Teaching Bits: Statistics Education Articles from 2010 & 2011

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www.amstat.org/publications/jse/v19n1/garfieldtb.pdf

We located 25 articles that have been published from October 2010 through January 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 *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.

"Distance Learning for Teacher Professional Development in Statistics Education"

By Maria Meletiou-Mavrotheris, Efstathios Mavrotheris, Efi Paparistodemou
Volume 33, number 1 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2010.00425.x/full
Abstract: We provide an overview of EarlyStatistics, an online professional development course in statistics education targeting European elementary and middle school teachers. The course facilitates intercultural collaboration of teachers using contemporary technological and educational tools. An online information base offers access to all of the course content and resources.

"Simple Data Sets for Distinct Basic Summary Statistics"

By Lawrence M. Lesser
Volume 33, number 1 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2009.00408.x/full
Abstract: This article offers, with accompanying rationale, simple data sets that produce distinct values of certain basic summary statistics.

"The Magical Number 7"

By Mary Richardson, Diann Reischman
Volume 33, number 1 (2011)
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2009.00406.x/full
Abstract: This article describes an interactive activity that involves students participating in a memory recall test. Data collected from the activity may be used to illustrate the one-sample t test or one-sample sign test.

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.

"Qualitative Research: An Essential Part of Statistical Cognition Research"

By Pav Kalinowski, Jerry Lai, Fiona Fidler, and Geoff Cumming
Volume 9, number 2 (2010)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ9(2)_Kalinowski.pdf
Abstract: Our research in statistical cognition uses both qualitative and quantitative methods. A mixed method approach makes our research more comprehensive, and provides us with new directions, unexpected insights, and alternative explanations for previously established concepts. In this paper, we review four statistical cognition studies that used mixed methods and explain the contributions of both the quantitative and qualitative components. The four studies investigated concern statistical reporting practices in medical journals, an intervention aimed at improving psychologists' interpretations of statistical tests, the extent to which interpretations improve when results are presented with confidence intervals (CIs) rather than p-values, and graduate students' misconceptions about CIs. Finally, we discuss the concept of scientific rigour and outline guidelines for maintaining rigour that should apply equally to qualitative and quantitative research.

"Approaching the Borderlands of Statistics and Mathematics in the Classroom: Qualitative Analysis Engendering an Unexpected Journey"

By Jane M. Watson and Erica L. Nathan
Volume 9, number 2 (2010)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ9(2)_Watson_Nathan.pdf
Abstract: To capture aspects of pedagogical content knowledge (PCK) not illuminated in an earlier written survey, an interview protocol was used with 40 middle school teachers. The scenarios were intended to elicit teachers' understanding of the big ideas, ability to anticipate students' answers, and intervention strategies for the classroom. This was expected to be a straight-forward journey based on teachers' responses to three context-based scenarios regarding students' answers to questions. Instead we were surprised by teachers' responses that revealed their perceptions that their experiences teaching mathematics and teaching statistics are very different. This led to further analysis of the PCK tasks and a suggestion that the mathematics embedded in the tasks was sometimes an impediment for the teachers, especially in relation to intervention strategies in the classroom.

"Statistical Education: Focusing on the Learner"

By Alain Bihan-Poudec
Volume 9, number 2 (2010)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ9(2)_Bihan-PoudecExtended.pdf
Abstract: For over thirty years, statistical education has fought for a "pedagogy of proximity." But if this seems to bring greater success, it does not guarantee the understanding of statistical concepts. An analysis of an experiment by Gattuso & Mary (2003, 2005), and an observational study made by the author, highlight the phenomenon of "cognitive isolation." This underlines the importance of the learners' views of statistics. The work of Reid and Petocz (2002) corroborates this and provides more insight into the necessity of an exogenous disturbance to learning so that it is fully realized. Methodologically, it emerges that qualitative methods have their full place in statistical education research, including as an opportunity to reassess the research objectives.

