Journal of Statistics Education

Teaching Bits: Statistics Education Articles from 2009

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We located 27 articles that have been published in the first half of 2009 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 *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.

"An Array of Online Teaching Tools"

By Stephen Bush, Gordon Menzies and Susan Thorp
Volume 31, Number 1 (2009)
http://www3.interscience.wiley.com/cgi-bin/fulltext/121620304/PDFSTART
Abstract: The Internet offers a huge array of teaching resources for statistics. Here we present a selection of engaging Web-based tools, ranging from class surveys to individual simulation experiments.

"What Is Benford's Law?"

By Jonathan R. Bradley and David L. Farnsworth
Volume 31, Number 1 (2009)
http://www3.interscience.wiley.com/cgi-bin/fulltext/121620306/PDFSTART
Abstract: The surprising property of many data sets that their first significant digits follow Benford's Law provides examples that can pique and hold students' interest. Several ideas for student activities are presented.

"The Obsolescence of Computational Formulae"

By Daved M. Muttart
Volume 30, Number 1 (2009)
http://www3.interscience.wiley.com/cgi-bin/fulltext/121620305/PDFSTART
Abstract: Computational formulae are a throwback to a time when computers were not widely available. Today their teaching obscures important underpinnings of statistical theory and practice.

"Internet Approach versus Lecture and Lab-Based Approach for Teaching an Introductory Statistical Methods Course: Students' Opinions"

By H. Dean Johnson, Nairanjana Dasgupta, Hao Zhang and Marc A. Evans
Volume 31, Number 1 (2009)
http://www3.interscience.wiley.com/journal/121620310/abstract
Abstract: The use of the Internet as a teaching tool continues to grow in popularity at colleges and universities. We consider, from the students' perspective, the use of an Internet approach compared to a lecture and lab-based approach for teaching an introductory course in statistical methods. We conducted a survey of introductory statistics students. Contradictory to what was hypothesized by the authors, they favored keeping the lecture and lab-based approach for teaching the class.

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.

"Modeling the Growth of Students' Covariational Reasoning During an Introductory Statistics Course"

By Andrew S. Zieffler and Joan B. Garfield
Volume 8, Number 1 (2009)
http://www.stat.auckland.ac.nz/~iase/publications.php?show=serjarchive
Abstract: This study examined students' development of reasoning about quantitative bivariate data during a one-semester university-level introductory statistics course. There were three research questions of interest: (1) What is the nature, or pattern of change in students' development in reasoning throughout the course?; (2) Is the sequencing of quantitative bivariate data within the course associated with differences in the pattern of change in reasoning?; and (3) Are changes in reasoning about foundational concepts of distribution associated with differences in the pattern of change? Covariational and distributional reasoning were measured four times during the course, across four cohorts of students. A linear mixed-effects model was used to analyze the data, revealing some interesting trends and relationships regarding the development of covariational reasoning.

"Factors Influencing the Development of Middle School Students' Interest in Statistical Literacy"

By Colin Carmichael, Rosemary Callingham, Jane Watson, and Ian Hay
Volume 8, Number 1 (2009)
http://www.stat.auckland.ac.nz/~iase/publications.php?show=serjarchive
Abstract: This paper reviews factors that contribute to the development of middle school students' interest in statistical literacy and its motivational influence on learning. To date very little research has specifically examined the influence of positive affect such as interest on learning in the middle-school statistics context. Two bodies of associated research are available: interest research in a mathematics education context and attitudinal research in a tertiary statistics context. A content analysis of this literature suggests that interest development in middle school statistics will be the result of a complex interplay of classroom influences and individual factors such as: students' knowledge of statistics, their enjoyment of statistics and their perceptions of competency in relation to the learning of statistics.

"A Framework for Thinking about Informal Statistical Inference"

By Katie Makar and Andee Rubin
Volume 8, Number 2 (2009)
http://www.stat.auckland.ac.nz/~iase/publications.php?show=serjarchive
Abstract: Informal inferential reasoning has shown some promise in developing students' deeper understanding of statistical processes. This paper presents a framework to think about three key principles of informal inference - generalizations 'beyond the data,' probabilistic language, and data as evidence. The authors use primary school classroom episodes and excerpts of interviews with the teachers to illustrate the framework and reiterate the importance of embedding statistical learning within the context of statistical inquiry. Implications for the teaching of more powerful statistical concepts at the primary school level are discussed.

