POWER PLANNER 3

in Whyville

CAREER FOCUS

Power Planner Engineer

ACADEMIC FOCUS

Ratios, proportions, and quantitative reasoning are used to help students understand the differing impacts of traditional and alternative energy sources.

Contents of this lesson plan

1.	Teacher Preparation	
2.	Part 1	EXPLORE (directed inquiry)
3.	Part 2	REFLECT (group discussion)
4.	Part 3	ACCOMPLISH (the assigned task)
5.	Part 4	CONNECT (to standards and real life)
6.	Student Worksheets	
7.	Standards Met	

In the Power Planner 3 activity, students deduce the best power scenario for Whyville. Students will compare the two remaining power scenarios based on cost, emissions, and total land use. Students participate in an inquiry-driven discussion on which factors are most important to them. The lesson challenges students to think critically about which power sources are optimal, given varying situations. Finally, the students cast an informed vote in the WhyPower poll.

By completing this lesson, students cover topics including ratios, proportions, and quantitative reasoning, and will understand the relative cost, emissions, and total land use created by each energy source. The Power Planner lessons culminate in students casting an informed vote in the weekly WhyPower poll! Students will receive a Power Planner Engineer badge for completing the Practice Worksheets. Finally, students will connect their experiences in the lesson to aligned academic standards and to real world experiences.

DaVinci Minds

POWER ACROSS TEXAS

NEXT GENERATION LEARNING CHALLENGES

ALAMO COLLEGES

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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)

In Power Planner 3, the students compare the final two power scenarios along the factors of emissions, land use and cost.

These instructions are for the teacher only! 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 *Predict Power Needs* section previously, then the section for *Decide on a Power Mix* should load automatically. If not, the student may need to complete section 2 before gaining access to section 3.
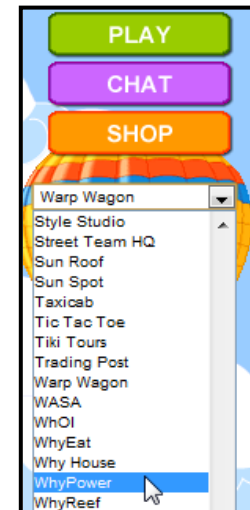
5. Upon entering the *Decide on a Power Mix* page, students are presented with the two power scenarios they thought were most appropriate in Power Planner 2.

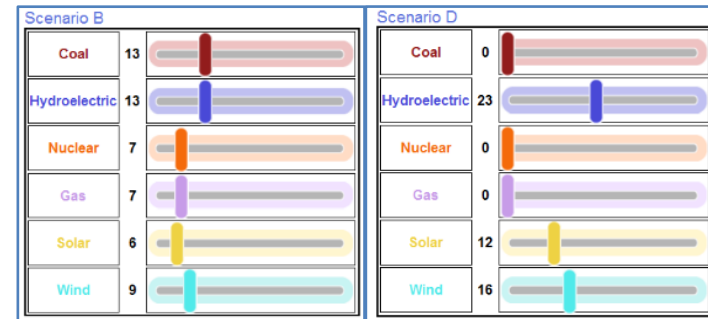| Scenario	Power	Components
B : Low Mixed	**35,900 MW**	13 Coal , 13 Hydroelectric , 7 Nuclear , 7 Gas , 6 Solar , 9 Wind
D : Low Clean	**35,900 MW**	23 Hydroelectric , 12 Solar , 16 Wind

6. Students should read the introductory text which provides a framework for why some cities choose certain power sources over others.
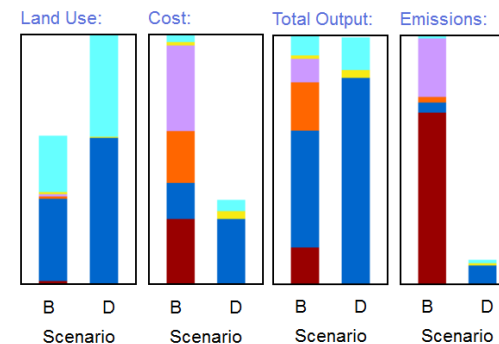
Teacher Tip

Students can look back at all of their worksheets by visiting *Power Planner History*, 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			

