POWER PLANNER 2 in Whyville

CAREER FOCUS

Power Planner Engineer

ACADEMIC FOCUS

Students use measures of central tendency to come to an informed decision in predicting the upcoming week's power demand.

Contents of this lesson plan

In Power Planner 2, students participate in an inquiry-driven activity on the amount of power Whyville will most likely need in the upcoming week. Students look at historical data from the Whyville data archives and make informed predictions from the data provided.

Through Power Planner 2, students will become familiar with probability and statistics concepts. Students will use measures of central tendency such as mean, median, and mode to consider Whyville's likely power usage in the coming week. Upon completion of this activity, students will choose what they believe is an appropriate amount of power for Whyville in the coming week. Consequently, two of the four power scenarios are removed from the deductive process. Students progress towards earning their Power Planner Engineer career badge by completing the activity. Students will connect their experiences in the activity to aligned academic standards and to real world experiences.

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POWER PLANNER 2 in Whyville

TEACHER PREPARATION

Review this prior to class!

Instructional Approach

This lesson plan uses directed inquiry to lead students to discover the questions they should ask about a topic, and the answers to those questions.

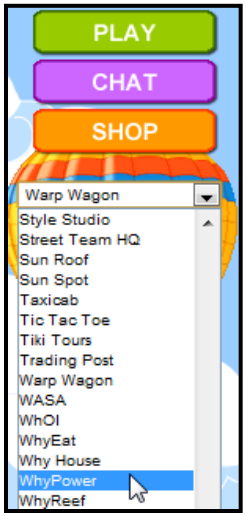
Teacher's Role

The teacher's role is classroom facilitator and expert consultant. You will lead students to explore and help them when they have problems. Many students will learn much more than is formally included in this lesson plan, and they will also be able to help other students.

Materials

1. Computers with Internet access and confirmed access to Whyville
2. CONNECT worksheet, included in this lesson plan.
3. Calculator (Optional)

Power Planner 2 is the second a series of lessons that introduce students, through exploration and practice, to concepts related to making an informed decision about power policy in Whyville. Ultimately, in Power Planner 3, students will make an informed vote on the coming week's power policy.



<u>These instructions are for the teacher only!</u> They help you quickly learn about the Whyville content and see how the lessons are learned by the students. When class time arrives, follow the instructions in *PART 1 -- EXPLORE*, and let the students explore the content and discover the lessons on their own.

1. Log into Whyville and select *WhyPower* from the Bus menu (see picture →).
2. Click the link *WhyPower Station.*
3. Click the link *Power Planner Central*. Once inside, click on the practice pages on Stacy's desk or click on the *Practice Worksheets* link.
4. If the student has completed the *Compute Power Generated* section previously, then the section for Predict Power Needs should load automatically. If not, the student may need to complete section 1 before gaining access to section 2.

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5. Teacher Tip: Students can look back at all of their worksheets by visiting *Power Planner History*, which can be accessed within *Power Planner Overview*. Here, they can revisit worksheets they did or did not complete.

Week of	Status	Page 1	Page 2	Page 3
Mar 4, 2012	Partially Completed			
Feb 19, 2012	Completed Feb 24, 2012	View	View	View
Feb 5, 2012	Completed Feb 10, 2012	View	View	View
Jan 29, 2012	Partially Completed			

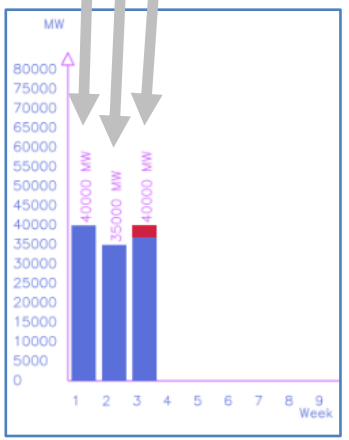
6. Upon entering the *Predict Power Needs* page, students are presented with the four power scenarios for which they discovered the total power output in Power Planner 1.

