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Perspective

The Role of Austin Statistics in Research and Education

Siadat MV*

Department of Mathematics/Richard J. Daley College Chicago, USA
Department of Mathematics and Statistics/Loyola University Chicago, USA

***Corresponding author:** Siadat MV, Department of Mathematics, Richard J. Daley College, 7500 South Pulaski Road, Chicago, Illinois 60652, USA, Tel: 773-838-7658; Fax: 773- 838-7524, Email: vsiadat@ccc.edu

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It's a real privilege and high honor for me to write for the Inaugural issue of Austin Statistics. The publication of Austin Statistics is indeed welcomed news! I also wish to extend my congratulations to the Austin Publishing Group and the Editor for assembling a diverse group of talented professionals to serve on the editorial board of the journal.

Statistics is a field of knowledge with extensive theoretical and applied dimensions. Statistical science is now recognized as an interdisciplinary subject, which spans all areas of research from agriculture to biomedical sciences, to engineering, computer and hard sciences, to education and social sciences and psychology, to mathematical sciences, to business and economics, to criminal investigations and forensics, to art and music and many others. The statistical domain encompasses areas of research and investigation from highly theoretical probability theory and reliability to modeling and applications.

Austin Statistics aims to bring together all interdisciplinary research and investigations in theoretical and applied statistics in an open access scientific arena. While there are presently a large number of respected journals in statistics, they often have a limited scope, and they are not widely accessible to scientific or interested public. Austin Statistics is intended to precisely fill this gap.

In this note, I wish to comment on two topics. One is in mathematics education. A growing and somewhat new area of research where statistics is widely used is in mathematics education at the post-secondary, college, and university levels. Traditionally, graduate mathematics programs in the U.S. were focused exclusively on pure and applied mathematics research. Thus graduate math degrees at the M.S. and Ph.D. levels were granted on the basis of competency in knowledge of mathematics, and not on teaching of the subject matter. The prospective math professors entered academia with no skills or training as to how to teach the subject to undergraduates.

For many years, research in pedagogy and methodology in teaching mathematics was either scant or considered unimportant since the criteria for advancement at most universities were mathematical research and publishing, and not in the quality of teaching or mathematics education research. Applied research, however, has dramatically changed in the last few decades. Presently, a growing number of higher education institutions in the U.S. confer not only the traditional M.S. and Ph.D. degrees in mathematics, but also Master's and doctorates in mathematics education. In many reputable mathematics departments, the faculty members include professors of mathematics and clinical professors specializing in mathematics education research.

The math education dynamics that exists today is in response to the real need to develop meaningful and improved models of teaching and learning. Here is where statistical science plays a crucial role. Any new and innovative educational model in mathematics must pass the rigor of statistical testing. Mathematics education research is, therefore, intimately integrated with applied statistics.

In this regard, Austin Statistics can certainly play an important role as a scientific medium for publishing and dissemination of research in mathematics education.

My second comment concerns statistics education. On this issue, I would like to reflect on the quality of introductory (non-calculus based) statistics texts as taught in colleges and universities. I have taught introductory statistics for many years and although there are a number of good books in this area, most of them treat statistics as a collection of formulas and procedures without producing proofs or adequate reasoning for their validity. Thus students can apply the formulas, but they don't know why such formulae are valid or why the given procedure is justified. For example, in defining the standard deviation for a sample, the text books explain that the idea is to find the average deviation of the data from the mean. Therefore, we sum up the squares of deviations, average them out, and then undo the squaring by taking the square root. This represents what is known as the definitional formula for standard deviation. The reasoning goes that not squaring the deviations leads to a meaningless zero standard deviation for all sorts of data. But why is it that absolute value of the deviations is not used, instead, students wonder? If the justification for using the definitional formula is to facilitate further algebraic manipulation which, among other things, improves computability, then this should be clearly demonstrated. As another example in a separate topic, when explaining the transformation from a normal distribution to the standard normal, the text books state that such transformation will result in a mean of zero, and a standard deviation of one. But why are these true, what about an algebraic proof of those? If there is a constraint imposed on the number of pages in the texts by the publishers, then at least the explanations of the whys and the proofs can be delegated to end of chapter exercises. Thinking about and doing proofs will certainly enhance learning, and will also stimulate the intellectual curiosity of students. And lastly, what about the elegant proof of the mean of a Binomial distribution, which leads to a very nice and simple formula- the product of the number of trials and probability of a trial? You rarely find such proofs in those text books!

In my opinion, Austin Statistics can provide a forum to address

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these educational issues, which have great impact on the learning of statistics in our schools and colleges. An open and expansive discussion of statistics instruction among educators and authors in the journal can certainly contribute to improved knowledge and appreciation of the role of statistics in our modern society.

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