

# **Readington Township Public Schools**

## **Grade 6 Math Curriculum**

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## Sixth Grade Mathematics

### Overview

Readington Township Public Schools' mathematics curriculum provides students with a strong foundation in mathematics content while promoting and instilling the skills of problem solving, communication in mathematics, making mathematical connections, and reasoning. Throughout the delivery of the K-5 mathematics program, various tools and technology are employed, including manipulatives, calculators, software, apps, videos, websites, and computing devices (computers, tablets, interactive whiteboards, etc.). A strong focus of the program is on promoting high levels of mathematical thought through experiences that extend beyond traditional computation.

The Math 6 course is the required, full year course for 6<sup>th</sup> grade students working on grade level. This course is directly aligned with the New Jersey Student Learning Standards ("NJSLS") for grade 6. Through their work in this course, students will understand and apply their knowledge in real world applications. Focus will be on the content as specified in the NJSLS, as well as the NJSLS Practice Standards. The Practice Standards focus on the development of competencies used by mathematicians in all grades and throughout life.

Students in this course will study ratios, rates and proportional reasoning. They will expand their understanding of fractions to include algorithms and uses for dividing fractions. Students will use positive and negative numbers together to describe real world situations. They will order numbers and understand absolute value. Students will begin their work in Algebra as they use variables and expressions and understand the properties of numbers. They will engage in writing equations and inequalities that represent real world situations. Students will also understand area, surface area, and volume.

### STUDENT OUTCOMES

(Linked to [New Jersey Student Learning Standards for Mathematics 2016](#))

#### Ratios and Proportional Reasoning (6.RP)

##### **Understand ratio concepts and use ratio reasoning to solve problems.**

1. Understand the ratio concept and use ratio language to describe a relationship between two quantities.
2. Understand the concept of a unit rate and use rate language in the context of a ratio relationship.
3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
  - a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
  - b. Solve unit rate problems including those involving unit pricing and constant speed.
  - c. Find a percent of a quantity as a rate per 100. Solve problems involving finding the whole, given a part and the percent.
  - d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

#### Number Systems (6.NS)

##### **Apply and extend previous understandings of multiplication and division to divide whole numbers and fractions by fractions.**

1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions using visual fraction models and equations to represent the problem.

##### **Compute fluently with multi-digit numbers and find common factors and multiples.**

2. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
3. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12.
4. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

##### **Apply and extend previous understandings of numbers to the system of rational numbers.**

5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes to represent points on the line and in the plane with negative number coordinates.
  - a. Recognize opposite signs of numbers as locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself.
  - b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
  - c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
7. Understand ordering and absolute value of rational numbers.
  - a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
  - b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.
  - c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
  - d. Distinguish comparisons of absolute value from statements about order.
8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane.

### **Expressions and Equations (6.EE)**

#### **Apply and extend previous understandings of arithmetic to algebraic expressions.**

1. Write and evaluate numerical expressions involving whole-number exponents.
2. Write, read, and evaluate expressions in which letters stand for numbers.
  - a. Write expressions that record operations with numbers and with letters standing for numbers.
  - b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
  - c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems.
3. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
4. Apply the properties of operations to generate equivalent expressions.

#### **Reason about and solve one-variable equations and inequalities.**

5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
7. Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$ , and  $x$  are all nonnegative rational numbers.
8. Write an inequality of the form  $x > c$  or  $x < c$  to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form  $x > c$  or  $x < c$  have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

#### **Represent and analyze quantitative relationships between dependent and independent variables.**

9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

### **Geometry (6.G)**

#### **Solve real-world and mathematical problems involving area, surface area and volume.**

1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes.
2. Find the volume of a right rectangular prism. Apply the formulas  $V = lwh$  and  $V = Bh$  to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world problems.
3. Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate.
4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.

## Statistics and Probability (6.SP)

### Develop an understanding of statistical variability.

1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers
2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

### Summarize and describe distributions.

1. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
2. Summarize numerical data sets in relation to their context, such as by:
  - a. Reporting the number of observations.
  - b. Describing the nature of the attribute, including how it was measured and units of measurement.
  - c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern.
  - d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

## Mathematical Practices

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.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

## Strategies

- Teacher presentation
- Teacher read-aloud
- Group discussion
- Small Group instruction
- Group presentations
- Interactive Smartboard Lessons
- Partner work
- Museum walks
- Math talk (students explain their thinking)
- Small Group Work
- Daily 5 Math
- Centers/ stations

## Accommodations

[Accommodations and Modification Addendum](#)