"An Empirical Consideration of a Balanced Amalgamation of Learning Strategies in Graduate Introductory Statistics Classes"

By Brandon K. Vaughn
Volume 8, Number 1 (2009)
http://www.stat.auckland.ac.nz/~iase/publications.php?show=serjarchive
Abstract: This study considers the effectiveness of a "balanced amalgamated" approach to teaching graduate level introductory statistics. Although some research stresses replacing traditional lectures with more active learning methods, the approach of this study is to combine effective lecturing with active learning and team projects. The results of this study indicate that such a balanced amalgamated approach to learning not only improves student cognition of course material, but student morale as well. An instructional approach that combines mini-lectures with in-class active-learning activities appears to be a better approach than traditional lecturing alone for teaching graduate-level students.

From *Technology Innovations in Statistics Education*

http://repositories.cdlib.org/uclastat/cts/tise/vol3/iss1/art1/
TISE reports on studies of the use of technology to improve statistics learning at all levels, from kindergarten to graduate school and professional development.

"TinkerPlots as a Research Tool to Explore Student Understanding"

By Jane Watson and Julie Donne
Volume 3, Number 1 (2009)
http://repositories.cdlib.org/uclastat/cts/tise/vol2/iss1/art1/
Abstract: This paper explores the use of the dynamic software package, TinkerPlots, as a research tool to assist in assessing students' understanding of aspects of beginning inference. Two interview protocols used previously with middle school students in printed format without computer software were introduced to a new sample of students through data sets entered in TinkerPlots. The later group of students had experienced a series of lessons using TinkerPlots but the activities were based on different data sets. Of interest in this exploratory study is an analysis of the affordances provided by TinkerPlots to researchers in their quest to assist students in explaining their thinking about the data sets. These are considered in relation to those provided by the format of the earlier interviews.

"Social Data Analysis with StatCrunch: Potential Benefits to Statistical Education"

By Webster West
Volume 3, Number 1 (2009)
http://repositories.cdlib.org/uclastat/cts/tise/vol3/iss1/art2/
Abstract: StatCrunch (www.statcrunch.com) is an online data analysis package that can be used as a low cost alternative to traditional statistical software for introductory statistics courses. StatCrunch offers a wide array of numerical and graphical routines for analyzing data along with several features such as interactive graphics, which can be used for pedagogical purposes. StatCrunch has a number of new features related to social data analysis where users may share data sets and associated analysis results via the StatCrunch site. Users may also interact via online discussions related to shared items. This manuscript provides a brief description of the mechanics of uploading and sharing information via the StatCrunch site and then discusses some of the potential benefits that these social data analysis capabilities offer to both students and instructors.

From the *Applied Cognitive Psychology*

http://www.wiley.com/WileyCDA/WileyTitle/productCd-ACP.html
The official journal of the Society for Applied Research in Memory and Cognition (SARMAC). It has 9 issues per year and has a subscription fee.

"Pictorial representations in statistical reasoning"

By Gary L. Brase
Volume 23, Number 3 (2009)
http://www3.interscience.wiley.com/journal/119054083/abstract?CRETRY=1&SRETRY=0
Abstract: In an ongoing debate between two visions of statistical reasoning competency, ecological rationality proponents claim that pictorial representations help tap into the frequency coding mechanisms of the mind, whereas nested sets proponents argue that pictorial representations simply help one to appreciate general subset relationships. Advancing this knowledge into applied areas is hampered by this present disagreement. A series of experiments used Bayesian reasoning problems with different pictorial representations (Venn circles, iconic symbols and Venn circles with dots) to better understand influences on performance across these representation types. Results with various static and interactive presentations of pictures all indicate a consistent advantage for iconic representations. These results are more consistent with an ecological rationality view of how these pictorial representations achieve facilitation in statistical task performance and provide more specific guidance for applied uses.

From *Higher Education*

http://www.springerlink.com/content/0018-1560
An international journal of higher education and educational planning. It has one issue per month and it is free of charge.

"The effect of directive tutor guidance in problem-based learning of statistics on students' perceptions and achievement"

By Luc Budé, Tjaart Imbos, Margaretha W. J. v. d. Wiel, Nick J. Broers and Martijn P. F. Berger
Volume 54, Number 1 (2009)
http://www.springerlink.com/content/c017675628772g26/?p=597b2ff1846e4d58abe440790731dc08&pi=1
Abstract: In this study directive tutor guidance in problem-based learning (PBL) of statistics is investigated. In a quasi experiment in an educational setting, directive guiding tutors were compared with tutors in a more traditional role.