"Situating Qualitative Modes of Inquiry within the Discipline of Statistics Education research"

By Randall E. Groth
Volume 9, number 2 (2010)
http://www.stat.auckland.ac.nz/~iase/serj/SERJ9(2)_Groth.pdf
Abstract: Qualitative methods have become common in statistics education research, but questions linger about their role in scholarship. Currently, influential policy documents lend credence to the notion that qualitative methods are inherently inferior to quantitative ones. In this paper, several of the questions about qualitative research raised in recent policy documents in the U.S. are examined. Each question is addressed by drawing upon examples from existing statistics education research. The

examples illustrate that qualitative methods can be used profitably to study statistical teaching and learning, and that in some cases qualitative methods are preferable to quantitative ones. By using the examples presented, qualitative researchers in statistics education can begin to more strongly situate their work within scholarly discourse about empirical research.

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.

"A Randomized Experiment Exploring How Certain Features of Clicker Use Effect Undergraduate Students' Engagement and Learning in Statistics"

By Herle M. McGowan and Brenda K. Gunderson
Volume 4, number 1 (2010)
http://escholarship.org/uc/item/2503w2np
Abstract: This paper describes a randomized experiment conducted in an undergraduate introductory statistics course that investigated the impact of clickers on students. Specifically, the effects of three features of clicker use on engagement and learning were explored. These features included: 1) the number of questions asked during a class period, 2) the way those questions were incorporated into the material, and 3) the grading or monitoring of clicker use. Several hierarchical linear models of both engagement and learning outcomes were fit. Based on these analyses, there was little evidence that clicker use increased students' engagement. There was some evidence, however, that clicker use improved students' learning. Increases in learning seemed to take place when the clicker questions were well incorporated into the material, particularly if the number of questions asked was low.

From *Philosophy of Mathematics Education Journal*

http://people.exeter.ac.uk/PErnest/
The *Philosophy of Mathematics Education Journal* publishes articles applicable to the philosophy of mathematics education. It includes articles, theses and other relevant resources. It is published once to three times a year and it is free.

"The Necessity of Equity in Teaching Statistics"

By Lawrence M. Lesser
Volume 25, number 1 (2010)
http://people.exeter.ac.uk/PErnest/pome25/index.html
Abstract: There is evidence that students have prior conceptions about fairness and these conceptions appear to have the potential to interfere with the learning of statistics topics such as

simulation with physical manipulatives, surveys, randomized experiments, and expected value, as well as the understanding of words such as bias or discrimination. Because of this, it is strongly recommended that statistics instructors explicitly acknowledge and take into account the role that student views of fairness play. Related to equity and fairness beliefs is the possible interaction of cultural background with the learning of specific topics, and empirical evidence ($p < .01$) suggests that this can happen with certain populations when using the common courtroom metaphor to illustrate hypothesis testing.

From *International Journal for the Scholarship of Teaching and Learning*

http://academics.georgiasouthern.edu/ijsotl/index.htm
IJ-SoTL is an international journal that publishes articles, essays and discussion regarding the scholarship of teaching and learning. It is published twice a year and it is free.

"Mapping the Field of Statistics Education Research in Search of Scholarship"

By Linda van der Merwe and Annette Wilkinson
Volume 5, number 1 (2011)
http://academics.georgiasouthern.edu/ijsotl/v5n1/essays_about_sotl/PDFs/_vanderMerweWilkinson.pdf
Abstract: This paper is intended as a contribution to the advancement of scholarship in the field of statistics education, which directly links with the scholarship of teaching and learning. It is apparent from the literature, that statistics education research, as an interdisciplinary field, does not rely on a single tradition of research methodology. There are different research backgrounds, different research methods are used, studies have different foci and different outcome variables are studied. What constitutes research in statistics education is therefore still a fundamental issue, with a consequent call for more research in this field. The present study attempts to identify the major themes of statistics education research in order to provide an overview of its current thematic nature. Twenty-four doctoral dissertations as well as 138 articles in three specialist statistics education journals, published between 2005 and 2009, were analyzed regarding their key themes and topics. The frequency of occurrence of the key themes is summarized.