## Assessments

### Formative

- Independent student work
- Ready Classroom Lesson Quizzes
- Teacher Observations
- Class Participation

### Summative

- Mid-Unit Test
- Unit Test

<ul style="list-style-type: none"> <li>• Class Discussions</li> <li>• Class Assignments</li> <li>• Homework Assignments</li> <li>• Notebooks</li> <li>• Anecdotal Records</li> </ul>	
<b>Benchmark</b>	<b>Alternative</b>
<ul style="list-style-type: none"> <li>• I-Ready Diagnostic</li> <li>• Performance Assessments</li> </ul>	<ul style="list-style-type: none"> <li>• Live Online Assessment Tools (Kahoot, Brainpop)</li> <li>• Student Projects</li> <li>• Student Presentations</li> <li>• Self-Assessments</li> </ul>
<b>Resources</b>	
<b>Required/Primary</b>	<b>Supplemental</b>
<ul style="list-style-type: none"> <li>• <i>Big Ideas Math 6</i> textbook (Ron Larson and Laurie Boswell; published by Big Ideas Learning)</li> <li>• <i>Associated Big Ideas Record and Practice Journal</i></li> </ul>	<ul style="list-style-type: none"> <li>• Brain Pop</li> <li>• IXL</li> <li>• Reflex Math</li> <li>• Online Tutorials (Learnzillion, Khan Academy, Math Antics)</li> <li>• Online Math Games (Math is Fun, Funbrain, Cool Math Games, Math Playground)</li> <li>• Illustrative Mathematics (<a href="http://www.illustrativemathematics.org">www.illustrativemathematics.org</a>)</li> <li>• Explore Learning <a href="#">Gizmos</a></li> <li>• Estimation 180</li> </ul>
<b>Essential Questions And Content</b>	
<p><b>Number Systems</b></p> <ul style="list-style-type: none"> <li>• How do you know which operation to choose when solving a real-life problem?</li> <li>• How can you use repeated factors in real-life situations?</li> <li>• What does it mean to multiply and divide fractions &amp; mixed numbers?</li> <li>• How is a coordinate plane used to graph and locate points that contain negative numbers?</li> </ul> <p><b>Ratios and Proportional Reasoning</b></p> <ul style="list-style-type: none"> <li>• How is a relationship between two quantities represented?</li> <li>• How are rates used to describe changes in real-life problems?</li> <li>• What is the connection between ratios, fractions, and percents?</li> <li>• How are lengths between the customary and metric system compared?</li> </ul> <p><b>Expressions and Equations</b></p> <ul style="list-style-type: none"> <li>• How are expressions that represent a real-life problem written and evaluated?</li> <li>• Does the order in which operations are performed matter?</li> <li>• How are mathematical operations used to solve an equation?</li> <li>• What happens to one variable when another changes?</li> <li>• How are mathematical operations used to solve an inequality?</li> </ul> <p><b>Geometry</b></p> <ul style="list-style-type: none"> <li>• How is a formula for the area of a polygon derived?</li> <li>• How are the lengths of line segments in a coordinate plane found?</li> <li>• How are three-dimensional figures drawn in two dimensions?</li> <li>• How do you measure the surface area or volume of certain shapes?</li> </ul> <p><b>Statistics and Probability</b></p> <ul style="list-style-type: none"> <li>• How is a statistical question identified?</li> <li>• What are the different ways to describe an average of a data set?</li> <li>• How can intervals, tables, and graphs be used to organize data?</li> </ul>	
<b>Pacing and Interdisciplinary Connections</b>	
<b>Number Systems</b>	

### Numerical Expressions and Factors (14 days)

1. Whole Number Operations
2. Powers and Exponents
3. Prime Factorization
4. Greatest Common Factor
5. Least Common Multiples

### Fractions and Decimals (20 days)

1. Multiplying Fractions
2. Dividing Fractions
3. Dividing Mixed Numbers
4. Adding and Subtracting Decimals
5. Multiplying Decimals
6. Dividing Decimals

### Integers and the Coordinate Plane (20 days)

1. Understanding Integers
2. Comparing and Ordering Integers
3. Fractions and Decimals on the Number Line
4. Absolute Value
5. Graphing on the Coordinate Plane

### ***Interdisciplinary Connections:***

- **6.NS.A.1** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

**6.NS.B.2** Fluently divide multi-digit numbers using the standard algorithm.

**6.NS.B.3** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

**MS-PS3-1.** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

**MS-PS3-2.** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

**Activity:** Students run a controlled, multi-step experiment to collect data. Students will apply data to evaluate the equation for kinetic versus stored energy. Students may use these equation solutions to recognize a relationship between the variables.