Scenario	Power	Components
A: High Mixed	50,400 MW	26 Coal , 9 Hydroelectric , 16 Nuclear , 14 Gas , 14 Solar , 13 Wind
B: Low Mixed	35,900 MW	13 Coal , 13 Hydroelectric , 7 Nuclear , 7 Gas , 6 Solar , 9 Wind
C: High Clean	50,400 MW	32 Hydroelectric , 19 Solar , 23 Wind
D: Low Clean	35,900 MW	23 Hydroelectric , 12 Solar , 16 Wind

7. Students see a spreadsheet displaying historical power usage.

Week Number	Week Date	Power Required (MW)
1	Jan 1	40,000 MW
2	Jan 8	35,000 MW
3	Jan 15	40,000 MW
4	Jan 22	35,000 MW
5	Jan 29	30,000 MW

8. They translate each week's data onto the following graph. The graph will display the mean, median, mode, minimum, and maximum for power use. The graph will update dynamically as the students enter data.



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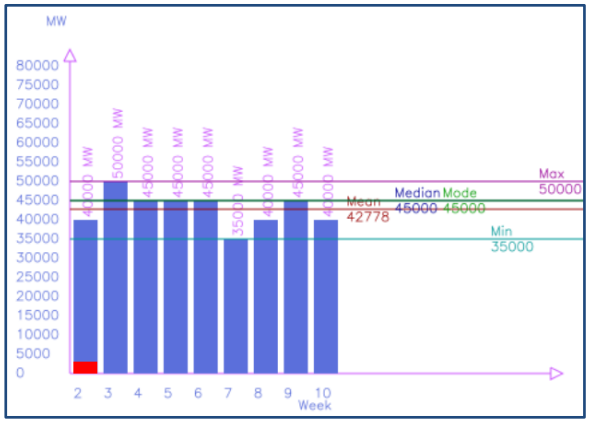
9. Once all data is entered into the graph correctly, the student will be asked a series of math questions based on the available data. Students will note the mean, median, mode, maximum, and minimum values of the data set. Students will also identify in which week specific values occur. For some questions, students will convert graphical data into fractions and percentages.



10. As they progress through the math questions, students may note a central tendency to the data.

11. Students decide for themselves what they think is the most appropriate power level for the upcoming week. Their decision will impact which scenarios are appropriate for later questions. Two of the scenarios will be equivalent to a low power level, the remaining two will be equivalent to a higher power level.

14. Extrapolating from the chart above, which power level would be best for satisfying the peak power need of Whyville in the next week?

- ○ 50000 MW
- ◉ 35000 MW

Submit

Scenario	Power	Components
A: High Mixed	50,400 MW	26 Coal , 9 Hydroelectric , 16 Nuclear , 14 Gas , 14 Solar , 13 Wind
B: Low Mixed	35,900 MW	13 Coal , 13 Hydroelectric , 7 Nuclear , 7 Gas , 6 Solar , 9 Wind
C: High Clean	50,400 MW	32 Hydroelectric , 19 Solar , 23 Wind
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12. Students choose the two scenarios that match their chosen power level for further analysis in Power Planner 3.

15. Based on your answer to question 13, which two scenarios will best supply that power level?

- ○ Scenarios A and B
- ○ Scenarios A and C
- ○ Scenarios A and D
- ○ Scenarios B and C
- ◉ Scenarios B and D
- ○ Scenarios C and D

Submit

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SCIENCE -- ENERGY TYPES

Like the first activity, Power Planner 2 exposes students to six primary sources of energy in large-scale energy production: coal, natural gas, nuclear, hydroelectric, wind, and solar energy. In other lessons, students place the power plants and collectors around Whyville, learning what is required for each type of energy (like a river for hydroelectric) and what constitutes wise placement. In later Power Planner lessons, students must consider other factors regarding these sources; for example, emissions. In this lesson plan, students are exposed to how much energy each can generate, and are therefore forced to consider to what degree various energy sources are able to meet modern power needs.

SCIENCE -- ENERGY MEASUREMENTS

While the current lesson is primarily focused on math content, there is meaningful science content in the lesson. First, the lesson reinforces the existence of multiple sources of large scale power, as listed above. Second, it lists the rate of energy generation of each source, helping students understand that different sources have different capacities to meet our power needs. Although not present in this lesson, Power Planner 3 will introduce the factors of emissions and land use.

