Teaching Bits: Statistics Education Articles from 2014 and 2015

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www.amstat.org/publications/jse/v23n1/frytb.pdf

I located one special journal issue and 32 total articles that have been published from November 1, 2014 through March 15, 2015 that pertained to statistics education. In this column, I highlight a few of these articles that represent a variety of different journals that include statistics education in their focus. I also provide information about the journals and a link to their websites so that abstracts of additional articles may be accessed and viewed.

Special issue of *Educational Studies in Mathematics: "Statistical Reasoning: Learning to Reason from Samples"*

http://link.springer.com/journal/10649/88/3/page/1

ESM is an international journal that focuses on presenting new ideas and developments of major importance to those working in the field of mathematical education. ESM is published eight to nine times a year.

This special issue features articles by members of the Statistical Reasoning, Thinking and Literacy (SRTL) research forum. The shadow editor of this issue was Luis Radford, and the guest editors were Dani Ben-Zvi, Arthur Bakker, and Katie Makar. Below are abstracts from three of the seven articles that appear in this special issue.

"Learning to reason from samples"

By Dani Ben-Zvi, Arthur Bakker, and Katie Makar
Volume 88, Number 3 (2015)
http://link.springer.com/article/10.1007/s10649-015-9593-3

Abstract: The goal of this article is to introduce the topic of learning to reason from samples, which is the focus of this special issue of Educational Studies in Mathematics on statistical reasoning. Samples are data sets, taken from some wider universe (e.g., a population or a process) using a particular procedure (e.g., random sampling) in order to be able to make generalizations about this wider universe with a particular level of confidence. Sampling is hence a key factor in making reliable statistical inferences. We first introduce the theme and the key questions this special issue addresses. Then, we provide a brief literature review on reasoning about samples and sampling. This review sets the grounds for the introduction of the five articles and the concluding reflective discussion. We close by commenting on the ways to support the development of students' statistical reasoning on samples and sampling.

"Data seen through different lenses"

By Clifford Konold, Traci Higgins, Susan Jo Russell, and Khalimahtul Khalil
Volume 88, Number 3 (2015)
http://link.springer.com/article/10.1007/s10649-013-9529-8
Abstract: Statistical reasoning focuses on properties that belong not to individual data values but to the entire aggregate. We analyze students' statements from three different sources to explore possible building blocks of the idea of data as aggregate and speculate on how young students go about putting these ideas together. We identify four general perspectives that students use in working with data, which in addition to an aggregate perspective include regarding data as pointers, as case values, and as classifiers. Some students seem inclined to view data from only one of these three alternative perspectives, which then influences the types of questions they ask, the data representations they generate or prefer, the interpretations they give to notions such as the average, and the conclusions they draw from the data.

"Developing students' reasoning about samples and sampling variability as a path to expert statistical thinking"

By Joan Garfield, Laura Le, Andrew Zieffler, and Dani Ben-Zvi
Volume 88, Number 3 (2015)
http://link.springer.com/article/10.1007/s10649-014-9541-7
Abstract: This paper describes the importance of developing students' reasoning about samples and sampling variability as a foundation for statistical thinking. Research on expert–novice thinking as well as statistical thinking is reviewed and compared. A case is made that statistical thinking is a type of expert thinking, and as such, research comparing novice and expert thinking can inform the research on developing statistical thinking in students. It is also posited that developing students' informal inferential reasoning, akin to novice thinking, can help build the foundations of experts' statistical thinking.

From *Teaching Statistics*

http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291467-9639
Teaching Statistics is 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.

"Using the five practices model to promote statistical discourse"

By Randall E. Groth
Volume 37, Number 1 (2015)
http://onlinelibrary.wiley.com/doi/10.1111/test.12052/abstract
Abstract: Statistical tasks that can be solved in a variety of ways provide rich sites for classroom discourse. Orchestrating such discourse requires careful planning and execution. Five specific practices can help teachers do so. The five practices can be used to structure conversations so that coherent classroom narratives about solutions to tasks may be formed. In this manuscript, two classroom examples that illustrate the five practices are offered. It is argued that employing the five practices can lead to higher quality classroom discussion than some commonly used arrangements.

