

Unit 5: Statistics

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **3-4 Weeks**
Status: **Published**

Unit Rationale

A unit on **Statistics** in Algebra 1 is crucial for equipping students with foundational skills in data analysis and interpretation. Statistics involves understanding and using data to make informed decisions, and its principles are applicable across various fields. Here's a detailed rationale for including a unit on Statistics in Algebra 1:

1. Foundation of Data Analysis

- **Introduction to Data:** Statistics introduces students to the concepts of collecting, organizing, and interpreting data. Understanding these basics is essential for analyzing and drawing conclusions from data in various contexts.
- **Descriptive Statistics:** Learning how to summarize data using measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation) provides a solid foundation for analyzing data sets.

2. Development of Critical Thinking and Problem-Solving Skills

- **Data Interpretation:** Students develop skills to interpret data effectively, including recognizing patterns, trends, and anomalies. This helps in making data-driven decisions and solving problems based on empirical evidence.
- **Analytical Techniques:** Applying statistical methods to analyze data enhances students' problem-solving abilities and critical thinking, as they learn to evaluate and draw conclusions from quantitative information.

3. Real-World Applications

- **Practical Use:** Statistics is used in a wide range of fields, including business, healthcare, social sciences, and engineering. Understanding statistics allows students to apply mathematical concepts to real-world problems, such as analyzing survey results, evaluating experimental data, and making predictions.
- **Informed Decision-Making:** Statistical literacy enables students to make informed decisions based on data, which is valuable in everyday life and in various professional contexts.

4. Preparation for Advanced Topics

- **Foundation for Higher-Level Statistics:** An introduction to statistics provides a basis for more advanced statistical concepts and methods, such as inferential statistics, hypothesis testing, and regression analysis.
- **Integration with Algebra:** Statistical concepts often involve algebraic operations, such as solving equations and working with functions. Understanding statistics in Algebra 1 helps students integrate these concepts and apply them in more complex scenarios.

5. Enhancement of Mathematical Literacy

- **Understanding Statistical Terms:** Familiarity with statistical terminology and notation helps students become more fluent in mathematical language and improves their ability to interpret and communicate data effectively.
- **Graphical Representation:** Learning to create and interpret various types of graphs (bar charts, histograms, box plots, scatter plots) enhances students' ability to visualize and analyze data.

6. Development of Data Literacy

- **Handling Data Sets:** Students learn how to handle and analyze different types of data sets, including categorical and numerical data. This broadens their ability to work with diverse data and apply appropriate statistical methods.
- **Critical Evaluation:** Understanding how to evaluate the reliability and validity of data and statistical conclusions helps students develop a critical perspective on data analysis.

7. Preparation for Standardized Testing

- **Test Preparation:** Statistics is a key component of standardized tests. Proficiency in statistical concepts and data analysis is essential for performing well on tests such as the SAT, ACT, and state assessments.

8. Fostering Analytical Skills for Future Studies

- **Interdisciplinary Connections:** Statistics connects with other areas of study, including science, social studies, and economics. A strong foundation in statistics prepares students for interdisciplinary learning and research.
- **Future Applications:** Skills gained from studying statistics are valuable for future academic and professional pursuits, including higher education and careers that involve data analysis and interpretation.

Including a unit on **Statistics** in Algebra 1 provides students with essential skills for analyzing and interpreting data, enhances their critical thinking and problem-solving abilities, and prepares them for more advanced mathematical and real-world applications. This unit supports students' overall mathematical development and helps them become informed and data-savvy individuals.

Topic 10: Statistics

Essential Questions

How do you use statistics to model situations and solve problems?

What information about data sets can you get from different data displays?

How can you use measures of center and spread to compare data sets?

How does the shape of a data set help you understand the data?

Why does the way in which data are spread out matter?

How can you use two-way frequency tables to analyze data?

Pre-Assessments

Topic Readiness Assessments available at [SavvasRealize.com](https://www.savvasrealize.com)

Instructional Plan

Lesson 10.1 Analyzing Data Displays

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to represent data using dot plots, box plots, and histograms.
- We are learning to interpret the data displayed in dot plots, box plots, and histograms within the context of the data that it represents.

