



# Statistics Education Research Journal

Volume 5 Number 1 May 2006

## **Editors**

*Iddo Gal*  
*Tom Short*

## **Assistant Editor**

*Beth Chance*

## **Associate Editors**

*Andrej Blejec*  
*Carol Blumberg*  
*Joan B. Garfield*  
*John Harraway*  
*Flavia Jolliffe*  
*M. Gabriella Ottaviani*  
*Lionel Pereira-Mendoza*  
*Peter Petocz*  
*Maxine Pfannkuch*  
*Mokaeane Polaki*  
*Dave Pratt*  
*Chris Reading*  
*Ernesto Sanchez*  
*Richard L. Scheaffer*  
*Gilberte Schuyten*  
*Jane Watson*

International Association for Statistical Education  
<http://www.stat.auckland.ac.nz/~iase>

International Statistical Institute  
<http://isi.cbs.nl/>

## **Statistics Education Research Journal**

The Statistics Education Research Journal (SERJ) is a peer-reviewed electronic journal of the International Association for Statistical Education (IASE) and the International Statistical Institute (ISI). SERJ is published twice a year and is free.

SERJ aims to advance research-based knowledge that can help to improve the teaching, learning, and understanding of statistics or probability at all educational levels and in both formal (classroom-based) and informal (out-of-classroom) contexts. Such research may examine, for example, cognitive, motivational, attitudinal, curricular, teaching-related, technology-related, organizational, or societal factors and processes that are related to the development and understanding of stochastic knowledge. In addition, research may focus on how people use or apply statistical and probabilistic information and ideas, broadly viewed.

The Journal encourages the submission of quality papers related to the above goals, such as reports of original research (both quantitative and qualitative), integrative and critical reviews of research literature, analyses of research-based theoretical and methodological models, and other types of papers described in full in the Guidelines for Authors. All papers are reviewed internally by an Associate Editor or Editor, and are blind-reviewed by at least two external referees. Contributions in English are recommended. Contributions in French and Spanish will also be considered. A submitted paper must not have been published before or be under consideration for publication elsewhere.

Further information and guidelines for authors are available at: <http://www.stat.auckland.ac.nz/serj>

### **Submissions**

Manuscripts must be submitted by email, as an attached Word document, to co-editor Tom Short <tshort@iup.edu>. These files should be produced using the Template available online. Full details regarding submission are given in the Guidelines for Authors on the Journal's Web page: <http://www.stat.auckland.ac.nz/serj>

© International Association for Statistical Education (IASE/ISI), May 2006

Publication: IASE/ISI, Voorburg, The Netherlands

Technical Production: California Polytechnic State University, San Luis Obispo, California, United States of America

**ISSN: 1570-1824**

### **International Association for Statistical Education**

**President:** Gilberte Schuyten (Belgium)

**President-Elect:** Allan Rossman (United States of America)

**Past-President:** Chris Wild (New Zealand)

**Vice-Presidents:** Andrej Blejec (Slovenia), John Harraway (New Zealand), Christine Reading (Australia), Michiko Watanabe (Japan), Larry Weldon (Canada)

## SERJ EDITORIAL BOARD

### Editors

Iddo Gal, Department of Human Services, University of Haifa, Eshkol Tower, Room 718, Haifa 31905, Israel. Email: iddo@research.haifa.ac.il

Tom Short, Mathematics Department, Indiana University of Pennsylvania, 210 South 10th St., Indiana, Pennsylvania 15705, USA. Email: tshort@iup.edu

### Assistant Editor

Beth Chance, Department of Statistics, California Polytechnic State University, San Luis Obispo, California, 93407, USA. Email: bchance@calpoly.edu

### Associate Editors

Andrej Blejec, National Institute of Biology, Vecna pot 111 POB 141, SI-1000 Ljubljana, Slovenia. Email: andrej.blejec@nib.si

Carol Joyce Blumberg, Department of Mathematics and Statistics, Winona State University, Winona, MN 55987-5838, USA. Email: cblumberg@winona.edu

Joan B. Garfield, Educational Psychology, 315 Burton Hall, 178 Pillsbury Drive, S.E., Minneapolis, MN 55455, USA. Email: jbg@umn.edu

John Harraway, Department of Mathematics and Statistics, University of Otago, P.O.Box 56, Dunedin, New Zealand. Email: jharraway@maths.otago.ac.nz

Flavia Jolliffe, Institute of Mathematics, Statistics and Actuarial Science, University of Kent, Canterbury, Kent, CT2 7NF, United Kingdom. Email: F.Jolliffe@kent.ac.uk

M. Gabriella Ottaviani, Dipartimento di Statistica Probabilità e Statistiche Applicate, Università degli Studi di Roma "La Sapienza", P.le Aldo Moro, 5, 00185, Rome, Italy. Email: Mariagabriella.ottaviani@uniroma1.it