Depending on the sequence in which you are using WhyPower lessons, this may be the first exposure of students to megawatts and megawatt-hours. This can be a difficult concept to describe. A megawatt is a *rate* of energy usage, even though that's not obvious from the name. Megawatts are like Miles per hour (mph). Miles per hour indicate how fast a car is going at a moment in time. Similarly, megawatts indicate how much energy is being used at a moment in time. Megawatt-hours indicate how much *total* energy is used, just like "miles" indicates total distance traveled. The important thing to remember about a megawatt-hour is that it is a measure of energy use over any time period, not just over one hour! The specific definition of a watt is Joules/second. A Joule is an absolute amount of energy.

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Term	Definition	Is this a Rate of use, or Total use?	It's analogous to …
Megawatts	The rate of usage of power in some process (like running an entire factory)	Rate of use	Miles per hour
Megawatt-hours	Total energy use over some amount of time	Total use	Total miles traveled

MATH

Math is the primary focus of the Power Planner 2 lesson. The power supply problem establishes a powerful real world context for students to learn math concepts. The majority of the math in this lesson focuses on using probability and statistics. Students transpose data from a written format to a graphical format and also use the graph to answer math questions. While entering the data onto the bar graph, students are exposed to concepts such as the mean, median, mode, minimum, and maximum of a data set. Students must also identify key points on the graph and how those points relate to the numerical data set. Students will also compute fractions and convert them to percentages in this lesson. As a review:

(next page)

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Math Concept	Definition	Example set: [3, 7, 4, 9, 1, 1, 30]	Note
Mean (average)	The sum of the values divided by the total number of items in the set.	$\frac{(3+7+4+9+1+1+30)}{N} = \frac{55}{7}$	The mean is influenced by outliers, such as 30 in the example.
Median	The value at the midpoint of a set of values, where the value is equally likely to fall above or below it (or the mean of the middle two terms when there is an even number of terms).	Odd-numbered set : $[1, 1, 3, \mathbf{4}, 7, 9, 30]=4$ Even-numbered set: $[1, 1, 3, \mathbf{4}, \mathbf{7}, 9, 30, 55]=\frac{4+7}{2}=5.5$	The median can be a better measure when there are extreme values in the data set, such as 30 and 55 in the example.
Mode	The most frequent value in a set.	Single mode set: $[\mathbf{1}, \mathbf{1}, 3, 4, 7, 9, 30] = 1$ Multimodal set: $[\mathbf{1}, \mathbf{1}, 3, 4, 5, 6, \mathbf{7}, \mathbf{7}, 9, 30] = 1, 7$	Some data sets can have more than one mode. Some data sets have no mode at all.
Minimum	The smallest value in a set.	$[\mathbf{1}, 1, 3, 4, 7, 9, 30] = 1$	
Maximum	The largest value in a set.	$[1, 1, 3, 4, 7, 9, \mathbf{30}] = 30$	

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Starter Question 3 minutes

How much power does Whyville need to run for the upcoming week? What information can help us predict?

Perform these *Teacher Actions* *Do these in the order indicated*	Expect this *Student Experience* *You should see your students experience the following*
1. ENGAGE (3 minutes) Ask students the Starter Question. Facilitate a class discussion for five minutes and help the students take ownership of the lesson.	**ENGAGEMENT** Students take ownership while they are discussing a question that matters to them.
2. DIRECT (2 minutes) Direct students to log into Whyville, go to *WhyPower*, and then to *WhyPower Station*, and then to *Power Planner Central*. Direct them to visit the *Practice Worksheets* instead of the *Voting Worksheets*. Whyville should automatically take the student to the second section in the practice worksheet, *Predict Power Needs*, if the first section was completed successfully.	**EXPLORATION** Within three minutes of the start of the lesson, students are logged into Whyville and in the *Power Planner – Predict Power Needs* practice worksheet, exploring the lesson and learning what is important and how to be successful.
3. COACH (15 minutes) Wander around the room, encourage students to help each other, and help individual students if they cannot work through problems. Ask students what the activity is, what is important to succeed, and where they have additional questions.	**Teacher Tips** • Avoid giving further directions. Let students explore individually and figure out for themselves what is going on, and how to be successful in the activities. • Students can look back at their worksheets by visiting *Power Planner History*, accessed from *Power Planner Overview*.