## **Ratios and Proportional Reasoning**

### Ratios & Percents (27 days)

1. Understanding and Writing Ratios
2. Ratio Tables
3. Rates
4. Comparing and Graphing Ratios
5. Percents
6. Solving Percent Problems
7. Converting Measurement

### ***Interdisciplinary Connections:***

**6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

**RI.6.4.** Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

**Activity:** Jigsaw activity in which students take charge of one particular word problem involving ratios and/or percentages, analyze the problem for relevant mathematical information, and then teach other students the process for dissecting the text and solving the problem.

**6.RP.A.3.A** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

**MS-ESS1-3.** Analyze and interpret data to determine scale properties of objects in the solar system.

**Activity:** Utilize ratio tables to determine weight (and other) conversions for other planets compared to Earth.

## Expressions and Equations

### Algebraic Expressions and Properties (16 days)

1. Understanding Algebraic Expressions
2. Writing Expressions
3. Order of Operations
4. Properties of Addition and Multiplication
5. Distributive Property

### Equations and Inequalities (20 days)

1. Writing Equations in One Variable
2. Solving Equations Using Addition or Subtraction
3. Solving Equations Using Multiplication or Division
4. Writing Equations in Two Variables
5. Writing and Graphing Inequalities
6. Solving Inequalities Using Addition or Subtraction
7. Solving Inequalities Using Multiplication or Division

### **Interdisciplinary Connections:**

**6.EE.A.1** Write and evaluate numerical expressions involving whole-number exponents.

**6.EE.A.2** Write, read, and evaluate expressions in which letters stand for numbers.

**6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.

**MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

**MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

**Activity:** Students run a controlled, multi-step experiment to collect force, mass, and acceleration data of the balloon rocket. Students will apply data to evaluate the equation  $f=m*a$ . Students may use these equation solutions to recognize a relationship between the variables (independent versus dependent, how changing one value will affect another).

## Geometry

### Areas of Polygons (9 days)

1. Areas of Parallelograms
2. Areas of Triangles
3. Areas of Trapezoids
4. Polygons in the Coordinate Plane

### Surface Area and Volume (10 days)

1. Three-Dimensional Figures
2. Surface Area of Prisms
3. Surface Area of Pyramids
4. Volumes of Rectangular Prisms

### **Interdisciplinary Connections:**

**6.G.A.2** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas  $V = l w h$  and  $V = b h$  to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

**MS-PS3-4.** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

**Activity:** Students will solve for and compare volumes of various solids, liquids, or gases.

## Statistics and Probability

### Statistical Measures (6 days)

1. Introduction to Statistics
2. Mean
3. Measures of Center
4. Measures of Variation
5. Mean Absolute Deviation

### Data Displays (6 days)

1. Histograms
2. Shapes of Distributions
3. Box and Whisker Plots

### ***Interdisciplinary Connections:***

**6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

**RI.6.7.** Integrate information presented in different media or formats (e.g. visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

**Activity:** Students will display survey information in different formats (histograms, dot plots, box plots, etc.) and summarize/ explain the results of the survey.

**6.SP.B.5.C** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

**MS-PS3-4.** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

**Activity:** Upon measuring and recording temperature over time, students will analyze for and find the mean, median, and mode of their data set.

## Career, Computer Science, and Key Skills

### **Number Systems**

#### • **Career Ready Practices**

Utilize critical thinking to make sense of problems and persevere in solving them.

**Activity:** Students must analyze word problems and interpret phraseology to determine that they are solving for the greatest common factor. They then must pick a problem solving strategy and carry it out completely for a final solution.

#### • **9.2 Career Awareness, Exploration, and Preparation**

**9.2.8.CAP.20-** Identify the items to consider when estimating the cost of funding a business.

**Activity:** Students use positive and negative numbers to examine profit and loss in business.

#### • **9.4 Life Literacies and Key Skills**

**9.4.8.TL.2-** Gather data and digitally represent information to communicate a real-world problem.

**9.4.8.TL.6:** Collaborate to develop and publish work that provides perspectives on a real-world problem.

**9.4.8.IML.14:** Analyze the role of media in delivering cultural, political, and other societal messages.

**9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

**Activity:** Students create Google Slides/ Presentations to display real-world word problems involving fraction and decimal operations.