Student Success Criteria ... “I can statements”

- I can organize and understand data using dot plots, histograms, and box plots.

Instructional Strategies and Activities

- Habits of Mind: What other information could you collect about the different types of information? How can you organize these data? How is interpreting a histogram similar to interpreting a dot plot? How is it different? When is it useful to display data as a dot plot? When is it useful to display data as a histogram? When is it useful to display data as a box plot?
- Student textbook page 431-437
- Vocabulary: bar graph, box plot, cluster, dot plot, histogram, interquartile range, outlier

Formative Assessments

- 10-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 10-1
- Additional Practice 10-1
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 12-29; Advanced 12-29

Reflections and Suggested Modifications

Common Error: Students understanding of 25% of the data- have students use the terms less than or equal to or greater than or equal to when referring to quartile values so they understand the values can be included in the descriptions of the data. Students may believe that you can use a histogram to find the minimum and maximum values of a data set because they misinterpret the numbers at the far ends of the intervals as the minimum and maximum.

Lesson 10.2 Comparing Data Sets

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use measures of center to interpret and compare data sets displayed in dot plots, box plots, and histograms.
- We are learning to explain and account for the effect of outliers on measures of center and variability.
- We are learning to use measures of variability such as the MAD and IQR to interpret and compare data sets.

Student Success Criteria ... “I can statements”

- I can use measures of center and spread to compare data sets.

Instructional Strategies and Activities

- Habits of Mind: Does the information given by a box plot allow you to determine the mean of a set of data? Does the type of graph you create with given data change the observations that can be made from the data display?
- Student textbook page 438-445
- Vocabulary: interquartile range, mean, mean absolute deviation, median, variability

Formative Assessments

- 10-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 10-2
- Additional Practice 10-2
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-24; Advanced 10-24

Reflections and Suggested Modifications

Common Error: Students may assume that any outlier will significantly affect the mean and the MAD, which will then affect the comparison with the other data set. Have the students compute the mean and the MAD without using the outlier to see that it does not significantly change the results. Have students add all data values and divide by the total number of values to calculate the mean. Point out the difference between the means and medians.

Lesson 10.3 Interpreting the Shapes of Data Displays

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to interpret and compare differences in the shape, center, and spread of data of different data sets.
- We are learning to determine the relationship between the mean and median of a data set when the shape of data is evenly spread, skewed right, or skewed left.

Student Success Criteria ... “I can statements”

- I can interpret shapes of data displays representing different types of data distributions.

Instructional Strategies and Activities

- Habits of Mind: Explain how the central tendencies of that data would shift if certain data are not included. If the mean and median of a set of data are equal or nearly equal are the data necessarily symmetric?
- Student textbook page 446-452
- Vocabulary: histogram, skewed

Formative Assessments

- 10-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 10-3
- Additional Practice 10-3
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 7-14; 16-22; Advanced 7-12; 14-22

Reflections and Suggested Modifications

Common Error: Students may think that data skewed right means that most of the data is to the right of the mean or median. Some students may interpret the graph as being skewed left since the bars are taller on the left. Remind students that shorter bars on the right indicate the data are skewed right. This usually means that the mean is greater than the median.

Lesson 10.4 Standard Deviation

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to interpret differences in the variability or spread in the context of a data set.
- We are learning to calculate the standard deviations of a data set and use it to compare and interpret data sets.

Student Success Criteria ... “I can statements”

- I can quantify and analyze the spread of data.

Instructional Strategies and Activities

- Habits of Mind: What is the range? What is the mean? Is it possible for data to fall more than two standard deviations above or below the mean? When the means of two or more data sets are equal, what does a greater standard deviation indicate?
- Student textbook page: 453-460
- Vocabulary: mean absolute deviation, variability, normal distribution, standard deviation, variance

Formative Assessments

- 10-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 10-4
- Additional Practice 10-4
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error: Students may neglect to use repeated data results when calculating standard deviation. Explain that when data sets are displayed, first arrange them in order from least to greatest. Then use each data value because every number in the data set represents a specific value from the set and repeated data does occur. Make sure students know how to interpret each column of the histogram as standard deviation indicators.

