ELECTRIC FARM 2 in Whyville

CAREER FOCUS

Power Planner Technician

ACADEMIC FOCUS

Understanding the differences in cost, emission, and land use of nuclear vs. hydroelectric energy generation; measuring electrical energy; understanding rate of return on investment.

Contents of this lesson plan

In Electric Farm 2, students participate in an inquiry-driven discussion about the differences between nuclear and hydroelectric energy plants. The lesson challenges students to think critically about the pros and cons of these two types of energy. Students will purchase each type of collector and place them in amenable Whyville locations. They generate power which is sold back to the power grid. In this lesson, we also reinforce energy-topics covered in earlier lessons.

In completing this lesson, students cover *rate of return* and will understand the differences in power output, initial cost, startup times, environmental impacts and total land usage between hydroelectric and nuclear power generation. Students progress towards earning their Power Planner Technician badges by placing the nuclear and hydroelectric collectors. Finally, students will connect their experiences to aligned academic standards and real world experiences.

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ELECTRIC FARM 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

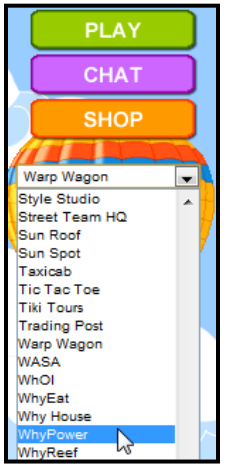
The teacher's role is classroom facilitator and expert consultant. You will lead students to explore and help them when they have problems. Many students will learn much more than is formally included in this lesson plan, and they will also be able to help other students.

Materials

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

In Electric Farm 2, the students compare nuclear and hydroelectric power generation by placing both kinds of power plants in Whyville.

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. Once inside, notice the power collectors available on Becky's desk. Hover your mouse over the collectors to learn about them.

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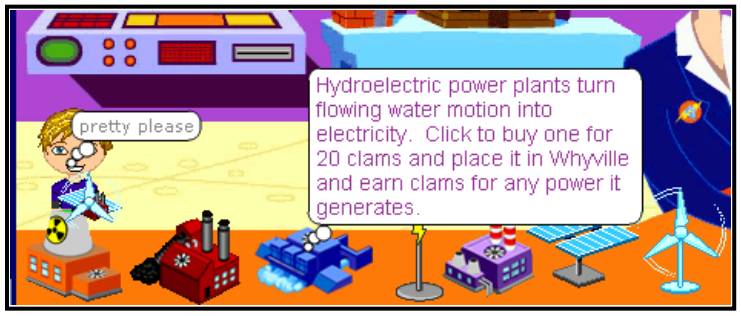
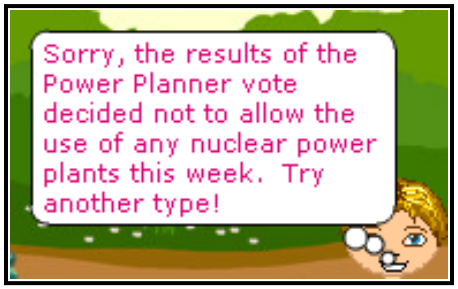
4. Click on the nuclear reactor once and type “pretty please” to purchase. Nuclear reactors cost 40 clams.

5. Click on the hydroelectric dam once and type “pretty please” to purchase. Hydroelectric dams cost 20 clams.



6. The ability to place power plants is impacted by how Whyvillians voted in the prior week’s WhyPower Poll. If Whyvillians voted for Clean Energy, you cannot place a coal, gas, or nuclear plant except in special places. If Clean Energy was selected, you may see this message:



However, collectors can be placed in *practice rooms* regardless of the outcome of the vote in the WhyPower Poll:

> Now, if the citizens of Whyville have voted to use only *clean energy*, you cannot place the coal, gas, and nuclear plants in Whyville; however, **at all times, you can place them in the practice rooms, regardless of the vote results**:
>
> - Practice Meadow
> - Practice Lake Fishin'
> - Practice Twin Rivers

7. Nuclear collectors can only be placed at *Lake Fishin’* or *Practice Lake Fishin’*. Hydroelectric plants can only be placed at *Twin Rivers* or *Practice Twin Rivers*.

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8. Transport to Lake Fishin' and place a nuclear reactor by typing ***whypower nuclear***.

