



# ABOUT *BRIDGING THE GAP*

*Bridging the Gap (BTG)* consists of 20 investigations in statistics and probability for grades K–8. It is written to help teachers implement the activities in their classrooms. Each investigation consists of the following headings appropriately written for its specific content:

Overview

Learning Goals

Common Core State Standards for Mathematical Practice

Common Core State Standards Grade Level Content

NCTM *Principles and Standards for School Mathematics (PSSM)*

Materials

Estimated Time


Instructional Plan consisting of the four steps of the GAISE process

Example of ‘Interpret the Results’

Assessment with Answers

Extensions

References

A CD-ROM is included that contains each investigation’s data-collection sheets, sample tables and graphs, examples of Interpret the Results, assessment, and other material for ease of making copies for classroom use. Material on the CD-ROM is indicated by  throughout the book.

There are four investigations in each of the following five topic sections:

Section 2 - Looking at Data

Section 3 - Describing Distributions

Section 4 - Comparing Groups

Section 5 - Exploring Relationship

Section 6 - Investigating Probability

## GAISE Framework

The GAISE framework emphasizes hands-on learning of statistics by using four steps:

**Formulating a statistical question** that can be answered with data

**Designing and implementing a plan** to collect appropriate data

**Analyzing the collected data** by graphical and numerical methods

**Interpreting the results** of the analysis in the context of the original question

In addition to references to the various Common Core ([www.corestandards.org](http://www.corestandards.org)) and National Council of Teachers of Mathematics' *PSSM* standards, each investigation explicitly contains the four components of the problem solving process presented in the American Statistical Association's *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K–12 Curriculum Framework* ([www.amstat.org/education/gaise](http://www.amstat.org/education/gaise)). The GAISE framework emphasizes hands-on learning of statistics by using four steps: formulating a statistical question that can be answered with data; designing and implementing a plan to collect appropriate data; analyzing the collected data by graphical and numerical methods; and interpreting the results of the analysis in the context of the original question. A second component of the GAISE framework is comprised of three levels of statistical development (levels A, B, and C detailed on pages 14 and 15 of the GAISE report). Students must progress through these levels to develop statistical understanding. In this regard, it is highly recommended that Level A investigations be presented before those at Level B.

By having written these investigations in the spirit of the GAISE framework, the authors of *Bridging the Gap* intend to help teachers unpack the Common Core State Standards (CCSS) for Mathematical Practice and the CCSS Statistics and Probability Domain for grades 6–8. As students progress through grades K–5, they will build a quantitative foundation in the CCSS Measurement and Data Domain in preparation for their study of statistics that begins in earnest in grade 6. This foundation is expanded in the middle school grades' standards with the "CCSS clusters" of developing understanding of statistical variability; summarizing and describing distributions; using random sampling to draw inferences about a population; drawing informal comparative inferences about two populations; investigating chance processes and developing, using, and evaluating probability models; and investigating patterns of association in bivariate data. *Bridging the Gap* follows this progression of growth in students' understanding of statistics and probability by providing model lessons tied to the CCSS and GAISE framework.

Note that in Linking Investigations, tables have been provided on pages xv and xvi to help teachers identify the connection of each investigation to GAISE levels A and B and the Common Core State Standards across grade levels. For planning purposes, a table has been included showing estimates of the time required to complete each investigation.

A brief description of the sections follows:

**Section 1:** Getting Started: Step One of the Data Analysis Process is devoted to the first GAISE step, formulating a statistical question that can be answered with data. It is important that this section is covered before doing any of the other sections. Understanding what is and is not a statistical question is fundamental to the statistical process.

**Section 2:** Looking at Data consists of four Level A investigations with emphasis on categorical data for one variable. This is the most basic of the five topic sections and is appropriate as an introduction to statistical thinking.

**Section 3:** Building distributions and describing their “center, spread, shape” is fundamental to understanding statistical variability. This section, Describing Distributions, discusses in particular the mean absolute deviation (MAD), a measure of spread that will be new to many teachers (CCSS 6.SP.5c). The importance of understanding and using the MAD is not only to develop a viable measure of variability, but also one that makes the understanding of standard deviation—a highly important measure of variation learned in the high-school curriculum—much clearer.

**Section 4:** Comparing Groups is concerned with experimental design for two variables for both numerical and categorical variables. All four of the investigations in this section are at GAISE Level B, so students need to have seen at least one investigation from Section 2 before tackling these.

**Section 5:** Exploring Relationship corresponds to the CCSS for Grade 8 on investigating bivariate data. Constructing scatterplots and drawing best-fitting lines through data that exhibit a linear relationship fit well into the Grade 8 mathematics standard of developing the equation of a line.