Peter Petocz, Department of Statistics, Macquarie University, North Ryde, Sydney, NSW 2109, Australia. Email: ppetocz@efs.mq.edu.au

Lionel Pereira-Mendoza, National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616. Email: lpereira@nie.edu.sg

Maxine Pfannkuch, Mathematics Education Unit, Department of Mathematics, The University of Auckland, Private Bag 92019, Auckland, New Zealand. Email: m.pfannkuch@auckland.ac.nz

Mokaeane Polaki, School of Education, National University of Lesotho, P.O. Box Roma 180, Lesotho. Email: mv.polaki@nul.ls

Dave Pratt, Centre for New Technologies Research in Education, Institute of Education, University of Warwick, Coventry CV4 7AL, United Kingdom. Email: dave.pratt@warwick.ac.uk

Christine Reading, SiMERR National Centre, Faculty of Education, Health and Professional Studies, University of New England, Armidale, NSW 2351, Australia. Email: creading@une.edu.au

Ernesto Sanchez, Joaquín Romo # 68 – 9, Col. Miguel Hidalgo; Del. Tlalpan, 14260 México D. F. Email: esanchez@cinvestav.mx

Richard L. Scheaffer, Department of Statistics, University of Florida, 907 NW 21 Terrace, Gainesville, FL 32603, USA. Email: scheaffe@stat.ufl.edu

Gilberte Schuyten, Faculty of Psychology and Educational Sciences, Ghent University, H. Dunantlaan 1, B-9000 Gent, Belgium. Email: Gilberte.Schuyten@UGent.be

Jane Watson, University of Tasmania, Private Bag 66, Hobart, Tasmania 7001, Australia. Email: Jane.Watson@utas.edu.au

## TABLE OF CONTENTS

Editorial	2
Message from Flavia Jolliffe	3
New Editorial Board Members	4
Felicity Boyd Enders and Marie Diener-West <i>Methods of Learning in Statistical Education: A Randomized Trial of Public Health Graduate Students</i>	5
Marie-Paule Lecoutre, Katia Rovira, Bruno Lecoutre, and Jacques Poitevineau <i>People's Intuitions about Randomness and Probability: An Empirical Study</i>	20
Daniel Canada <i>Elementary Pre-Service Teachers' Conceptions of Variation in a Probability Context</i>	36
J. Richard Alldredge and Gary R. Brown <i>Association of Course Performance with Student Beliefs: An Analysis by Gender and Instructional Software Environment</i>	64
Past IASE Conferences	78
Other Past Conferences	79
Forthcoming IASE Conferences	80
Other Forthcoming Conferences	83

## EDITORIAL

The new year has brought transitions to SERJ. Flavia Jolliffe and Chris Reading have ended their terms as Co-editor and Assistant Editor, respectively. We are pleased to report that both have agreed to continue to share their expertise with the statistics education research community as SERJ associate editors. Thanks to both of them for their tireless work to promote SERJ and ensure the highest standards of quality in peer review and publication. Flavia deserves special thanks for shepherding the articles that appear in this issue of SERJ through the review process.

We welcome Beth Chance from California Polytechnic University, San Luis Obispo as the new SERJ Assistant Editor. Beth will work with the editors and authors to prepare the SERJ articles and announcements for publication. We are very grateful that Beth is willing to share her time and technical expertise.

We also welcome Peter Petocz as a new SERJ Associate Editor. Peter is currently a faculty member at Macquarie University in Sydney, Australia. We are eager to provide opportunities for Peter to share his extensive knowledge and experience within the SERJ manuscript review process and in guiding the policies and procedures of SERJ through service on the editorial board.

SERJ has already received 15 original manuscripts in the first five months of 2006. This is an increase over past years, and represents the growing awareness of and respect for peer reviewed statistics education research. We will continue to work to foster growth both in the number and quality of SERJ submissions.

We hope that the upcoming International Conference on Teaching Statistics (ICOTS-7) to be held in Salvador (Bahia), July 2-7, 2006, will provide researchers with not only the opportunity to present their work and publish in the conference proceedings, but to also submit a more elaborate report to SERJ. We encourage interested authors to consult our author guidelines, and also attend to the advice there regarding needed differences between Proceedings papers and more elaborate papers submitted for SERJ review, in order to avoid duplicate publishing.

