

**STATISTICS EDUCATION
RESEARCH JOURNAL**

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STATISTICS EDUCATION RESEARCH JOURNAL

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TABLE OF CONTENTS

Editorial	4
Chao Xu, Michelle Peters, and Sue Brown <i>Instructor and Institutional Effects on Students' Statistics Attitudes</i>	6
Konstantinos Lavidas, Tasos Barkatsas, Dionisios Manesis, and Vasilios Gialamas <i>A Structural Equation Model Investigating the Impact of Tertiary Students' Attitudes Toward Statistics, Perceived Competence at Mathematics, and Engagement on Statistics Performance</i>	26
Robert F. Corwyn and Phillip P. McGarry <i>An Expectancy Value Theory Predicts Achievement in Undergraduate Statistics Through Academic Delay of Gratification</i>	41
Sarah L. Ferguson, Marybeth Walpole, and Madjiguene S. B. Fall <i>Achieving Statistics Self-Actualization: Faculty Survey on Teaching Applied Social Statistics</i>	56
Nicola Justice, Samantha Morris, Veronique Henry, and Elizabeth Brondos Fry <i>Paint-By-Number or Picasso? A Grounded Theory Phenomenographical Study of Students' Conceptions of Statistics</i>	75
Conferences	102

EDITORIAL

Welcome to the second issue of *SERJ* for 2020 and the first June Issue of *SERJ*. We have moved to a three-issue-per-year schedule, allowing us to publish a Special Issue every year. Typically, the Special Issue will be published in June, with the Regular Issues coming out in February and October. For 2020, the Special Issue, Building Future Generations of Statisticians, was released in February, with Regular Issues in June and October. The change in publication dates underscores the growth of the statistics education community in general, and of the number of high-quality manuscripts submitted to *SERJ* in particular. It is a very exciting time for our research field!

In this issue I have three changes in the *SERJ* Editorial Board to announce. Michele Millar served as an Associate Editor starting in 2014, but has retired from both Mount Saint Vincent University (Canada) and the *SERJ* Editorial Board to enjoy more time with family (grandchildren) and friends. We wish Michele well in retirement. I appointed two new Associate Editors, who began their work in 2020: Ana Luisa Gomez-Blancarte of Instituto Politécnico Nacional (Mexico) and Bruce Carlson of Ohio University (USA). Manfred Borovcnik of the University of Klagenfurt (Austria) served in the role of Editor of Special Issues from 2016–2020, managing the publication of the November 2017 Issue on Statistical Literacy and the February 2020 Issue on Building Future Generations of Statisticians. In addition, Manfred laid the foundation for the June 2021 Special Issue: Statistics Education Research from a Latin American Perspective, and provided the Conferences section for all *SERJ* Issues published during his term. We thank Manfred for his service to *SERJ* and the Statistics Education Research Community, and for his constant attention to detail. The June 2021 Special Issues, as well as the Special Issues for 2022 and 2023, will be edited by our new Editor for Special Issues, Daniel Frischmeier from Universität Paderborn (Germany). Finally, this will be the final issue produced by Beth Chance, faculty at Cal Poly - San Luis Obispo (USA), who served a second term as *SERJ* Assistant Editor beginning in 2017. There is no amount of thanks and praise I can offer that would capture the gratitude I have for Beth and the care she has taken to do the exacting job required of the Assistant Editor. The professional look of our issues is thanks to her hard work and diligence. These large shoes will be filled by Noleine Fitzallen, of La Trobe University (Australia), who will transition from her role as Associate Editor to be the Assistant Editor starting with the October 2020 Issue. I have no doubt that Noleine is up to the challenge.

There are five articles in this issue: the first three continue the tradition of quantitative exploration of factors associated with student attitudes toward statistics. A mixed-methods survey of statistics instructors' perceptions and use of recommended pedagogy follows. This issue concludes with a grounded theory phenomenological qualitative study that identifies several themes in students' conceptions of statistics as a discipline.

In the first article, Chao Xu, Michelle Peters, and Sue Brown use multilevel covariate adjustment models to quantify the sizes of instructor and instructional effects on students' statistics attitudes. Their results confirm previous research showing large instructor effects on students' attitudes toward statistics. In addition, they find a positive relationship between the pedagogical use of data in statistics courses and students' valuation of and affect toward statistics. One potentially controversial finding of the study is a relationship between the instructor effect on student attitudes and the students' perception of their grade. More research is needed to explore the direction of these effects. For example, do these results imply that good teaching leads to both better attitudes and better grades, or could it be that easy grading promotes better student attitudes, or something else entirely?