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WHERE DO THE LESSONS APPEAR? Recognize where the core content shows up.

Scenario	Power	Components
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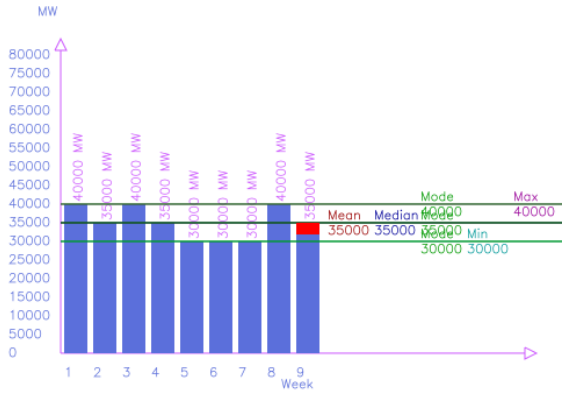
B: Low Mixed	35,900 MW	13 Coal , 13 Hydroelectric , 7 Nuclear , 7 Gas , 6 Solar , 9 Wind
C: High Clean	50,400 MW	32 Hydroelectric , 19 Solar , 23 Wind
D: Low Clean	35,900 MW	23 Hydroelectric , 12 Solar , 16 Wind

Students are provided with the four power scenarios whose total power was calculated in Power Planner 1. They will use this information later in the lesson, as they come to understand what an appropriate power level is for Whyville in the upcoming week.

Week Number	Week Date	Power Required (MW)
1	Jan 1	40,000 MW
2	Jan 8	35,000 MW
3	Jan 15	40,000 MW
4	Jan 22	35,000 MW
5	Jan 29	30,000 MW

Students are provided with a spreadsheet of historical power usage data for Whyville. Students translate this data from numerical form to graphical form on the bar graph.



Students use the bar graph to determine the mean, median, mode, minimum, and maximum. They use the graph to answer a series of math questions.

PART 2 – REFLECT

Do this for the next 10 minutes of class

	Perform these *Teacher Actions* ***Do these in the order indicated***	Expect this *Student Experience* ***You should see your students experience the following***
1.	**GATHER** Give students a warning that exploration time is almost over. After a minute has passed, have the students direct their attention towards you.	**GATHERING** Students wrap-up their self-guided exploration and turn their full attention to the discussion.
2.	**FACILITATE** Lead students to discuss the questions below. Guide them, and resist any urge to give them the answers.	**REFLECTING (group)** Students share their ideas and refine their ideas in large group discussion.

Questions

	Question	Expected Answer
1.	What is happening in this lesson?	We are looking at historical data to help us make informed decisions about the appropriate amount of power for the city.
2.	How do you succeed in this lesson?	Make an informed prediction about how much power Whyville will use, and choose the scenarios that best fit that prediction.
3.	What do you need to know to succeed?	The mean, median, mode, minimum, and maximum of the data. The *likelihood* that the data will fall within certain parameters.
4.	What questions do you still have?	
5.	Beyond being graded, do you care about this? Does this topic affect your life?	
6.	Name a real world job that is like this job.	Power Planner. *NOTE to teachers*: Use the students' knowledge of their parents' jobs, their real world experience, and their common sense to answer this question, and also any content the students have encountered in other career exploration resources.

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	Perform these *Teacher Actions* ***Do these in the order indicated***	Expect this *Student Experience* ***You should see your students experience the following***
1.	**DIRECT** Tell the students that their goal is to predict how much power Whyville will need for the coming week. Doing so, will help them progress towards earning their Power Planner Engineer badge. **Teacher Tip** • Many students will have progressed through the lesson during the EXPLORE section. Take advantage of students moving quickly by having them help other students.	**ACCOMPLISHING** Students work independently to progress toward their badges. Some students who have advanced farther naturally help other students.
2.	*Transition to* **CONNECT** As students finish and have no others to help, direct them to complete the CONNECT worksheet.	**CONNECTING** Students complete the worksheet, demonstrating their mastery of relevant standards and their understanding of real world applications.