9. Transport to Twin Rivers and place a hydroelectric dam by typing ***whypower hydro***.

10. Mouse over the collector after it's been in place for a while to see how much energy it is producing. The collector will stay in the room for one hour.

11. Take note of any environmental impacts you observe.

12. You can review the return from your purchased energy collectors by examining your checking account statement at the bank. Go to the Bank Account icon at the top of the window and view your Checking Statement.

Date	Transaction	Amount
May 2 4:38 AM	WhyPower Power Collector	40
May 2 4:37 AM	WhyPower Power Collector	32
May 2 3:41 AM	WhyPower Power Collector	-22
May 2 3:36 AM	WhyPower Power Collector	-50

13. Placing these two collectors will help you progress towards attaining the Power Planner Technician badge.

14. The students will need to consult information on the Electric Farm Info page to complete their Connect worksheets.

	Coal	Hydroelectric	Nuclear	Natural Gas	Solar	Wind
Renewable		✓			✓	✓
Capacity (MW)	400	1300	1000	500	100	300
Emissions (kg/hour)	396	23	22	250	5	6
Land Use (acres)	250	15000	42	58	371	15000
Cost in clams	22	20	40	50	3	3
Payoff in clams	32	104	80	40	0-8	0-20
LEGEND:		Good	Bad			

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SCIENCE

Hydroelectric dams take the mechanical energy of flowing water and turn turbine blades to drive an electric generator. The generator converts mechanical energy to electrical energy. It is the opposite of an electrical motor where electrical energy is converted to mechanical energy.

Nuclear plants use a process called nuclear fission. In this process, one atom splits into two atoms and releases energy. A naturally radioactive material, usually uranium-235, is artificially induced to more quickly progress through the fission process. The released energy heats water and the resulting steam drives a turbine. Surprisingly, the process following nuclear fission is virtually identical in concept to the conversion process used by hydroelectric dams and wind turbines! However, the water serves the dual purpose of keeping the nuclear material cool. Failure to keep the material cool leads to a nuclear meltdown.

Land use, emissions, and cost are attributes along which power plants are measured. Hydroelectric power uses a very large amount of land. Because a dam is required, much land winds up artificially under water. The emissions and by-products of nuclear energy are of a different nature than other sources. When plants operate correctly, the volume of waste is small, but waste potency is very high, and waste disposal is technically and politically challenging. When nuclear plants fail, emissions are immediately dangerous to the immediate population, and can be dangerous to distant populations downwind from nuclear plants.

MATH

Students will be asked to calculate earnings on their investment in nuclear and hydroelectric collectors, and the rate of return on their investment. To calculate their earnings, they will need to look at their checking account to obtain the total amount paid for collectors (cost) and the total amount of income earned in generating energy from their collectors. Remind them that their salary should not be a part of this calculation! Students will subtract the total cost from their total income:

Earnings = Income – Cost

The rate of return on investment is determined by dividing the earnings by the cost of the investment in energy collectors.

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Rate = (Income – Cost) / Cost
*RatePercentage = Rate * 100*

Students can compare that rate of return to the percentage they get from putting money in a savings account at the bank, or into a CD.

Students should be asked to compare the rate of return on nuclear collectors with the rate of return on hydroelectric collectors. Whyville pays a clam per kilowatt hour for energy irrespective of the source.

Prior Lesson Refresher: Energy Measurements

Remember the difficult concept of kilowatts vs. kilowatt-hours that we are working to teach the students! Kilowatts are like miles-per-hour (MPH). MPH indicates how fast a car is going per hour; kilowatts indicate how much energy-per-second is being used at a moment in time. **Kilowatt-hours indicate how much *total energy* is used, just like "miles" indicates total distance traveled.** The weird thing to understand about kilowatt-hours is that it is measures energy use over *any time period*, not over one hour!

Term	Definition	Is this a Rate of Use, or Total Use?	It's analogous to …
Kilowatts	The rate of usage of energy in some process	Rate of Use	Miles per hour
Kilowatt-hours	Total energy use over some amount of time	Total Use	Total miles traveled

For those of you mathematically inclined, we offer this "proof" to demonstrate how it is that kilowatt-hours is an absolute amount of *energy*.