Konstantinos Lavidas, Tasos Barkatsas, Dionisios Manesis, and Vasilios Gialamas also explore student attitudes toward statistics and student level outcomes. While many previous studies have linked higher attitudes toward statistics to better course performance, a path analysis shows that only the combined affective-cognitive competence component of attitudes seems to explain students' performance in statistics. This effect is moderate and indirect: students with more positive attitudes are also more engaged, and it is that engagement that appears to improve performance. The analysis also

reveals a direct link between attitudes toward statistics and perceived competence in mathematics. Students with higher perceived competence in mathematics appear to have more positive attitudes toward statistics. The authors suggest that instructors should work to build mathematical self-efficacy and engagement in their students, both of which should have positive impact on student attitudes and cognitive outcomes. The active research community may be surprised by that we are publishing an analysis that collapses the affective and cognitive subscales of the SATS-28, particularly given the 2011 *SERJ* letter to the editor on this subject (Millar & Schau, 2011) discussing how decisions like this are not supported by the Expectancy-Value Theory on which the SATS-28 was based, which posits affect and competence beliefs to be separate constructs, and the 2012 meta-analysis of validity evidence for the SATS-28 (Nolan et al., 2012), which indicates that most empirical studies find these to be two separate constructs. The almost perfect correlation between these two factors in the sample of Early Childhood Education students in Greece, however, indicates this approach in the analysis is appropriate and the high correlation is not without precedence (see for example, Dauphinee et al, 1997; Hilton et al., 2004; Schau et al., 1995; Templaar et al., 2007). These results should provide a basis for follow-up studies testing the structure of the SATS-28 subscales for other populations, as several studies have found strong correlation between the affective and cognitive competence dimensions.

Robert Corwyn and Phillip McGarry also explore the relationship between attitudes and student performance in statistics. These authors use a different approach to conceptualize and measure student attitudes, still based on Expectancy Value Theory. The findings of the two studies are relatively similar, however. This research shows a direct link between previous mathematics performance and performance in statistics, which may corroborate the findings of the Greek study if previous mathematics performance and perceived mathematics competence measure similar constructs. In addition, effort, which may be another aspect of engagement, has a direct link to student performance. Finally, the attitude scale has only an indirect link to performance, with past performance and academic delay of gratification as mediators. These first three manuscripts, taken together, provide findings to move forward the study of the effects of attitudes on student outcomes in statistics.

Sarah Ferguson, Marybeth Walpole, and Madjiguene Fall explore faculty perceptions and use of pedagogical strategies recommended for teaching statistics in the statistics education research literature. They use a convergent mixed-methods survey completed by 71 statistics instructors, primarily from the social sciences fields. The authors find that faculty perceive large-scale suggestions, such as using real data and diverse assessment strategies, to be most effective. Student support strategies and instructional approaches, such as student orientation letters or anonymous questions, are perceived by faculty as less effective. It is interesting to note that some of the lower-rated strategies are implemented by faculty in favor of the more highly-rated strategies. The authors hypothesize that faculty may value ease of implementation over perceived effectiveness. The authors use these results to remind us that increasing instructional effectiveness may require a systemic change in the way faculty are evaluated and how their time is allocated. The results provide directions for research and faculty professional development for teaching and institutional change models.

In the final paper in this issue, Nicola Justice, Samantha Morris, Veronique Henry, and Elizabeth Brondos Fry present a multi-dimensional framework to describe the way students of statistics conceptualize the domain of statistics and the work of statisticians. The research is grounded in the definition of statistical thinking offered by Wild and Pfannkuch (2000). The resulting framework contains two axes, one measuring the extent to which a student recognizes the position of uncertainty in statistics and the other the extent to which, on one end, a student considers statistics a collection of tests and procedures and, on the other end, a set of tools to solve real world problems. The authors describe the four quadrants created by the two axes using a metaphor of painting: completing a paint by number, taking a step by step class, a realist artist, and a modernist such as Picasso. The authors suggest that more instructional emphasis should be placed on the Problem and Plan aspects of the investigative cycle to help students appreciate the real world application of statistics, and their work provides a foundation from which other researchers can explore ways to encourage students to develop productive dispositions toward the domain of statistics.

JENNIFER J. KAPLAN

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