Lesson 10.5 Two-Way Frequency Tables

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to organize and summarize categorical data by creating two-way frequency tables.
- We are learning to calculate and interpret joint and marginal frequencies, joint and marginal relative frequencies, and conditional relative frequencies, and use them to make inference about a population.

Student Success Criteria ... “I can statements”

- I can organize data in two-way frequency tables and use them to make inferences.

Instructional Strategies and Activities

- Habits of Mind: How does joint relative frequency relate to joint frequency? How does marginal relative frequency relate to marginal frequency? Why can there be multiple values for conditional relative frequency?
- Student textbook page 461-466
- Vocabulary: conditional relative frequency, joint frequency, joint relative frequency, marginal frequency, marginal relative frequency

Formative Assessments

- 10-5 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 10-5
- Additional Practice 10-5
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-18, 21-27; Advanced 9-13, 16-27

Reflections and Suggested Modifications

Common Error: Understanding the use for each frequency

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

*SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.

Native language support: The teacher provides auditory or written content to students in their native language. [Sentence Stems](#)

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front-loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily

overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

*Always reference the students IEP for specific accommodations or modification per student need.

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Standards

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media Literacy

Diversity, Equity, and Inclusion

NCTM: Access and Equity in Mathematics Education

A Pathway to Equitable Math Instruction

Provide students with opportunities to give feedback to teachers about the classroom and instruction.

- Verbal Example: Fist to five, How well do you understand what we talked about today? Fist to five, How well did I teach this today?
- Classroom Activity: Exit tickets or surveys that ask students to identify how well teachers taught, what helped them learn, what got in the way of their learning, etc.

Treat mathematics as a language that everyone is learning while authentically centering students home languages.

- Classroom Strategies: Color-coding ideas, learning vocabulary in student languages, visual and kinesthetic learning, representations of learning without words.
- Classroom Activity: Multilingual Frayer Models for definitions or concepts

Incorporate true culturally relevant pedagogy, practice, and curriculum.

- Verbal Example: What are some of your family traditions that you are proud of? Would you be okay if we brought some of those into the classroom?
- Classroom Activity: Use Ankara fabric to teach mathematical concepts such as tessellations, fractions, area, percentages, etc.

Incorporate the history of mathematics into lessons.

- Verbal Example: Why do you think we call it Pythagorean's theorem, when it was used before he was even born? What should we call it instead?
- Classroom Activity: Learn about different bases and numerical ideas: Base 2, binary and connections to computer programming, how the Yoruba of Nigeria used base 20, and how the Mayans conceptualized the number 0 before the first recording of it

Solicit student ways of thinking and processing.

- Verbal Example: How might you all go about this? What do you notice?
- Classroom Activity: Incorporate explorations, where students interact with mathematics in a way that allows them to "discover" or experience mathematics.

Reorganize your classroom teaching around concepts, and teach them more like a web rather than discrete sets

of knowledge.

- Verbal Example: How does this connect to what you've learned in the past? How can you use that knowledge today?
- Classroom Activity: Learning webs that connect content

Start with more complex math problems and scaffold as necessary.

- Verbal Example: If we wanted to build a rocket, what are all the things we might need to know before we get started? Along the way, we decided that we want the rocket to reach the moon. What do we need to consider now?
- Classroom Activity: When solving equations, start with the most complex problem, generate ideas for how to solve it, and use the simpler equations as examples to support those ideas.

Offer a variety of ways to demonstrate thinking and knowledge.

- Verbal Example: Show your thinking with words, pictures, symbols.

Ask other questions that will demonstrate learning when it is not clear to you how students know the answer.

- Verbal Example: If you were working with a fellow mathematician who was absent this day, what might you tell them to help them learn it?

Learn about, engage with, and incorporate ethnomathematics.

- Verbal Example: Reflect on your day so far. What math have you already used today?
- Classroom Activity: Community walks to engage with slope.

Co-construct knowledge in the classroom.