"Unders and overs: Using a dice game to illustrate basic probability concepts"

By Sandra Hanson McPherson
Volume 37, Number 1 (2015)
http://onlinelibrary.wiley.com/doi/10.1111/test.12033/abstract
Abstract: In this paper, the dice game Unders and Overs is described and presented as an active learning exercise to introduce basic probability concepts. The implementation of the exercise is outlined and the resulting presentation of various probability concepts are described.

"A story-based simulation for teaching sampling distributions"

By Stephen Turner and Alan R. Dabney
Volume 37, Number 1 (2015)
http://onlinelibrary.wiley.com/doi/10.1111/test.12067/abstract
Abstract: Statistical inference relies heavily on the concept of sampling distributions. However, sampling distributions are difficult to teach. We present a series of short animations that are story-based, with associated assessments. We hope that our contribution can be useful as a tool to teach sampling distributions in the introductory statistics classroom.

From *Statistics Education Research Journal*

http://iase-web.org/Publications.php?p=SERJ_issues
SERJ is a peer-reviewed electronic journal of the International Association for Statistics Education (IASE) and the International Statistical Institute (ISI). It is published twice a year. SERJ is a free online journal.

The current issue (November 2014) is a special issue: "A Global View of Statistics Education Research."

"Building capacity for developing statistical literacy in a developing country: Lessons learned from an intervention"

By Delia North, Iddo Gal, and Temesgen Zewotir
Volume 13, Number 2 (2014)
http://iase-web.org/documents/SERJ/SERJ13(2)_North.pdf
Abstract: This paper aims to contribute to the emerging literature on capacity-building in statistics education by examining issues pertaining to the readiness of teachers in a developing country to teach basic statistical topics. The paper reflects on challenges and barriers to building statistics capacity at grass-roots level in a developing country, based in part on lessons learnt from the design of an in-service intervention for teachers in South Africa, and on illustrative data about teachers' attitudes, collected as part of this intervention. The paper reflects on implications for future design of interventions, as well as on research needs that can inform future capacity-building in statistics education in developing countries.

"Use of data visualisation in the teaching of statistics: A New Zealand perspective"

By Sharleen Forbes, Jeanette Chapman, John Harraway, Doug Stirling, and Chris Wild
Volume 13, Number 2 (2014)
http://iase-web.org/documents/SERJ/SERJ13(2)_Forbes.pdf
Abstract: For many years, students have been taught to visualise data by drawing graphs. Recently, there has been a growing trend to teach statistics, particularly statistical concepts, using interactive and dynamic visualisation tools. Free down-loadable teaching and simulation software designed specifically for schools, and more general data visualisation tools are increasingly being used in New Zealand classrooms. This paper discusses four examples: the use of GenStat for Teaching and Learning Schools and Undergraduate (GTL); Auckland University's iNZight and VIT (Visual Inference Tools) for teaching bootstrapping and randomisation; the CAST e-books, and the use of data visualisation tools to assist learning concepts in official statistics. All these tools are publically available and several are already being used internationally.

"Blind Students' Learning of Probability Through the Use of a Tactile Model"

By Aida Carvalho Vita, and Verônica Yumi Kataoka
Volume 13, Number 2 (2014)
http://iase-web.org/documents/SERJ/SERJ13(2)_Vita.pdf
Abstract: The objective of this paper is to discuss how blind students learn basic concepts of probability using the tactile model proposed by Vita (2012). Among the activities were part of the teaching sequence 'Jefferson's Random Walk', in which students built a tree diagram (using plastic trays, foam cards, and toys), and pictograms in 3D (using the toys) to represent the possible ways in which Jefferson can visits his five friends and the expected frequencies of visits. The analysis of students' answers was based on the SOLO taxonomy, and developed from initial prestructural responses to final responses that were classified at the relational level. The study suggests adaptations of materials and teaching methods for helping blind students to learn about probability.

From *Mathematics Teacher*

http://www.nctm.org/publications/mathematics-teacher/
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.