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Name and Date		
Class Period and Whyville ID:		
Estimate how much power is needed for Whyville next week (in MW).		
1. What do you need to know to make your estimates better?		
2. Looking back at the graph, how does knowing the minimum & maximum help make your estimates better? Why?		
3. Looking back at the graph, did knowing the mean, median, and mode help make your choices better than only knowing the minimum & maximum? Why?		
4. What is the range between the maximum and the minimum? How much larger, by a percentage, was the maximum compared to the minimum?		
5. What is the range between the median and mode? Is this range larger, smaller, or equal to the range in question 4?		

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Name and Date		
Class Period and Whyville ID:		
1. Is the range between minimum & maximum or the range between the median & mode more focused? Which do you think is more likely to be closest to the power demanded by Whyville? Why?		
2. Do any of the 4 power scenarios fall outside the range of the minimum & maximum values found on the bar chart? If so, which scenarios? (Circle any that apply.)	a. Low, Mixed c. High, Mixed	b. Low, Clean d. High, Clean
3. Is it likely that Whyville will use a power scenario that is outside the minimum & maximum found on the bar chart? Why or why not?		
4. Which two power scenarios did you end up choosing by the end of the activity? (Circle any that apply.)	a. Low, Mixed c. High, Mixed	b. Low, Clean d. High, Clean

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5. What is the difference in power, in MW, between your 1st guess in question 1 compared to the scenario that you ended up choosing? Were they very close? Did using math help you come to a better conclusion than just guessing?	
6. What was the goal of the lesson?	
7. Do you think that predicting power demands might be an important job? Why or why not? What might happen if the wrong amount of power was predicted for a city?	
8. Do you care about what you learned? Is it relevant to your life? Why or why not? (The only wrong answer is no answer.)	

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TEKS: Career Portals

(1) The student explores one or more career clusters of interest. The student is expected to:
- **(A) identify the various career opportunities within one or more career clusters; and**
- **(B) identify the pathways within one or more career clusters.**

(2) The student explores pathways of interest within one or more career clusters. The student is expected to:
- **(A) investigate career opportunities within the pathways;**
- (B) explore careers of personal interest;

(4) The student explores the professional skills needed for college and career success. The student is expected to:
- (E) identify professional associations affiliated with a specified program of study;
- **(F) employ effective leadership, teamwork, and conflict management;**

TEKS: Career Investigation

(2) The student knows how to locate, analyze, and apply career information. The student is expected to:
- **(A) access career information using print and on-line resources to complete an educational and/or training plan for a career pathway;**
- **(B) access career information using interviews with business and industry representatives to create a career resource file;**

(6) The student knows the process of career planning. The student is expected to:
- **(B) prepare an oral or written plan describing the specific factors considered in the decision-making process used to solve a simulated career problem;**

(8) The student knows the effect change has on society and career opportunities. The student is expected to:
- **(A) cite examples of change in our society;**

TEKS: Exploring Careers

1) The student explores personal interests and aptitudes as they relate to education and career planning. The student is expected to:
- (D) research current and emerging fields related to personal interest areas;
- (F) explore how career choices impact the balance between personal and professional responsibilities; and

(2) The student analyzes personal interests and aptitudes regarding education and career planning. The student is expected to:
- (C) develop and analyze tables, charts, and graphs related to career interests;
- (D) determine the impact of technology on careers of personal interest; and

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(4) The student evaluates skills for personal success. The student is expected to:
- **(A) implement effective study skills for academic success;**
- **(C) use a problem-solving model and critical-thinking skills to make informed decisions;**
- **(D) use effective time-management and goal-setting strategies;**
- **(E) effectively use information and communication technology tools;**

(5) The student recognizes the impact of career choice on personal lifestyle. The student is expected to:
- (A) prepare a personal budget reflecting the student's desired lifestyle;

(7) The student develops skills for professional success. The student is expected to:
- **(E) explore and model characteristics necessary for professional success such as work ethics, integrity, dedication, perseverance, and the ability to interact with a diverse population; and**
- **(F) complete activities using project- and time-management techniques.**

(8) The student identifies and explores technical skills essential to careers in multiple occupations, including those that are high skill, high wage, or high demand. The student is expected to:
- **(A) complete actual or virtual labs to simulate the technical skills required in various occupations; and**
- (B) analyze the relationship between various occupations such as the relationship between interior design, architectural design, manufacturing, and construction on the industry of home building or the multiple occupations required for hospital administration.