- Verbal Example: Let's get into partners and do a think pair-share. We will incorporate everyone's ideas and try to synthesize them.
- Classroom Activity: Have students create mathematical definitions in their own words in groups, and bring the groups together to co-construct mathematical definitions as a class

Choose problems that have complex, competing, or multiple answers.

- Verbal Example: Come up with at least two answers that might solve this problem.
- Classroom Activity: Challenge standardized test questions by getting the "right" answer, but justify other answers by unpacking the assumptions that are made in the problem.
- Classroom Activity: Deconstructed Multiple Choice
- given a set of multiple choice answers, students discuss why these answers may have been included (can also be used to highlight common mistakes).

Identify what is right about the thinking, and highlight the mistake in what is factually or procedurally accepted.

- Verbal Example: You recognized that you had to combine the constants 27 and 9, could you explain your thinking?
- Classroom Activity: Error Analysis worksheets that highlight what is the right idea behind the mistake.

Using thoughtful questioning to solicit mathematical thoughts rather than telling.

- Verbal Example: What would a mathematician who is confused ask about this question?
- Classroom Activity: After students demonstrate knowledge of a topic, have them play a game where they have to explain their topic to a fellow mathematician and a skeptic. Develop their own reflective questioning/explaining in all three roles.

Create multiple ways of participating that honor myriad ways of thinking and being.

- Verbal Example: For this section, feel free to work alone, in pairs, trios, or quads (let them choose).
- Classroom Activity: Community circles or storytelling circles, incorporating dance, music, song, call and response, and other cultural ways of communicating.

Climate Change

[Math Climate Change Companion Guide](#)

- S.ID.B.6a Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.

Climate Change Example: Students may use linear or exponential functions fitted to geoscience data to solve problems and analyze the results from global climate models to make an evidence-based forecast of the current rate of global climate change.

- F.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m , where $c(m)$ is the number of molecules of carbon dioxide.

- F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

Climate Change Example: Students may relate the domain of a function $c(m)$ representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for $c(m)$.

- F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Climate Change Example: Students may calculate the average rate of change of a function $c(m)$ presented symbolically or as a table, where $c(m)$ represents the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline).

- A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.

- A.CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.

- A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law to highlight resistance R.

Climate Change Example: Students may rearrange formulas related to the economic impact of climate change to highlight a quantity of interest, using the same reasoning as in solving equations.

- N.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Climate Change Example: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.

- N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Climate Change Example: Students may define appropriate quantities for a descriptive model of how variations in the flow of energy into and out of Earth's systems result in climate change. Note: changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.

21st Century Life and Career

WRK.9.2.12.CAP.10

Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

There are strategies to improve one's professional value and marketability.

Integration of Computer Science and Design Thinking

CS.9-10.3A-AP-17

Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

CS.9-10.3A-AP-22

Design and develop computational artifacts working in team roles using collaborative tools.

CS.9-10.3A-AP-14

Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.

Interdisciplinary Connections: NJSL for ELA, Social Studies, Science and/or Math

SOC.K-12.1

Developing Questions and Planning Inquiry

Language: System and structure, effective use, and vocabulary

Speaking and Listening: Flexible communication and collaboration

Integration of Career Readiness. Life Literacies and Key Skills

TECH.9.4.2.CI

Creativity and Innovation

TECH.9.4.2.CT

Critical Thinking and Problem-solving

TECH.9.4.2.TL

Technology Literacy

New Jersey Student Learning Standards: Content Area

MATH.9-12.S.ID

Interpreting Categorical and Quantitative Data

MATH.K-12.1

Make sense of problems and persevere in solving them

MATH.K-12.2

Reason abstractly and quantitatively

MATH.K-12.3

Construct viable arguments and critique the reasoning of others

MATH.9-12.S.ID.B

Summarize, represent, and interpret data on two categorical and quantitative variables

MATH.K-12.4

Model with mathematics

MATH.K-12.5

Use appropriate tools strategically

MATH.K-12.6

Attend to precision

MATH.K-12.7

Look for and make use of structure

MATH.K-12.8

Look for and express regularity in repeated reasoning