



## Teaching Bits: Statistics Education Articles from 2013

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I located 19 articles that have been published from August through October 2013 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 journal and a link to the journal's website so that abstracts of additional articles may be accessed and viewed.

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### 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.

#### **“Better Articulating Normal Curve Theory for Introductory Mathematical Statistics Students: Power Transformations and Their Back-Transformations”**

By Daniel A. Griffith  
Volume 67, Number 3 (2013)

<http://amstat.tandfonline.com/doi/full/10.1080/00031305.2013.801782#.Unq4JppYuI0>

**Abstract:** This article addresses a gap in many, if not all, introductory mathematical statistics textbooks, namely, transforming a random variable so that it better mimics a normal distribution. Virtually all such textbooks treat the subject of variable transformations, which furnishes a nice opportunity to introduce and study this transformation-to-normality topic, a topic students frequently encounter in subsequent applied statistics courses. Accordingly, this article reviews variable power transformations of the Box–Cox type within the context of normal curve theory, as well as addresses their corresponding back-transformations. It presents four theorems and a conjecture that furnish the basics needed to derive equivalent results for all nonnegative values of

the Box–Cox power transformation exponent. Results are illustrated with the exponential random variable. This article also includes selected pedagogic tools created with R code.

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### **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.

#### **“Bringing Data to Life into an Introductory Statistics Course with Gapminder”**

By Dai-Trang Le

Volume 35, Number 3 (2013)

<http://onlinelibrary.wiley.com/doi/10.1111/test.12015/full>

**Abstract:** Gapminder is a free and easy to use software for visualising real-world data in multiple dimensions. The simple format of the Cartesian coordinate system is used in a dynamic and interactive way to convey a great deal of information. This tool can be readily used to arouse students' natural curiosity regarding world events and to increase the motivation to understand statistics.

#### **“Scenarios for Motivating the Learning of Variability: An Example in Finances”**

By Lisbeth K. Cordani

Volume 35, Number 3 (2013)

<http://onlinelibrary.wiley.com/doi/10.1111/test.12017/full>

**Abstract:** This article explores an example in finances in order to motivate the random variable learning to the very beginners in statistics. In addition, it offers a relationship between standard deviation and range in a very specific situation.

#### **“I Can't Make Heads Or Tails Out Of What You Are Saying, So Let's Just Agree To Be Fair”**

By Rickey E. Carter

Volume 35, Number 3 (2013)

<http://onlinelibrary.wiley.com/doi/10.1111/test.12013/full>

**Abstract:** Assuming a coin is fair is common place in introductory statistical education. This article offers three approaches to test if a coin is fair. The approaches lend themselves to straightforward simulation studies that can enrich student understanding of joint probability and sample size requirements. Simulation studies comparing the relative merits of the three, or potential other, approaches are an example of problem-based learning.

## **“Technology-enhanced Interactive Teaching of Marginal, Joint and Conditional Probabilities: The Special Case of Bivariate Normal Distribution”**

By Ivo D. Dinov, Scott Kamino, Bilal Bhakhrani and Nicolas Christou  
Volume 35, Number 3 (2013)

<http://onlinelibrary.wiley.com/doi/10.1111/test.12012/full>

**Abstract:** Data analysis requires subtle probability reasoning to answer questions like What is the chance of event A occurring, given that event B was observed? This generic question arises in discussions of many intriguing scientific questions such as What is the probability that an adolescent weighs between 120 and 140 pounds given that they are of average height? and What is the probability of (monetary) inflation exceeding 4% and housing price index below 110? To address such problems, learning some applied, theoretical or cross-disciplinary probability concepts is necessary. Teaching such courses can be improved by utilizing modern information technology resources. Students' understanding of multivariate distributions, conditional probabilities, correlation and causation can be significantly strengthened by employing interactive web-based science educational resources. Independent of the type of a probability course (e.g. majors, minors or service probability course, rigorous measure-theoretic, applied or statistics course) student motivation, learning experiences and knowledge retention may be enhanced by blending modern technological tools within the classical conceptual pedagogical models.

We have designed, implemented and disseminated a portable open-source web-application for teaching multivariate distributions, marginal, joint and conditional probabilities using the special case of bivariate Normal distribution. A real adolescent height and weight dataset is used to demonstrate the classroom utilization of the new web-application to address problems of parameter estimation, univariate and multivariate inference.

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## ***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.

