Statistics Education Research Journal

Volume 21 Number 3, November 2022

Editor

Jennifer J. Kaplan

Editor of Special Editions

Daniel Frischemeier

Assistant Editor

Noleine Fitzallen

Associate Editors

Carmen Batanero
Bruce Carlson
Egan Chernoff
Sue Finch
Ana Luisa Gomez-Blancarte
Leigh Harrell-Williams
Aisling Leavy
Jennifer Noll
Rini Oktavia
Susan Peters
Mauren Porciuncula
Susanne Schnell
Douglas Whitaker

International Statistical Institute http://isi-web.org/

International Association for Statistical Education http://iase-web.org

Statistics Education Research Journal, 21(3). https://doi.org/10.52041/serj.v21i3.639
© International Association for Statistical Education (IASE/ISI), November 2022

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 three times a year (Regular Articles in May and November; Special Issue in June), available open access, and publication cost 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.

Submissions

Manuscripts must be submitted via the *SERJ* website at https://iase-web.org/ojs/SERJ

© International Association for Statistical Education (IASE/ISI), November 2022

Publication: IASE/ISI, The Hague, The Netherlands
Technical Production: California Polytechnic State University, San Luis Obispo, California, United States of America

ISSN: 1570-1824

International Association for Statistical Education (IASE) – an association of the International Statistical Institute (ISI)

President: Ayse Bilgin (Australia)
President-Elect: Dani Ben-Zvi (Israel)
Past-President: Joachim Engel (Germany)
Vice-Presidents: Pip Arnold (New Zealand), Bruno de Sousa (Portugal), Rob Gould (USA), Sibel Kazak (Turkey), James Musyoka (Kenya)

EDITORIAL: ISSUE 3, 2022

Welcome to the third issue of *SERJ* for 2022, the second of two Regular Issues. As I complete my five-year term as the Editor of Regular Papers for *SERJ* at the end of 2022, I want to use some of this space to thank the people who have helped make my work easier and provide information about the transition to our next Editor of SERJ. Maxine Pfannkuch, now retired from the University of Auckland, New Zealand, provided excellent mentorship in my transition to Editor and, Beth Chance, California Polytechnic State University, USA, served as Assistant Editor in my first years as Editor. Gail Burrill, Michigan State University, USA, Daniel Frischemeier, University of Munster, Germany, the current *SERJ* Editor for Special Issues, and his students, Tim Overhues and Marie Haibach, and Noleine Fitzallen, University of New South Wales Sydney, Australia, the current Assistant Editor of *SERJ*, were instrumental in the move to the Online Journal System (OJS) and the assignment of DOIs to all archived *SERJ* papers as they were imported into the *SERJ* OJS. The Associate Editors have been workhorses through the pandemic, taking care of editorial duties even when taking on more responsibility at their home institutions and while caring for their families and themselves. We have had two recent retirements: Maria Gabriella Ottaviani, Universitá degli Studi di Roma "La Sapienza", Italy, has stepped down after 20 years of service to *SERJ*. Stephanie Casey, Eastern Michigan University, USA, has completed her three-year term as Associate Editor. Please join me in wishing them well in their future endeavors. A bit more locally, please join me in congratulating Daniel Frischemeier and the Guest Editors, Rolf Biehler, Paderborn University, Germany, Richard deVeaux, Williams College, USA, Joachim Engel, University of Education Ludwigsburg, Germany, and Sibel Kazak, Pamukkale University, Turkey, for the outstanding special issue on Research in Data Science Education, published in July of this year. Finally, many thanks again to Noleine Fitzallen, our current Assistant Editor, who keeps the entire *SERJ* operation on track, monitoring problems with the OJS system and doing the extremely important work of copy-editing and publishing the journal articles and without whose work, you would not be reading the fine research being done by our community.

Turning now to the future, I am pleased to announce the new Editor for *SERJ*, beginning in 2023, will be Susan Peters, University of Louisville, USA. Sue has served as an Associate Editor for *SERJ* since 2017. In addition, she recently served as the Editor of the ICOTS-11 Proceedings. From my time working with Sue as a *SERJ* Associate Editor, I am convinced she will lead *SERJ* successfully and with vision.

This issue of *SERJ* has five articles, the first four of which use quantitative methods. In the first article, Odette Umugiraneza, Sarah Bansilal, and Delia North explored mathematics teachers' confidence about teaching mathematics and statistics. As in many countries, in South Africa where this study was undertaken, statistics is taught at the primary and secondary school levels by mathematics teachers. In this research, mathematics teachers indicted their level of confidence for teaching topics across mathematics and statistics using a 5-point Likert scale. A factor analysis of the data indicated separate factors for the mathematics topics and the statistics topics. Teachers had less confidence in teaching statistics than mathematics and were the least confident about engaging their students in critical debate about the use of statistics in the media. This study adds to the literature of teacher confidence or self-efficacy for teaching also measured the Self-Efficacy for Teaching Statistics (SETS) instrument but may provide different nuance than the results provided by the SETS studies.

