Teaching Bits: Statistics Education Articles from 2011

Audbjorg Bjornsdottir and Joan Garfield
University of Minnesota

We located 28 articles that have been published from January 2011 through June 2011 that pertained to statistics education. In this column, we highlight a few of these articles that represent a variety of different journals that include statistics education in their focus. We also provide information about the journal and a link to their website so that abstracts of additional articles may be accessed and viewed.

From *The American Statistician*

http://pubs.amstat.org/
The American Statistician contains articles related to statistics education that are organized into the following sections: Statistical Practice, Teacher's Corner, Reviews of Books and Teaching Materials. It is published quarterly and is available by paid subscription.

"Rethinking Assessment of Student Learning in Statistics Courses"

By Joan Garfield, Andrew Zieffler, Daniel Kaplan, George W. Cobb,
Beth L. Chance, and John P. Holcomb
Volume 65, number 1 (2011)
http://pubs.amstat.org/doi/pdf/10.1198/tast.2011.08241
Abstract: Although much attention has been paid to issues around student assessment, for most introductory statistics courses few changes have taken place in the ways students are assessed. The assessment literature describes three foundational elements—cognition, observation, and interpretation—that comprise an "assessment triangle" underlying all assessments. However, most instructors focus primarily on the second component: tasks that are used to produce grades.

This article focuses on three sections written by leading statistics educators who describe some innovative and even provocative approaches to rethinking student assessment in statistics classes.

From *Teaching Statistics*

http://www.rsscse.org.uk/ts/
An International Journal for Teachers that first appeared in 1979 and has been published three times a year ever since. It is available by paid subscription.

"Buffon's Coin Problem and Beyond"

By Kady Schneiter
Volume 33, number 2 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2010.00433.x/abstract
Abstract: This article describes an investigation of Buffon's coin problem and related problems with the aid of an applet. The problems are accessible at a variety of grade levels and facilitate making connections between geometry and probability.

"Understanding Student Attempts to Find a Line of Fit"

By M. Alejandra Sorto, Alexander White and Lawrence M. Lesser
Volume 33, number 2 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2010.00458.x/abstract
Abstract: The least squares method of fitting a line is not one that naturally occurs to students. We present three tasks to understand student views on how lines may be fit.

"A Visual Model for the Variance and Standard Deviation"

By J. B. Orris
Volume 33, number 2 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2010.00426.x/abstract
Abstract: This paper shows how the variance and standard deviation can be represented graphically by looking at each squared deviation as a graphical object – in particular, as a square. A series of displays show how the standard deviation is the size of the average square.

From *Mathematics Teacher*

http://www.nctm.org/publications/mt.aspx
MT is an official journal of the National Council of Teachers of Mathematics. It is published nine times a year and is available by paid subscription.

"When 95% Accurate Isn't: Exploring Bayes's Theorem"

By Todd D. Cadwallader Olsker
Volume 104, number 6 (2011)
http://www.nctm.org/eresources/article_summary.asp?URI=MT2011-02-426a&from=B
Abstract: Bayes's theorem—a difficult concept for many students—can be introduced through simulated data, expected frequencies, and probabilities.

From *Statistics Education Research Journal*

http://www.stat.auckland.ac.nz/~iase/publications.php?show=serj#archives/
SERJ is a peer-reviewed electronic journal of the International Association for Statistics Education (IASE) and the International Statistical Institute (ISI). SERJ is published twice a year and is free.

"The impact of a proficiency-based assessment and reassessment of learning outcomes system on student achievement and attitudes"

By Michael A. Posner
Volume 10, number 1 (2011)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ10(1)_Posner.pdf
Abstract: This research compares a student-centered, proficiency-based assessment and reassessment of learning outcomes (PARLO) system to traditional assessment in a college-level introductory statistics class. The PARLO class was assessed on learning outcomes using a three-tiered proficiency scale and given the opportunity to resubmit assignments to increase their rating. Students' attitudes towards statistics improved more in the PARLO group, but no differences between groups were found on the CAOS test or on a common final exam. Within the PARLO group, students with a higher resubmission rate scored better on the final exam and those who resubmitted and achieved proficiency performed similarly to those achieving proficiency with the first submission. Assessing proficiency on specific learning outcomes allowed both students and the instructor to better evaluate learning.

"Statistical Analysis when the Data is an Image: Eliciting Student Thinking about Sampling and Variability"

By Margret A. Hjalmarson, Tamara J. Moore, Robert delMas
Volume 10, number 1 (2011)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ10(1)_Hjalmarson.pdf
Abstract: Results of analysis of responses to a first-year undergraduate engineering activity are presented. Teams of students were asked to develop a procedure for quantifying the roughness of a surface at the nanoscale, which is typical of problems in Materials Engineering where qualities of a material need to be quantified. Thirty-five teams were selected from a large engineering course for analysis of their responses. The results indicate that engagement in the task naturally led teams to design a sampling plan, use or design measures of center and variability, and integrate those measures into a model to solve the stated problem. Team responses revealed

misunderstandings that students have about measures of center and variability. Implications for instruction and future research are discussed.

"Robust Understanding of Statistical Variation"

By Susan A. Peters
Volume 10, number 1 (2011)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ10(1)_Peters.pdf

Abstract: This paper presents a framework that captures the complexity of reasoning about variation in ways that are indicative of robust understanding and describes reasoning as a blend of design, data-centric, and modeling perspectives. Robust understanding is indicated by integrated reasoning about variation within each perspective and across perspectives for four elements: variational disposition, variability in data for contextual variables, variability in relationships among data and variables, and effects of sample size on variability. This holistic image of robust understanding of variation arises from existing expository and empirical literature, and additional empirical study.