Several SERJ activities are being planned for ICOTS-7. A lunchtime workshop on July 7<sup>th</sup> is designed for prospective authors; it focuses on writing and publishing research papers in peer-reviewed journals such as SERJ and on ways to avoid common problems found in manuscripts being submitted for review. Another lunchtime workshop on July 3<sup>rd</sup> is designed for current and future referees of papers submitted for review; it will examine the role of a referee in the scientific review process, and make suggestions for improving referees' work in light of what is sought in high-quality papers and the 'critical yet supportive' spirit expected in a referee report. If you intend to attend ICOTS and consider publishing research papers or helping as a journal referee, make sure to include these events in your planning.

The current issue of SERJ represents the first issue in the fifth year of the journal's existence. We feature three articles on a variety of topics. The article by Boyd Enders and Diener-West illustrates how a randomized trial can be used in education research, specifically to demonstrate that active learning can enhance student learning in an introductory biostatistics course. Lecoutre, Rovira, Lecoutre, and Poitevineau present empirical results to compare the understanding of randomness between teenagers, psychology researchers, and mathematics researchers. They found that in all three groups there were differences in understanding depending on whether the example was "real,"

that is, associated with a realistic context, or “stochastic,” which means that the context involved traditional devices such as coins and dice. With an article about pre-service elementary school teachers’ conceptions about variability, Canada provides a natural follow-up to the Fall 2004 theme issue of SERJ on “Research on Reasoning about Variability.” The population of pre-service teachers provides fertile ground for further statistics education research. Alldredge and Brown use a non-randomized experiment to explore the effects of technology and student gender on pre-course beliefs and student learning. The surprising result is that the association between beliefs and learning evolved throughout the course. We hope that these articles will inspire others to ask “I wonder ...” questions and initiate their own research agendas.

In November 2006 we anticipate the publication of a Special Issue on Reasoning about Distributions, with guest editors Chris Reading and Maxine Pfannkuch.

Thanks to our readers, authors, Editorial Board members, reviewers, and IASE and ISI leadership for your enthusiastic support for SERJ!

IDDO GAL AND TOM SHORT

### **MESSAGE FROM FLAVIA JOLLIFFE**

As this is the first issue of SERJ where I have not acted as co-editor, I should like to take the opportunity of reminding readers of a few key developments, and of thanking past and present members of the editorial board for their support and for their tolerance of my nagging. I should also like to thank the many colleagues from around the world who have submitted papers or acted as referees. Without all these people there would be no journal.

I was a founding co-editor with Carmen Batanero and we and five others started planning what was then a new electronic journal, replacing the Statistics Education Research Newsletter from the Summer of 2001. The first issue was published in May 2002 and the editorial board was expanded later that year. Iddo Gal replaced Carmen as co-editor in December 2003. It has been a privilege for me to work with both of them, and also with Chris Reading whose period as assistant editor responsible for the production of issues and the web site has coincided with my time as co-editor.

There are many decisions to make when a new journal is started and SERJ has come a long way in the last five years. It is, however, still evolving. It is my hope that before too long we shall have so many publishable papers submitted to us that we shall grow to three issues a year.

FLAVIA JOLLIFFE

## NEW EDITORIAL BOARD MEMBERS

SERJ is pleased to announce the appointment of **Beth Chance** as SERJ's new Assistant Editor. Beth is Associate Professor of Statistics at California Polytechnic State University in San Luis Obispo, California, USA. Her research interests include effective integration of technology into statistics courses and use of authentic assessment in introductory statistics. In addition to her research publications, she is co-author of the *Workshop Statistics* series (Key College Publishing), an innovative text that fully incorporates active learning and student discovery in introductory statistics, and of *Investigating Statistical Concepts, Applications, and Methods* (Duxbury Press). She served as an associate editor for textbook reviews for the *Journal of the American Statistical Association* (1998-2000) and as co-editor of *STATS: The Magazine for Students of Statistics* (2002-2004). She was the inaugural recipient of the American Statistical Association's Waller Education Award for innovation and excellence in teaching introductory statistics and was named a Fellow of the American Statistical Association in 2005. Beth has already been in communication with Chris Reading, who volunteered to offer further support during the transition process. Please join us in welcoming Beth to the SERJ Board.

SERJ welcomes **Peter Petocz** as a new SERJ Associate Editor. Peter is Associate Professor in the Department of Statistics at Macquarie University in Sydney, Australia, and Associate Dean for Teaching and Learning in the Division of Economic and Financial Studies. He is the author of several textbooks and video-based learning packages in statistics and mathematics, and has written about the development and use of appropriate learning materials. He has a research interest in statistics pedagogy in general, and more particularly in students' and teachers' conceptions of statistics and learning, and higher-level graduate "dispositions" such as creativity, ethics, sustainability and cross-cultural sensitivity. He has published widely on these topics, mostly with his research partner Anna Reid. Peter has a PhD in the area of stochastic processes, and is involved with several applied statistical studies mainly in the areas of orthodontics, nutrition and diabetes.