Hiroki Matsuo, Aleise L. Nooner, and Amy R. Pearce set out to examine the differences in students' attitudes toward statistics for students in traditional and online courses. The researchers began their data collection in January 2020, collecting data from students in both types of courses using the Survey of Attitudes Toward Statistics (SATS). By the time the post-course data were collected, the world was experiencing the beginning of the COVID-19 pandemic and all of the traditional courses had been moved online. The researchers were then able to evaluate the effect of the sudden move to online courses on students' attitudes toward statistics. In brief, the research showed traditional students at the beginning of the course had more positive attitudes toward statistics. At the end of the course, however, differences in attitudes had been eliminated. While we hope not to have to pivot to online instruction again the way we did in March 2020, the results of this study should inform instructors of the impacts of decisions related to

course delivery mode on student affect and provide insight into how to address and improve online students' attitudes toward statistics.

Alyssa Counsell, Joseph Rovetti, and Erin M. Buchanan provide new psychometric evidence for the Students' Attitudes Toward Statistics and Technology Scale (SASTSc), an instrument designed to expand the familiar and widely used Survey on Attitudes Towards Statistics (SATS) to capture student attitudes to the inclusion of technology used in statistics teaching and learning. As the authors argue, independent evidence on the reliability and validity of the instruments used in statistics education is important in advancing our field. In particular, the authors were concerned with the wide use of the SASTSc given the lack of psychometric evaluation of the instrument. The study presented largely replicated earlier results from the SASTSc but identified some items on the instrument that might warrant further investigation. The study also found good internal consistency and convergent evidence with the domains of the SATS. Finally, the authors note future work may need to be undertaken given the strong association between the domain scores, leading them to surmise the affective domains may not be independent from each other. The authors also make suggestions for potential rewording of items in the instrument to strengthen the results garnered from its use.

Beth Chance, Nathan Tintle, Shea Reynolds, Ajay Patel, Katherine Chan, and Sean Leader investigated differences in student learning across several simulation-based inference (SBI) curricula and compared to traditionally taught inference in a large-scale study conducted across 126 tertiary institutions in the USA. The study presented is the largest of its kind in the fifteen years since George Cobb exhorted us to reconsider the center of the introduction to statistics course as inference from the perspective of the Central Limit Theorem. Using a subset of questions from the Comprehensive Assessment of Outcomes of a first Statistics course (CAOS), which was developed prior to the advent simulation-based statistics courses, the authors found higher learning gains for students in SBI classes compared to traditional courses. In addition, the authors found differences based on textbook choice when controlling for instructor and institution effects under multi-level modeling. The authors also found some interesting interactions in the data. In particular, there was a quadratic relationship between student pre- and post-course knowledge and students with low pre-course knowledge tended to have higher gains (measured by gain scores) than students with higher pre-course knowledge, especially students in SBI courses. Furthermore, women seemed to have more gains than men. The quantity and diversity of the data are impressive and represent one of the largest data collections in statistics education to date except potentially the data collected for the development of the CAOS. Even so, the authors recognize there is future work to be done to investigate how SBI curricula lead to student learning of statistics. This paper provides a basis for future qualitative studies to investigate that avenue of research.

In the last article, Mary Kingston and Aisling Twohill use qualitative methods to explore the use of subjective thinking in probability tasks by 5- and 6-year old children. Subjective thinking involves making intuitive judgements based on imagination and personal preferences and represents the basic level of probabilistic thinking in the frameworks used in the field of probability education. The researchers used task-based interviews of groups of children. The tasks including games using spinners and dice as well as selection of items from a collection. The results of the study provide insights into the range of values and beliefs on which young children base their subjective probability judgements, and suggest children need to be supported in reflecting on their subjective judgements and evaluating their appropriateness in relation to particular tasks. This research provides not only implications for the teaching of probability to young children, but also an example of a potentially valuable research strategy, the use of task-based group interviews.

I hope *SERJ* readers enjoy this set of papers and many thanks again to the *SERJ* Assistant Editor, Associate Editors, Reviewers, and Authors, without whom this Issue would not exist.

JENNIFER J. KAPLAN
Editor

Editorial
Jennifer J. Kaplan

An Analysis of Teachers' Confidence in Teaching Mathematics and Statistics Article 1
Odette Umugiraneza, Sarah Bansilal, & Delia North

Initial Attitudes Toward Statistics are Better in Traditional Compared to Online Courses, at Least Until Covid-19 Article 2
Hiroki Matsuo, Aleise L. Nooner, & Amy R. Pearce

Psychometric Evaluation of the Students' Attitudes Toward Statistics and Technology Scale (SASTSc) Article 3
Alyssa Counsell, Joseph Rovetti, & Erin Buchanan

Student Performance in Curricula Centered on Simulation-based Inference Article 4
Beth Chance, Nathan Tintle, Shea Reynolds, Ajay Patel, Katherine Chan, & Sean Leader

Young Children's use of Subjective Thinking in Response to Probabilistic Tasks Article 5
Mary Kingston, & Aisling Twohill