7. Students will move to the power comparison charts. They'll input the number of power sources for each power type.

Scenario B		Scenario D	
Coal	13	Coal	0
Hydroelectric	13	Hydroelectric	23
Nuclear	7	Nuclear	0
Gas	7	Gas	0
Solar	6	Solar	12
Wind	9	Wind	16

8. The stacked bar graphs, to the right, will update dynamically.

Land Use: Cost: Total Output: Emissions:
B D Scenario, B D Scenario, B D Scenario, B D Scenario

9. Once the sliders are adjusted properly, the students will have a set of good data to be asked questions on.

10. The students will be asked to identify which scenario uses the most land, costs the most, and produces the most emissions. Then, they will compare the two scenarios on each factor. <u>NOTE</u>: By design, the scenarios have the same power output.
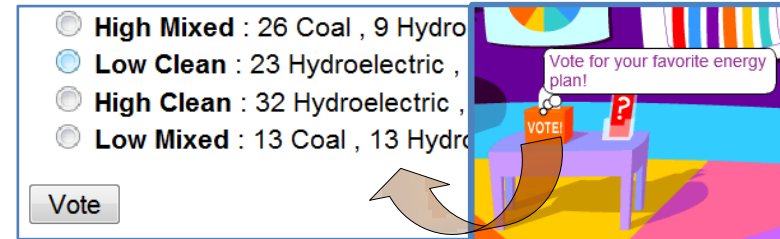
11. Upon completion of the last question, students will receive their Power Planner career badge and a boost to their Whyville salary. If completing the Practice Worksheets, students will receive a Junior Power Planner badge. If completing the Voting Worksheets, students will receive a Senior Power Planner badge.

12. To recap on the deductive process: In Power Planner 1, the students discovered the total power output of the four power scenarios. In Power Planner 2, the students chose two scenarios that best fit Whyville's power demands. In Power Planner 3, students looked at the pros and cons of the two power scenarios in terms of cost, emissions, and land use. Now, that the students are informed, it is time for them to cast an informed vote in the WhyPower poll! For example, they might make the choice indicated below, after having selected "B" and "D" during Power Planner 2.

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

13. To get to the poll, go to *Power Planner Central*. There is a small table with a voting ballot on it. Click there to access the poll.

High Mixed : 26 Coal , 9 Hydro
Low Clean : 23 Hydroelectric ,
High Clean : 32 Hydroelectric ,
Low Mixed : 13 Coal , 13 Hydro

Vote

Vote for your favorite energy plan!

14. Encourage the students to vote. The voting each week impacts which power sources are available within Whyville. For example, if scenario D wins the poll, then no nuclear, coal, or gas power sources will be available for Whyvillians to purchase and place throughout Whyville!
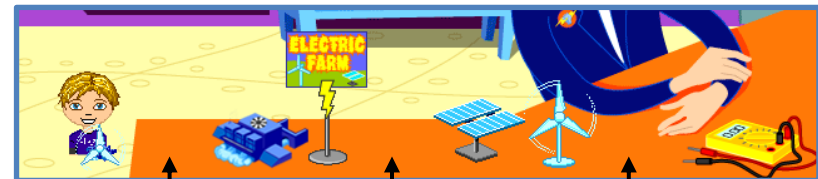
Nuclear, coal, and gas are absent from available power collectors after a Whyville vote.

SCIENCE -- LAND USE, EMISSIONS AND COST

Like the first activity, Power Planner 3 exposes students to six primary sources of energy in large-scale energy production: coal, natural gas, nuclear, hydroelectric, wind, and solar energy. In addition, students must consider other factors regarding these sources. Specifically, they will consider land use, emissions and cost.

MATH

Math is the primary focus of the Power Planner 3 lesson. The power supply problem establishes a powerful real world context for students to learn math concepts, making the concepts of fractions, ratios, and proportions relevant to the student, and calling on their intuitive understanding that there are parts of a whole. By manipulating the slider bars, the lesson engages students visually, and also kinesthetically, through physical interaction with the mouse or touchpad. Through questions about the graphs that call on students to evaluate reasonableness, they are driven to apply higher order thinking and get beyond the technical details and challenges of fractions, ratios and proportions. Through these approaches, this lesson focuses on using rational numbers, fractions, percentages, and understanding proportional relationships.

