This conference would not have been possible without the support of many people, groups and organizations. First and foremost, we are most thankful to our host, the Max-Planck-Institute for Human Development and its two directors, Prof Gerd Gigerenzer and Prof Ralph Hertwig for their generosity in opening their institute for our meeting.

The conference was jointly managed and its program and activities planned by an International Program Committee (IPC) and Local Organizin Committee (LOC). The contributions of the following members of the IPC and LOC are greatly appreciated:

International Program Committee (IPC)

- Joachim Engel, (Chair), MPIB & Ludwigsburg University of Education, Germany
- Carmen Batanero, University of Granada, Spain
- Rolf Biehler, University of Paderborn, Germany
- Pedro Campos, Statistics Portugal & University of Porto, Portugal
- Iddo Gal, University of Haifa, Israel
- Peter Kovacs, University of Szeged, Hungary
- Laura Martignon, Ludwigsburg University of Education, Germany (LOC Chair)
- James Nicholson, Durham University, UK
- Jim Ridgway, Durham University, UK

Local Organising Committee (LOC)

- Laura Martignon (Chair), Ludwigsburg University of Education, Germany
- Achim Schiller, Ludwigsburg University of Education, Germany
- Jana Wegener, Max Planck Institute for Human Development, Germany

The main ideas and concepts in the preparation of this conference originated from the ProCivicStat project, a strategic Partnership within the ERASMUS+ program of the European Commission, involving 6 universities from 5 countries. ProCivicStat (see www.procivicstat.org) offers a platform for continuing cooperation, exchange of ideas, exploration and dissemination of theoretical concepts and concrete teaching materials for promoting civic engagement via exploration of evidence and understanding of statistics about society.

Meetings like this only happen because of the commitment of a number of people from around the world who are prepared to freely give much time and effort. We give special thanks to the authors of the papers and posters and the workshop leaders for their committed and engaged cooperation. We also thank the discussants and referees who gave generously of their time and expertise to do such a professional job to help improve the quality of the papers and provoke discussion during the

conference. Our thanks extends to the local helpers who did a wonderful job in organizing the logistics around this conference and who made us feel welcome and comfortable at this inspiring conference and research centre.

We also thank the support of the International Statistical Institute (ISI) and its Permanent Office Staff, and the financial support of the ISI-World Bank Trust Fund for Statistical Capacity Building (WBTFSCB) and the IASE which jointly supported the participation of several delegates from countries deemed "developing" by the World Bank. The conference was greatly helped by financial sponsorship by the IPUMS-International project and by the SAS Institute/JMP division, whose representatives also presented workshops and papes at the conference. Additional sponsors included DAGStat (German Consortium in Statistics), DZLM (German Center for Mathematics Teacher Education), and Verein zur Förderung des Stochastikunterrichts (German stochastics association). Last but not least, the conference benefitted greatly from the backing and ongoing advise of the IASE Executive Committee and IASE President Andrej Blejec, and received skilful service from the IASE webmaster, John Shanks.

You are invited to read the conference proceedings and all full papers and workshop descriptions here: http://iase-web.org/Conference_Proceedings.php?p=Promoting_Understanding_of_Statistics_about_Society_2016

Joachim Engel (Proceedings Editor and IPC Chair),
Iddo Gal & Jim Ridgway (for the International Program Committee)

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Group Photo with (most of) the participants