"Tracking Rates and History along the Transcontinental Railroad"

By Arnold E. Perham and Faustine L. Perham
Volume 108, Number 7 (2015)
http://www.nctm.org/Publications/mathematics-teacher/2015/Vol108/Issue7/Tracking-Rates-and-History-along-the-Transcontinental-Railroad/
Abstract: A cross-disciplinary unit asks students to analyze data in historical information.

From *Journal of Mathematics Teacher Education*

http://www.springer.com/education+%26+language/mathematics+education/journal/10857
The Journal of Mathematics Teacher Education is dedicated to research that seeks to improve mathematics teacher education and develop teaching methods that promote student learning of mathematics. It is published 4-6 times per year and is available by paid subscription.

"An investigation of prospective secondary mathematics teachers' conceptual knowledge of and attitudes towards statistics"

By Ailish Hannigan, Olivia Gill, and Aisling M. Leavy
Volume 16, Number 6 (2013)
http://link.springer.com/article/10.1007/s10857-013-9246-3
Abstract: The development of statistical literacy is fast becoming the focus of a large part of mathematics instruction at primary, secondary and tertiary levels. This broadening of the mathematics curriculum to encompass a focus on statistics makes considerable demands on teachers. Most mathematics teachers acknowledge the practical importance of statistics and are willing to give more relevance to the teaching of statistics; however, many mathematics teachers do not consider themselves well prepared to teach statistics. The aims of this study were to investigate the conceptual understanding of statistics of prospective secondary mathematics teachers; the nature of their attitudes towards statistics and if there was a relationship between attitude towards statistics and conceptual understanding of statistics. Conceptual understanding was measured using a standard assessment instrument (comprehensive assessment of outcomes in a first statistics course) which allows comparison across other disciplines. Despite being very mathematically able and confident, the prospective mathematics teachers in this study do no better in the assessment than students from other (mostly non-quantitative) disciplines. This, perhaps, gives further evidence that statistical thinking is different from mathematical thinking and that a strong background in mathematics does not necessarily translate to statistical thinking. Conceptual knowledge was poor in some fundamental areas of statistics such as being able to properly describe the distribution of a quantitative variable and data production. The attitudes of these teachers towards statistics were measured using a widely used instrument (survey of

attitudes towards statistics). The results indicate generally positive attitudes but an acknowledgement that statistics is not a subject quickly learned by everyone and requires discipline to learn. No strong correlation was found between attitudes and conceptual knowledge. It is recommended that in order to improve teacher knowledge, teacher education programmes must include tailored modules in statistics and highlight the differences between mathematical and statistical thinking.

"Developing understanding of statistical variation: Secondary statistics teachers' perceptions and recollections of learning factors"

By Susan A. Peters
Volume 17, Number 6 (2014)
http://link.springer.com/article/10.1007/s10857-013-9242-7
Abstract: This retrospective phenomenological study investigates activities and actions identified by secondary statistics teachers who exhibit robust understandings of variation as deepening their understandings of statistical variation. Using phenomenological methods and a frame of Mezirow's transformation theory, analysis revealed learning factors that include their interests in statistics, motivation to encounter and resolve dilemmas, desires to have an overarching content framework, propensities for critical reflection, and actions on opportunities to engage in statistical learning activities and rationale discourse with more knowledgeable others. The extent to which these teachers embrace these opportunities distinguishes them from other teachers. Results from this study provide some basis for formulating hypotheses about secondary teachers' statistics learning in general by contributing to understanding circumstances that may be conducive to developing deep understandings of statistical content. This study also advances the use of retrospective methods within a theoretical frame for adult learning to investigate teacher learning.

From *Mathematics Teaching in the Middle School*

MTMS 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.
http://www.nctm.org/publications/toc.aspx?jrnl=mtms

"The oldest person you've known"

By Sarah B. Bush, Karen S. Karp, Judy Albanese, and Fred Dillon
Volume 20, Number 5 (2014)
http://www.nctm.org/Publications/mathematics-teaching-in-middle-school/2014/Vol20/Issue5/The-Oldest-Person-You_ve-Known/
Abstract: A Super Bowl commercial became the impetus for engaging students in a meaningful data collection project.

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