#### • **Computer Science**

**8.1.8.DA.1-** Organize and transform data collected using computational tools to make it usable for a specific purpose.

**Activity:** Students collect and organize data using a Google Form, Google Doc table, or Google Sheet and plot the data points on a coordinate plane.

## **Ratios and Proportional Reasoning**

- **Career Ready Practices**

Use technology to enhance productivity, increase collaboration, and communicate effectively.

**Activity:** Students utilize an online Desmos Activity “Click Battle” to understand rates and derive the meaning of a unit rate.

- **9.2 Career Awareness, Exploration, and Preparation**

**9.2.8.CAP.13** Compare employee benefits when evaluating employment interests and explain the possible impact on personal finances.

**Activity:** Students can interpret ratio tables of benefit packages and make comparisons.

- **9.4 Life Literacies and Key Skills**

**9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option

**9.4.8.IML.4:** Ask insightful questions to organize different types of data and create meaningful visualizations.

**9.4.8.TL.6:** Collaborate to develop and publish work that provides perspectives on a real-world problem.

**Activity:** Students will use various methods to determine the best, or most cost-effective option, in different scenarios.

- **Computer Science**

**8.1.8.DA.1-** Organize and transform data collected using computational tools to make it usable for a specific purpose.

**Activity:** Students will use a Google Form to collect and analyze data to create part-to-part, part-to-whole, and whole-to-part ratios.

## **Expressions and Equations**

- **Career Ready Practices**

Utilize critical thinking to make sense of problems and persevere in solving them.

**Activity:** Students evaluate descriptions of relationships between values and variables, and write expressions based on these descriptions. Students explain the distributive property and why it is mathematically reasonable.

- **9.2 Career Awareness, Exploration, and Preparation**

**9.2.8.CAP.20-** Identify the items to consider when estimating the cost of funding a business.

**Activity:** Students will write expressions to model costs for a particular quantity of a product.

- **9.4 Life Literacies and Key Skills**

**9.4.8.TL.2:** Gather data and digitally represent information to communicate a real-world problem

**9.4.8.IML.12:** Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

**Activity:** Students gather data about the costs of real-world products, write expressions modeling the costs, make comparisons, and share their findings digitally.

- **Computer Science**

**8.1.8.DA.1-** Organize and transform data collected using computational tools to make it usable for a specific purpose.

**Activity:** Students collect data and develop a presentation for different real life problems in which variables represent unknown values.

## **Geometry**

- **Career Ready Practices**

Demonstrate creativity and innovation.

**Activity:** Students can identify more than one way to decompose a composite figure. They then solve for smaller areas and add together.

- **9.2 Career Awareness, Exploration, and Preparation**

**9.2.8.CAP.11:** Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.

**Activity:** Students explore how different occupations use geometry and apply geometric principles.

- **9.4 Life Literacies and Key Skills**

**9.4.8.TL.2:** Gather data and digitally represent information to communicate a real-world problem

**9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities)

**9.4.8.IML.8:** Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).

**Activity:** Students will apply area formulas to determine the area of a state, which can then be compared to population for discussion on how one might market to inhabitants of that area.

- **Computer Science**

**8.1.8.IC.1:** Compare the trade-offs associated with computing technologies that affect individual's everyday activities and career options.

**Activity:** Students make a digital anchor chart displaying knowledge of how the area of polygons (parallelograms, triangles, trapezoids, and composite figures) are used in different careers. Students would include defining features of the polygon, formula for area, and how/if computing technologies have changed how the geometry is used in the career field.

### **Statistics and Probability**

- **Career Ready Practices**

Utilize critical thinking to make sense of problems and persevere in solving them

**Activity:** Students can summarize and communicate data displayed in graphs, charts, etc. and describe the contextual meaning of its various mathematical attributes.

- **9.2 Career Awareness, Exploration, and Preparation**

**9.2.8.CAP.8:** Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.

**Activity:** Students use different measures of center to compare education and training requirements, as well as income potential, of two jobs of interest.

- **9.4 Life Literacies and Key Skills**

**9.4.8.CI.1:** Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions

**9.4.8.TL.2:** Gather data and digitally represent information to communicate a real-world problem.

**9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

**Activity:** Students will analyze data presented in different forms concerning garbage and recycling weights over time. Students can discuss how this affects their environment, community, etc.

- **Computer Science**

**8.1.8.DA.1-** Organize and transform data collected using computational tools to make it usable for a specific purpose.

**Activity:** Students demonstrate understanding of data interpretation by creating a display of student survey responses, and will analyze the quantitative measures of center and variability.