Bridging the Gap

Between Common Core State Standards and Teaching Statistics

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In memory of

Martha Aliaga

whose passion and love for statistics education
have been and will continue to be
an inspiration for us all to follow.

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Foreword

I am honored to write the foreword for *Bridging the Gap Between Common Core State Standards and Teaching Statistics* (*BTG*), a collection of data-centric activities for elementary and middle-school students. As statistics is being recognized as a necessary component in the K–12 mathematics curriculum, there is an urgency for the development of materials such as *BTG*. This urgency is most immediate with the Common Core State Standards (CCSS), in which statistics is one of the major components (alongside algebra and geometry).

How did statistics come to be a part of the K–12 mathematics curriculum? In its *Principles and Standards for School Mathematics* (*PSSM*), the National Council of Teachers of Mathematics (NCTM) articulated a vision for mathematics education that included data analysis and probability as one of five major content strands. NCTM's Data Analysis and Probability standard states the following:

> Instructional programs from pre-kindergarten through Grade 12 should enable all students to—
>
> - Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
> - Select and use appropriate statistical methods to analyze data
> - Develop and evaluate inferences and predictions based on data
> - Understand and apply basic concepts of probability

To support and further elaborate on the Data Analysis and Probability standard, the ASA/NCTM Joint Committee on Curriculum in Statistics and Probability (JC) produced *Guidelines for Assessment and Instruction in Statistics Education (GAISE): A Pre-K–12 Curriculum Framework*, which was endorsed by the American Statistical Association (ASA) in 2005 (*www.amstat.org/education/gaise*). The JC, in 2007, worked with the authors of the GAISE framework to incorporate final editing and provide funding for printing the report in book format.

What motivated the development of the GAISE Pre-K–12 framework? In NCTM's PSSM, the concept of the mean is discussed at the elementary, middle, and secondary levels. In 2003, the ASA sponsored the TEAM's conference, held at the University of Georgia. Johnny Lott, a keynote speaker

and then president of NCTM, asked the statisticians, "What is going on in statistics if you are doing the mean at all three levels? Are you doing the same thing?" These questions led a group of writers to author the GAISE report over a two-year period.

Goals of the GAISE framework are to:

- Present the statistics curriculum for grades pre-K–12 as a cohesive and coherent curriculum strand (e.g., the progression of the mean from elementary to middle to secondary)
- Promote and develop statistical literacy
- Provide links with the NCTM standards
- Discuss differences between mathematical and statistical thinking, particularly the importance of context and variability within statistical thinking
- Clarify the role of probability in statistics
- Illustrate concepts associated with the data analysis process

Why data analysis in K–12? The GAISE framework answers this question as the following:

> Every high-school graduate should be able to use sound statistical reasoning to intelligently cope with the requirements of citizenship, employment, and family and to be prepared for a healthy and productive life. Statistics education can promote the 'must-have' competencies for high-school graduates to 'thrive in this modern world of mass information.'

Let's not forget the intellectual merit of statistics thinking. The well-known mathematician George Polya said, "Plausible reasoning—the inferential reasoning of science and everyday life by which new knowledge is obtained— is an important part of mathematical reasoning."

The GAISE framework outlines the conceptual structure for statistics education in a two-dimensional model with one dimension defined by the four-step problem solving process (formulate questions, collect data, analyze data, and interpret results) plus the nature of variability. The second dimension is comprised of three levels of statistical development (levels A, B, and C) that students must progress through to develop statistical understanding. Grade ranges for attainment of each level are intentionally unspecified. Students must begin and master the concepts at Level A before moving on to levels B and C. It is paramount for students to have worthwhile experiences at levels

A and B during their elementary school years to prepare for future development at Level C at the secondary level. Without such experiences, a middle- [or high-] school student who has had no prior experience with statistics will need to begin with Level A concepts and activities before moving to Level B.

The GAISE framework has become instrumental in providing guidance to writers of national mathematics documents, writers of state standards, writers of assessment items, curriculum directors, pre-K–12 teachers, and faculty of teacher preparation colleges on the essential topics and concepts in data analysis and probability for all students as they progress from kindergarten to graduation from high school. The GAISE framework has influenced the statistics components of both the Mathematics and Statistics College Board Standards for College Success (2007) and the NCTM document *Focus in High School Mathematics* (2008). The GAISE framework also influenced the data analysis and probability strand of recent state mathematics standard revisions (which includes my home state of Georgia). Most recently, the GAISE framework was the basis for the statistics and probability component included in the Common Core State Standards in mathematics.

Bridging the Gap is an excellent classroom resource that follows both the GAISE framework and Common Core State Standards for grades K–8. The elementary and middle grades are critical in laying the foundation of skills needed for our students to grow and evolve into sound statistical thinkers. These activities bring the real world to the student and provide the student the opportunity to understand the necessity of statistical reasoning and sense making for everyday life and post-secondary education. I'm appreciative to the writers of *BTG* and the ASA/NCTM Joint Committee for developing this valuable resource in support of both the recommendations of GAISE, the recommendations of the Common Core State Standards, and the importance of statistical reasoning in our K–8 curriculum.

Christine Franklin, University of Georgia
Chair of the GAISE report for grades pre-K–12

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We are indebted to the ASA/NCTM Joint Committee on Curriculum in Statistics and Probability (JC) for its support throughout the process of creating and publishing *Bridging the Gap* (*BTG*). This project began at a workshop held in the summer of 2008 at The Lawrenceville School in New Jersey. Its initial purpose was to begin the writing of classroom activities at levels A, B, and C of the GAISE framework. Several writings from the workshop formed the basis for the *BTG* investigations. Heartfelt thanks are extended to the workshop participants: Gloria Barrett, Cindy Bryant, Tim Erickson, Bonnie Hagelberger, Katherine Halvorsen, Pat Hopfensperger, Tim Jacobbe, Sibel Kazak, Michael Kimmel, Henry Kranendonk, Jim Landwehr, Mike Perry, Dick Scheaffer, and Daren Starnes.

As the Common Core State Standards (CCSS) in mathematics were initiated and the JC published *Making Sense of Statistical Studies* (15 high-school activities on surveys, observational studies, and experiments), it was decided that *BTG* should focus on only GAISE levels A and B and connect them to the CCSS for elementary and middle childhood.

In 2009, the JC approved Tim Jacobbe, Deborah Lurie, Pat Hopfensperger, and Jerry Moreno as the main writers of *BTG*. Some of the investigations are based on those initiated by the "Lawrenceville Group"; others are based on activities in the Data-Driven Mathematics series and *Exploring Statistics in the Elementary Grades*. We are also thankful for Tena Katsaounis, who contributed "What Do Frogs Eat?"

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Pat Hopfensperger
Tim Jacobbe
Deborah Lurie
Jerry Moreno