## **“Getting Real Statistics into all Curriculum Subject Areas: Can Technology Make this a Reality?”**

By James Nicholson, Jim Ridgway and Sean McCusker  
Volume 7, Number 2 (2013)

<http://escholarship.org/uc/item/7cz2w089>

**Abstract:** Technology has revolutionised society and it has revolutionised the way in which statistics, as a professional discipline, is done. The collection of data is growing exponentially both in relation to the quantity of data assembled on any particular measure and also in relation to the range of topics, and the measures, on which data is collected. Accessing data has become much simpler, and tools for exploring, manipulating and representing that data visually have multiplied, both in commercially available software and open-source freeware. However, the

curriculum in schools in the UK is constrained by important factors which restrict the use of technology in assessment. The statistics curriculum is largely dull and does not address the core issues of most relevance in statistics today. Here, we explore ways in which technology can enhance the teaching of subjects in which statistics are used, and also the teaching of statistics within mathematics.

### **“The Data Science Education Dilemma”**

By William Finzer

Volume 7, Number 2 (2013)

<http://escholarship.org/uc/item/7gv0q9dc>

**Abstract:** The need for people fluent in working with data is growing rapidly and enormously, but U.S. K–12 education does not provide meaningful learning experiences designed to develop understanding of data science concepts or a fluency with data science skills. Data science is inherently inter-disciplinary, so it makes sense to integrate it with existing content areas, but difficulties abound. Consideration of the work involved in doing data science and the habits of mind that lie behind it leads to a way of thinking about integrating data science with mathematics and science. Examples drawn from current activity development in the Data Games project shed some light on what technology-based, data-driven might be like. The project’s ongoing research on learners’ conceptions of organizing data and the relevance to data science education is explained.

### **“Designing Games for Understanding in a Data Analysis Environment”**

By Tim Erickson

Volume 7, Number 2 (2013)

<http://escholarship.org/uc/item/31t469kg#>

**Abstract:** Ordinarily, when a student plays a game on a computer, a great deal of data are generated, but never used. This paper describes a technological innovation: games designed for learning mathematics or statistics concepts in which success requires data analysis. These “Data Games” are small-scale, short, web-based games, embedded in a data analysis environment, suitable for students in about year 7 onwards, and in teacher preparation. We discuss design for the games themselves, curriculum and assessment issues, and connections to research.

### **“Faculty Attitude towards Technology-Assisted Instruction for Introductory Statistics in the Context of Educational Reform”**

By Rossi A. Hassad

Volume 7, Number 2 (2013)

<http://escholarship.org/uc/item/9k19k2f7>

**Abstract:** Technology-assisted instruction is a core focus of educational reform in most disciplines. This exploratory study (N=227) examined instructors’ attitudes toward technology integration for the teaching of introductory statistics at the college level. Salient attitudinal elements (including perceived usefulness, self-efficacy, and comfort), which can serve as barriers to, and facilitators of, technology integration were identified. Additionally, a preliminary scale (ATTIS) for measuring instructors’ attitudes toward technology integration was developed with

acceptable levels of internal reliability and validity. The results underscore the need for training and support for instructors, by way of workshops, modeling of best practices through team teaching and mentoring, and other targeted professional development activities.

**“Students' Experiences and Perceptions of Using a Virtual Environment for Project-Based Assessment in an Online Introductory Statistics Course”**

By James Baglin, Anthony Bedford and Michael Bulmer  
Volume 7, Number 2 (2013)

<http://escholarship.org/uc/item/137120mt#>

**Abstract:** Course projects have been argued to help develop students' statistical thinking, but implementing authentic and realistic course projects still presents major challenges. This paper evaluated students' experiences and perceptions of using an online simulated virtual environment, known as the Island, for implementing major course projects within an online masters level introductory statistics course. The use of the Island aimed to overcome significant practical and ethical constraints imposed on project-based work in online courses. The project required students to answer a self-posed research question by gathering and analysing data using methods covered in the course. The project was divided into two parts, a mid-semester proposal and an end of semester online presentation. Following completion of the projects, forty-two students responded to a questionnaire which rated their level of agreement to three aspects of using the Island: engagement, ease of use and contributes to understanding. Students were also asked to provide qualitative comments and five students participated in semi-structured interviews. Qualitative feedback was analysed to help explain the results from the quantitative questionnaire. In conclusion, perceptions of the use of the Island for project-based assessment were very positive. Qualitative feedback provided insight into how the Island-based projects may help to develop students' statistical thinking.

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