Results showed that the subjective perceptions of the students with regard to the course, the tutor, and the discussions in the tutorial meetings were more positive in the guided condition. The quality of the problems used in the meetings and general tutor functioning were evaluated as equal in both conditions. Achievement was marginally higher in the guided condition. It can be concluded that directive tutor guidance is an effective addition to PBL of statistics.

From *Contemporary Educational Psychology*

http://www.elsevier.com/wps/find/journaldescription.cws_home/622811/description#description
A journal that publishes four issues per year with articles that involve the application of psychological theory and science to the educational process. There is a subscription price.

"The effects and side-effects of statistics education: Psychology students' (mis-)conceptions of probability"

By Kinga Morsanyi , Caterina Primi, Francesca Chiesi and Simon Handle
Volume 34, Number 2 (2009)
Abstract: In three studies we looked at two typical misconceptions of probability: the representativeness heuristic, and the equiprobability bias. The literature on statistics education predicts that some typical errors and biases (e.g., the equiprobability bias) increase with education, whereas others decrease. This is in contrast with reasoning theorists' prediction who propose that education reduces misconceptions in general. They also predict that students with higher cognitive ability and higher need for cognition are less susceptible to biases. In Experiments 1 and 2 we found that the equiprobability bias increased with statistics education, and it was negatively correlated with students' cognitive abilities. The representativeness heuristic was mostly unaffected by education, and it was also unrelated to cognitive abilities. In Experiment 3 we demonstrated through an instruction manipulation (by asking participants to think logically vs. rely on their intuitions) that the reason for these differences was that these biases originated in different cognitive processes.

From the book *Quality Research in Literacy and Science Education International Perspectives and Gold Standards* (2009)

Edited by Mack C. Shelley, Larry D. Yore and Brian Hand. Springer Publishers
http://www.springerlink.com/content/x46383/?p=4b809fe555d8415a88053517d6803aa0&pi=0

Approaches to Broadening the Statistics Curricula

By Deborah Nolan and Duncan Temple Lang
Introduction: Recently, there has been a lot of discussion about what a statistics curriculum should contain, and which elements are important for different types of students. For the most part, attention has been understandably focused on the introductory statistics course. This course services thousands of students who take only one statistics course. In the United States, the course typically fulfills a general education requirement of the university or a degree program. There has also been considerable activity regarding the use of computers to present statistical concepts and to leverage the Web and course management software to interact with students. Recently, there has been debate as to whether statisticians should make ambitious changes using resampling, the bootstrap, and simulation in place of the more traditional mathematical topics that are seen as the fundamentals or origins of the field (Cobb, 2007). It is unclear that we are achieving the goals of basic statistical literacy by focusing on formulae or even by concentrating almost exclusively on methodology. Instead, we believe the field and students would be significantly better served by showing the challenges and applicability of statistics to everyday life, policy, and scientific decision making in many contexts, and by teaching students how to think statistically and creatively. In contrast to the activity at the introductory level,

there has been much less attention paid to updating the statistics curricula for other categories of students. While smaller in number, these students—undergraduate majors and minors, masters, and doctoral students—are very important, as they are the ones who will use statistics to further the field and improve the quality of research. Other disciplines (e.g., biology, geography, and political and social sciences) are increasingly appreciating the importance of statistics and including statistical material in their curricula. Further, statistics has become a broader subject and field. However, the statistics curricula at these levels have not changed much past the introductory courses. Students taking courses for just 2 years may not see any modern statistical methods, leading them to a view that the important statistical ideas have all been developed. More importantly, few students will see how these methods are really used, and even fewer will know at the end of their studies what a statistician actually does. This is because statisticians very rarely attempt to teach this; instead, they labor over the details of various methodologies. The statistics curricula are based on presenting an intellectual infrastructure in order to understand the statistical method. This has significant consequences for improved quantitative literacy. As the practice of science and statistics research continues to change, its perspective and attitudes must also change so as to realize the field's potential and maximize the important influence that statistical thinking has on scientific endeavors. To a large extent, this means learning from the past and challenging the status quo. Instead of teaching the same concepts with varying degrees of mathematical rigor, statisticians need to address what is missing from the curricula. In our work, we look at what statistics students might do and how statistics programs could change to allow graduates to attain their potential.