We found that the teaching and learning of statistics was the most popular theme or topic. In particular, there is a growing network of researchers interested in studying the development of students' statistical reasoning. Only 15% of the literature was dedicated to studies on the use of information communications technology (ICT), with the relevant studies reflecting the popularity of JAVA Applets and simulation tools. A smaller portion of the literature was devoted to course design and non-cognitive factors.

This study provides a framework for understanding current developments in statistics education research and suggests structure to the field, making it easier for future researchers to become acquainted with the discipline. In this way a contribution is made in furthering scholarship 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 subscription.

"Lessons from Inferentialism for Statistics Education"

By Arthur Bakker; Jan Derry
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/ftinterface~db=all~content=a932649732~fulltext=713240928
Abstract: This theoretical paper relates recent interest in informal statistical inference (ISI) to the semantic theory termed inferentialism, a significant development in contemporary philosophy, which places inference at the heart of human knowing. This theory assists epistemological reflection on challenges in statistics education encountered when designing for the teaching or learning of ISI. We suggest that inferentialism can serve as a valuable theoretical resource for reform efforts that advocate ISI. To illustrate what it means to privilege an inferentialist approach to teaching statistics, we give examples from two sixth-grade classes (age 11) learning to draw informal statistical inferences while developing key concepts such as center, variation, distribution, and sample without losing sight of problem contexts.

"The Role of Context in Developing Informal Statistical Inferential Reasoning: A Classroom Study"

By Maxine Pfannkuch
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/ftinterface~db=all~content=a932641196~fulltext=713240928
Abstract: Context is identified as an important factor when considering the learning of informal statistical inferential reasoning, but research in this area is very limited. This small exploratory study in one grade 10 (14 year olds) classroom seeks to learn more about the role context plays in learners' inferential reasoning, where both teacher and students are positioned as learners. Two frameworks for context are used to analyze the classroom dialogue: The data-context used in statistical enquiry and in the formation of statistical concepts and the learning-experience-contexts such as prior statistical knowledge, which can affect the learning process. The analysis tracks the learning of informal inferential reasoning before, during, and after the introduction of sampling variability concepts. Data-context was found to assist learners in finding meaning from observed patterns, but could divert their attention during the construction of concepts and when attempting to apply newly-learned theory. Learning-experience-contexts played a significant role in mediating learners' development of informal inferential reasoning. Implications for developing concepts for informal inferential reasoning and for research are discussed.

"Conceptual Challenges in Coordinating Theoretical and Data-centered Estimates of Probability"

By Cliff Konold; Sandra Madden; Alexander Pollatsek; Maxine Pfannkuch; Chris Wild; Ilze Ziedins; William Finzer; Nicholas J. Horton; Sibel Kazak
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/ftinterface~db=all~content=a932644653~fulltext=713240928
Abstract: A core component of informal statistical inference is the recognition that judgments based on sample data are inherently uncertain. This implies that instruction aimed at developing informal inference needs to foster basic probabilistic reasoning. In this article, we analyze and critique the now-common practice of introducing students to both "theoretical" and "experimental" probability, typically with the hope that students will come to see the latter as converging on the former as the number of observations grows. On the surface of it, this approach would seem to fit well with objectives in teaching informal inference. However, our in-depth analysis of one eighth-grader's reasoning about experimental and theoretical probabilities points to various pitfalls in this approach. We offer tentative recommendations about how some of these issues might be addressed.

"Explanations and Context in the Emergence of Students' Informal Inferential Reasoning"

By Einat Gil; Dani Ben-Zvi
Volume 13, number 1 & 2 (2011)
http://www.informaworld.com/smpp/ftinterface~db=all~content=a932648436~fulltext=713240928
Abstract: Explanations are considered to be key aids to understanding the study of mathematics, science, and other complex disciplines. This paper discusses the role of students' explanations in making sense of data and learning to reason informally about statistical inference. We closely follow students' explanations in which they utilize their experiences and knowledge of the context, statistical tools, and ideas to support their emerging informal inferential reasoning (IIR). This case study focuses on two independent inquiry episodes of sixth-grade students (age 12) within an unstructured, inquiry-based, technology-rich learning environment that was designed to promote students' IIR. We discuss research and practical issues related to the role of explanations and context in developing students' IIR.