TEKS: Mathematics

Update with TEKS

(1) Number, operation, and quantitative reasoning. The student understands that different forms of numbers are appropriate for different situations. The student is expected to:(A) compare and order rational numbers in various forms including integers, percents, and positive and negative fractions and decimals;
- (B) select and use appropriate forms of rational numbers to solve real life problems including those involving proportional relationships;

(2) Number, operation, and quantitative reasoning. The student selects and uses appropriate operations to solve problems and justify solutions. The student is expected to:
- (A) select appropriate operations to solve problems involving rational numbers and justify the selections;
- (B) use appropriate operations to solve problems involving rational numbers in problem situations;
- **(D) use multiplication by a given constant factor (including unit rate) to represent and solve problems involving proportional relationships including conversions between measurement systems.**

(3) The student identifies proportional or non-proportional linear relationships in problem situations and solves problems. The student is expected to:
- **(B) estimate and find solutions to application problems involving percents and other proportional relationships such as similarity and rates.**

(5) **Patterns, relationships, and algebraic thinking. The student uses graphs, tables, and algebraic representations to make predictions and solve problems**. The student is expected to:

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(A) predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations;

(9) The student uses indirect measurement to solve problems. The student is expected to

(B) use proportional relationships in similar two-dimensional figures or similar three-dimensional figures to find missing measurements.

(14) Underlying processes and mathematical tools. The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to:

(A) **identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;**

(B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness;

(C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem; and

(D) select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

(15) Underlying processes and mathematical tools. The student communicates about Grade 8 mathematics through informal and mathematical language, representations, and models. The student is expected to:

(A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models; and

(16) Underlying processes and mathematical tools. The student uses logical reasoning to make conjectures and verify conclusions. The student is expected to:

(A) make conjectures from patterns or sets of examples and nonexamples; and

(B) validate his/her conclusions using mathematical properties and relationships.

TEKS: Science

(3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) use models to represent aspects of the natural world such as an atom, a molecule, space, or a geologic feature;

(C) identify advantages and limitations of models such as size, scale, properties, and materials;

Blooms (Taxonomy):

X	Knowledge: arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state.
X	Comprehension: classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate
X	Application: apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write.
X	Analysis: analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test.
X	Synthesis: arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write.
X	Evaluation: appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support,

Instructional Strategies:

X	Identifying similarities and differences
X	Summarizing and note taking
X	Reinforcing effort and providing recognition
	Homework and practice
X	Nonlinguistic representations
X	Cooperative learning
X	Setting objectives and providing feedback
	Generating and testing hypotheses
X	Cues, questions, and advanced organizers

All standards listed are impacted by this lesson plan. **Boldfaced** standards represent the focus of the lesson plan.

Sixth Grade

Subcategory	*Standard ID*	*Standard Description*
Statistics and Probability	**6.SP.1**	**Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.**
Statistics and Probability	**6.SP.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.**
Statistics and Probability	**6.SP.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.**
Statistics and Probability	**6.SP.4**	**Display numerical data in plots on a number line, including dot plots, histograms, and box plots.**
Statistics and Probability	**6.SP.5.A**	**Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations.**
Statistics and Probability	**6.SP.5.B**	**Summarize numerical data sets in relation to their context, such as by: b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.**
Statistics and Probability	**6.SP.5.C**	**Summarize numerical data sets in relation to their context, such as by: 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.**

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Subcategory	*Standard ID*	*Standard Description*
Statistics and Probability	6.SP.5.D	Summarize numerical data sets in relation to their context, such as by: 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.

Seventh Grade

Subcategory	*Standard ID*	*Standard Description*
Expressions and Equations	**7.EE.3**	**Solve multi-step real life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.**
Expressions and Equations	**7.EE.4.A**	**Use variables to represent quantities in a real world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?**
Statistics and Probability	7.SP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

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Subcategory	*Standard ID*	*Standard Description*
Statistics and Probability	7.SP.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.
Statistics and Probability	**7.SP.5**	**Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.**

Eighth Grade

Subcategory	*Standard ID*	*Standard Description*
Expressions and Equations	8.EE.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

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