The chart below summarizes the math standards taught by all Power Planner lesson plans, including this lesson plan.

Covered in Power Planner Activity #	TEKS Reporting Category	Texas College Readiness Standard?	Texas Standard #	Description
1, 3	QUANTITATIVE REASONING	YES	8.1A	compare and order rational numbers in various forms including integers, percents, and positive and negative fractions and decimals; Readiness Standard
1, 3	QUANTITATIVE REASONING	NO	8.1B	select and use appropriate forms of rational numbers to solve real-life problems including those involving proportional
3	QUANTITATIVE REASONING	NO	8.1C	approximate (mentally [and with calculators]) the value of irrational numbers as they arise from problem situations (such as π, 2);
	QUANTITATIVE REASONING	NO	8.1D	(D) express numbers in scientific notation, including negative exponents, in appropriate problem situations.
1, 3	QUANTITATIVE REASONING	NO	8.2A	select appropriate operations to solve problems involving rational numbers and justify the selections; Supporting Standard
1, 3	**QUANTITATIVE REASONING**	**YES**	**8.2B**	**use appropriate operations to solve problems involving rational numbers in problem situations; Readiness Standard**
3	QUANTITATIVE REASONING	NO	8.2C	evaluate a solution for reasonableness; and Supporting Standard
1	QUANTITATIVE REASONING	NO	8.2D	use multiplication by a given constant factor (including unit rate) to represent and solve problems involving proportional relationships including conversions between measurement systems.
1, 3	ALGEBRAIC REASONING	YES	8.3B	estimate and find solutions to application problems involving percents and other proportional relationships such as similarity and rates. Readiness Standard
2	ALGEBRAIC REASONING	YES	8.4A	(A) generate a different representation of data given another representation of data (such as a table, graph, equation, or verbal description). Readiness Standard
ALL	ALGEBRAIC REASONING	YES	8.5A	(A) predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations; and
1	MEASUREMENT	YES	8.9B	(B) use proportional relationships in similar two-dimensional figures or similar three-dimensional figures to find missing measurements.
2	PROBABILITY& STATISTICS	YES	8.11A	(A) find the probabilities of dependent and independent events; and
2, 3	PROBABILITY& STATISTICS	NO	8.11B	(B) use theoretical probabilities and experimental results to make predictions and decisions. Supporting Standard
2	PROBABILITY& STATISTICS	NO	8.12A	(A) use variability (range, including interquartile range (IQR)) and select the appropriate measure of central tendency to describe a set of data and justify the choice for a particular situation;
2, 3	PROBABILITY& STATISTICS	NO	8.12B	draw conclusions and make predictions by analyzing trends in scatterplots; and Supporting Standard
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.14A	identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.14B	use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness;
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.14C	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
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.14D	select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.15A	(A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.16A	make conjectures from patterns or sets of examples and nonexamples; and
ALL	UNDERLYING PROCESSES & TOOLS	NO	8.16B	validate his/her conclusions using mathematical properties and relationships.

Starter Question 3 minutes

Now that you know how much power you will use for Whyville, which power sources will you choose to fill that demand? How will your choices affect Whyville?

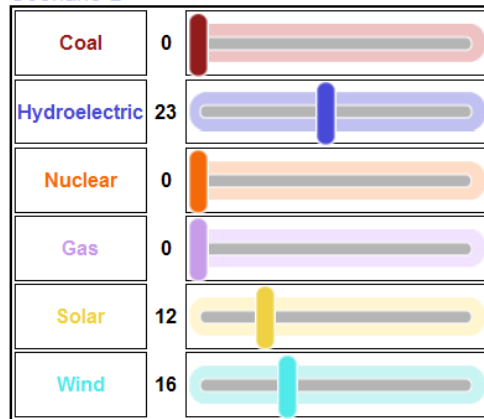| Perform these *Teacher Actions* *Do these in the order indicated*	Expect this *Student Experience* *You should see your students experience the following*
1. ENGAGE (3 minutes) Ask students the Starter Question. Facilitate a class discussion for five minutes and help the students take ownership of 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*, then to *WhyPower Station*, and then to *Power Planner Central*. Direct them to visit the *Practice Worksheets* instead of the *Voting Worksheets*. Students should go to the third section in the practice, *Decide on a Power Mix*. <u>NOTE</u>: Avoid giving further directions. Let them explore individually and figure out the activities, and how to be successful in the activities.	**EXPLORATION** Within three minutes of the start of the lesson, students are logged into Whyville and in the *Power Planner – Decide on a Power Mix* practice worksheet, exploring the lesson and learning what is important and how to be successful. **Teacher Tip** Students can look back at all of their worksheets by visiting *Power Planner History*, which can be accessed within *Power Planner Overview*.
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.	