From *Technology Innovations in Statistics Education*

http://repositories.cdlib.org/uclastat/cts/tise/
TISE reports on studies of the use of technology to improve statistics learning at all levels, from kindergarten to graduate school and professional development.   It is a free, online journal.

"Assessing Statistical Understanding in Middle Schools: Emerging Issues in a Technology-Rich Environment"

By Rosemary Callingham,
Volume 5, number 1 (2011)
http://escholarship.org/uc/item/3qr2p70t

Abstract: The increased importance of developing statistical understanding in school education is recognized in curriculum documents across the world. The role of technology in enhancing the teaching of statistics is emphasized in these documents and the emergence of quality computer software and websites provides teachers with access to unprecedented resources for teaching statistics to young students. Assessment processes, however, have not kept pace with the advances in technology. This paper highlights some emerging and existing issues in the assessment of statistical understanding at the school level, and includes discussion of the implications for teachers and researchers.

From *Model Assisted Statistics and Applications*

http://www.iospress.nl/loadtop/load.php?isbn=15741699
Model Assisted Statistics and Applications is an international peer reviewed journal. It is published four times a year and is available by paid subscription.

"On the use of mnemonics for teaching statistics."

By Lawrence Lesser
Volume 6, number 2 (2011)
http://iospress.metapress.com/content/4110606635520345/?p=5df2cd152d744eb79c5aed60be76eca8&pi=8

Abstract: This paper is a comprehensive attempt to compile and classify mnemonics (memory aids) that can be used in statistics education.

From *Mathematical Thinking and Learning*

http://www.informaworld.com/smpp/title~db=all~content=t775653685
Mathematical Thinking and Learning is a journal that publishes research from the field of mathematics education. It is published four times a year and it is available by paid prescription.

"The Role of Context Expertise When Comparing Data"

By Cynthia Langrall; Steven Nisbet; Edward Mooney; Sinchai Jansem
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/title~db=all~content=g932654185

Abstract: Our research addresses the role that context expertise plays when students compare data. We report findings from a study conducted in 3 countries: Australia, United States, and Thailand. In each country, six middle school students analyzed authentic data relating to selected students' areas of interest. We examined the data analysis processes and discussion among students as each country cohort worked in two groups of three, where only one group included a student with particular expertise with the data context. We found that students used context knowledge to (a) bring new insight or additional information to the task, (b) explain the data, (c) provide justification or qualification for claims, (d) identify useful data for the task at hand, and (e) state facts that may enhance the picture of the data but are irrelevant to the process of analyzing the data. Implications for practice are discussed.

"Statistically, Technologically, and Contextually Provocative Tasks: Supporting Teachers' Informal Inferential Reasoning"

By Sandra R. Madden
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/title~db=all~content=g932654185

Abstract: Recent studies have highlighted the potential importance of informal inferential reasoning (IIR) in supporting learners' general statistical reasoning. This paper presents a framework based on a retrospective analysis of design research in the context of technology-rich statistical professional learning experiences for high school mathematics teachers. The framework was developed to understand elements of the tasks—identified as statistically, contextually, and/or technologically provocative—that appeared to trigger the teachers' engagement and IIR. Characteristics that make a task provocative and how tasks may interact to

impact learning are explored and connected to theories including expectation failure and epistemological obstacles.

"Authentic Practices as Contexts for Learning to Draw Inferences Beyond Correlated Data"

By Adri Dierdorp; Arthur Bakker; Harrie Eijkelhof; Jan van Maanen
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/title~db=all~content=g932654185

Abstract: To support 11th-grade students' informal inferential reasoning, a teaching and learning strategy was designed based on authentic practices in which professionals use correlation or linear regression. These practices included identifying suitable physical training programmes, dyke monitoring, and the calibration of measurement instruments. The question addressed in this study is: How does a teaching and learning strategy based on authentic practices support students in making statistical inferences about authentic problems with the help of correlation and linear regression? To respond to this question we used video-recordings of lessons, audio-taped interviews, classroom field notes, and student work from a teaching experiment with 12 Dutch students (aged 16-17 years). The analysis provided insights into how the teaching and learning strategies based on authentic practices supported them to draw inferences about authentic problems using correlated data. The evidence illustrates how an understanding of the authentic problem being solved, collecting their own data to become acquainted with the situation, and learning to coordinate individual and aggregate views on data sets seemed to support these students in learning to draw inferences that make sense in the context.

"The Reasoning Behind Informal Statistical Inference"

By Katie Makar; Arthur Bakker; Dani Ben-Zvi
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/title~db=all~content=g932654185

Abstract: Informal statistical inference (ISI) has been a frequent focus of recent research in statistics education. Considering the role that context plays in developing ISI calls into question the need to be more explicit about the reasoning that underpins ISI. This paper uses educational literature on informal statistical inference and philosophical literature on inference to argue that in order for students to generate informal statistical inferences, there are a number of interrelated key elements that are needed to support their informal inferential reasoning. In particular, we claim that ISI is nurtured by statistical knowledge, knowledge about the problem context, and useful norms and habits developed over time, and is supported by an inquiry-based environment (tasks, tools, scaffolds). We adopt Peirce's and Dewey's view that inquiry is a sense-making process driven by doubt and belief, leading to inferences and explanations. To illustrate the roles that these elements play in supporting students to generate informal statistical inferences, we provide an analysis of three sixth-graders' (aged 12) informal inferential reasoning—the reasoning processes leading to their informal statistical inferences.

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