**Section 6:** The GAISE framework views probability as a mathematical model and a tool for statistics. This section, Investigating Probability, develops fundamental concepts of probability that pave the way for developing probability models at the high-school level.

**Section 7:** Teacher resources such as articles about the ASA poster and project competitions, STatistics Education Web (STEW), Statistics Teacher Network, Census at School, and webinars are included.

*Bridging the Gap* is designed so each lesson can stand alone. Our goal is to provide you with a resource giving you and your students data analysis experiences that bring the standards to life. It also is designed to give you flexibility. Several investigations can be completed in one class period, but many require multiple class periods so students can collect their data. For planning purposes, the following table shows an estimate of the time required to complete each investigation. Additional time will be needed for the assessment and extensions.

Estimated Time Guide

| Investigation | Estimated Time |
|---------------|----------------|
| 1.1           | 1 day          |
| 2.1           | 2 days         |
| 2.2           | 1 day          |
| 2.3           | 1 day          |
| 2.4           | 2 days         |
| 3.1           | 1 day          |
| 3.2           | 2 days         |
| 3.3           | 2 days         |
| 3.4           | 2–3 days       |
| 4.1           | 1–2 days       |
| 4.2           | 1–2 days       |
| 4.3           | 2 days         |
| 4.4           | 1 day          |
| 5.1           | 1–2 days       |
| 5.2           | 2 days         |
| 5.3           | 1 day          |
| 5.4           | 2 days         |
| 6.1           | 1 day          |
| 6.2           | 1 day          |
| 6.3           | 1 day          |
| 6.4           | 1–2 days       |

# LINKING INVESTIGATIONS

The following table shows the alignment of the GAISE levels A and B with the investigations in *Bridging the Gap*.

Linking GAISE Levels and Bridging the Gap

| Investigation | Level A | Level B |
|---------------|---------|---------|
| 1.1           | x       | x       |
| 2.1           | x       |         |
| 2.2           | x       | x       |
| 2.3           | x       | x       |
| 2.4           | x       |         |
| 3.1           | x       |         |
| 3.2           | x       |         |
| 3.3           |         | x       |
| 3.4           |         | x       |
| 4.1           |         | x       |
| 4.2           |         | x       |
| 4.3           |         | x       |
| 4.4           |         | x       |
| 5.1           |         | x       |
| 5.2           |         | x       |
| 5.3           |         | x       |
| 5.4           |         | x       |
| 6.1           | x       |         |
| 6.2           | x       |         |
| 6.3           |         | x       |
| 6.4           |         | x       |

The following table shows the alignment of the Common Core State Standards between the investigations in *Bridging the Gap* and grades K–8. Each investigation also is linked with the **Common Core State Standards for Mathematical Practice**. The following four practices are the focus of many of the investigations:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.

### Linking Grade Levels and the Common Core State Standards

| Investigation | Grades K-5                 | Grade 6                 | Grade 7                    | Grade 8                      |
|---------------|----------------------------|-------------------------|----------------------------|------------------------------|
| 1.1           |                            | 6.SP.1                  |                            |                              |
| 2.1           | K.MD.3, 1.MD.4,<br>2.MD.10 |                         |                            |                              |
| 2.2           | K.MD.3, 1.MD.4,<br>2.MD.10 |                         |                            |                              |
| 2.3           | K.MD.3, 1.MD.4,<br>2.MD.10 |                         |                            |                              |
| 2.4           | K.MD.3, 1.MD.4,<br>2.MD.10 |                         |                            |                              |
| 3.1           | K.CC.7                     |                         |                            |                              |
| 3.2           |                            | 6.SP.1-4                |                            |                              |
| 3.3           |                            | 6.EE.2, 6.SP.1-4        |                            |                              |
| 3.4           |                            | 6.SP.1-5                |                            |                              |
| 4.1           |                            | 6.SP.1-5                |                            |                              |
| 4.2           |                            | 6.SP.1-5                | 7.SP.3                     |                              |
| 4.3           |                            | 6.SP.1 and 5,<br>6.RP.1 |                            | 8.SP.1                       |
| 4.4           |                            | 6.RP.3c, 6.SP.3         |                            | 8.SP.4                       |
| 5.1           |                            |                         |                            | 8.SP.1                       |
| 5.2           |                            |                         |                            | 8.SP.1                       |
| 5.3           |                            |                         |                            | 8.SP.1 and 2                 |
| 5.4           |                            |                         |                            | 8.F.3 and 4,<br>8.SP.2 and 3 |
| 6.1           |                            |                         | 7.SP.5                     |                              |
| 6.2           |                            | 6.SP.1 and 2            | 7.SP.5 and 8a              |                              |
| 6.3           |                            |                         | 7.SP.5, 7.SP.7b,<br>7.SP.8 |                              |
| 6.4           |                            |                         | 7.SP.6                     |                              |