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

Students are provided with the two power scenarios which were chosen in Power Planner 2. They will use this information to adjust the slider bars on the Power Analyzer.

Scenario	Power	Components
B : Low Mixed	**35,900 MW**	13 Coal , 13 Hydroelectric , 7 Nuclear , 7 Gas , 6 Solar , 9 Wind
D : Low Clean	**35,900 MW**	23 Hydroelectric , 12 Solar , 16 Wind

Scenario D

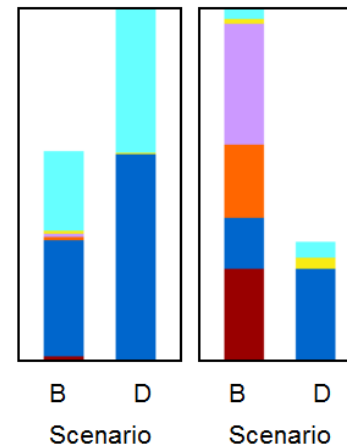| Coal | 0 |
Hydroelectric	23
Nuclear	0
Gas	0
Solar	12
Wind	16

Students adjust the Power Analyzer to match the two scenarios. The sliders will augment a set of stacked bar graphs, to the right.

Land Use: Cost:

B   D   B   D
Scenario   Scenario

The stacked bar graphs show the relative contribution of each power type with regards to cost, emissions, and total land use. Students use the graphs to answer math questions.

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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.	**GATHER** Give students a warning that exploration time is almost over. After a minute has passed, have the students direct their attention to 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 and refine ideas in large group discussion.

Questions

	Question	Expected Answer
1.	What is happening in this lesson?	We are looking at how different power sources have different pros and cons, when varying factors are taken into consideration.
2.	How do you succeed in this lesson?	By becoming an informed voter and by casting a vote in the weekly WhyPower poll.
3.	What do you need to know to succeed?	Which scenarios have the biggest impact on emissions and land use, and which scenario costs the most. Knowing which of the factors matters most to me.
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.	Energy Analyst. *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 win their Power Planner Engineer badge by completing the online worksheet and voting in the weekly WhyPower poll. Instruct students who finish early to assist other students.	**ACCOMPLISHING** Students work independently to earn their badges. Those that already earned their badge help those who have not. They receive help from the teacher as needed. Students cast their votes in the weekly WhyPower poll.
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.

Name and Date		
Class Period and Whyville ID:		
1. What new factors did you consider in this lesson?		
2. Of the two scenarios, which had the greatest emissions?		
3. Of the two scenarios, which used the most land?		
4. Of the two scenarios, which cost the most?		
5. Where was the biggest difference between the scenarios? By what factor?		
6. Based on what you already knew about the different power sources, did you find any surprising results in the graphs?		
7. Why did you choose the scenario you voted for?		

Name and Date		
Class Period and Whyville ID:		
1. Which power source uses the most land? Why?		
2. Which power source generates the most emissions? Why?		
3. Which power source costs the most? Why?		
4. If you were a real life power planner, which factor would be most important to you, and why?		
5. Do you think that choosing the amount of power from different power sources might be an important job? Why or why not?		
6. Can you give an example about what might happen if we didn't choose the power sources that fit our city's needs?		

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

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

(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:

(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
Ratios and Proportions	6.RP.3.C	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. c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
Expressions and Equations	**6.EE.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.**

Seventh Grade

Subcategory	Standard ID	Standard Description
Ratios and Proportions	7.RP.2.B	Recognize and represent proportional relationships between quantities. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

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?

Eighth Grade

Subcategory	Standard ID	Standard Description
Expressions and Equations	8.EE.7.B	Solve linear equations in one variable. b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.