1. Suppose we have ***25 kilowatt-hours***.
2. Kilowatt-hours is really shorthand for ***kilowatt * 1 hour***.
3. A ***watt*** is 1 Joule / second. So:
   25 kilowatt-hours = 25,000 Joules / 1 ~~second~~ * 1 hr (3,600 ~~seconds~~)
4. **25 kilowatt-hours = 90,000,000 Joules!** *Terms cancel!*

Since a ***Joule*** is an **absolute amount of energy** (named after James Prescott Joule), we have proven that ***kilowatt-hours is an absolute amount of energy!***

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Scenario/Starter Question 3 minutes

Read the scenario from the Connect worksheet to the students, and then ask:

What are the strengths and weaknesses of hydroelectric and nuclear? Which is a better choice for your city?

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 three 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 the hydroelectric and nuclear plants. Point out that this is an opportunity to make clams if they can make some good choices. NOTE: Avoid giving further directions. Let them explore individually or in teams and figure out for themselves what is going on, and how to be successful in the activities.	**EXPLORATION** Within five minutes of the start of the lesson, students are logged into Whyville and in the energy collection activity, exploring the placement of hydroelectric and nuclear collectors to effectively collect energy and make clams.
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.	

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

Students purchase a nuclear and hydroelectric power collector from WhyPower Station.

Students place the collectors in the appropriate rooms: *Lake Fishin'* for nuclear, *Twin Rivers* for hydroelectric.

	Coal	Hydroelectric	Nuclear	Natural Gas	Solar	Wind
Renewable		✓			✓	✓
Capacity (MW)	400	1300	1000	500	100	300
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Land Use (acres)	250	15000	42	58	371	15000
Cost in clams	22	20	40	50	3	3
Payoff in clams	32	104	80	40	0-8	0-20

LEGEND: Good Bad

Students complete their Connect worksheets, utilizing the Payoff Graph and data table in the Electric Farm Info page and by visiting the Peak Power activity.

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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 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 placing a nuclear and hydroelectric collector in an appropriate room and observing the results in terms of power output, clams generated, and environmental impacts.
3.	What do you need to know to succeed?	How to purchase collectors and where to place them.
4.	What questions do you still have?	
5.	Beyond being graded, do you care about this? Does this topic affect your life?	Yes, the power sources we choose can affect our quality of life. Ex: Fukushima
6.	Name a real world job that is like this job.	Power Planner

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PART 3 – ACCOMPLISH

Do this for the next 15 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.	**DIRECT** Tell the students that their goal is to progress towards earning their *Power Planner Technician* badge by placing 2 of the 6 collectors. Instruct students who finish early to assist other students.	**ACCOMPLISHING** Students place one nuclear reactor and one hydroelectric dam in Whyville. They observe the differences between the two types of collectors. They receive help from the teacher as needed.
2.	**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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Scenario: Your city needs to add at least 900MW to its power grid. Your boss, the *Power Planner Engineer*, has been given a budget of 50 clams by the city to build the best power source for the city. The engineer has asked you, the apprentice *Power Planner Technician*, to look more closely at two potential candidates: nuclear and hydroelectric energy. Things to consider: Your city is in a mountainous region, containing deep gorges and fast-flowing rivers. A threatened species of fish spawns in these rivers each year; there are also historic sites within the gorges. Your city is also near the sea -- the prevailing winds blow from the sea over the town. The only available site for the nuclear plant is near the ocean. 35% of the citizens of your city are employed by the commercial fishing industry.

Name and Date	Class Period and Whyville ID:
1. What are we learning in this lesson?	
2. How do the two collectors create energy differently?	
3. How many clams did you earn from placing each collector? What was your % rate of return for each type?	*Earnings = Income - Cost* *Rate = (Income - Cost) / Cost* *Rate % = Rate * 100* Hydro: Nuclear:
4. Let's look at the Payoff Graph. Which two collectors will pay back the most clams?	(*Payoff Graph is on the Electric Farm Info page*):
5. Is there an environmental impact from either power source? If so, what did you observe?	
6. Taking into consideration the scenario above, do you feel hydroelectric or nuclear energy is the best choice for your city? Justify your answer.	

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

TEKS: Career Investigation

(1) The student analyzes the effect of personal interest and aptitudes upon educational and career planning. The student is expected to:
  (B) match interests and aptitudes to career opportunities; and
(3) The student knows that many skills are common to a variety of careers and that these skills can be transferred from one career opportunity to another. The student is expected to:
  (A) compile a list of multiple career options matching interests and aptitudes; and
(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;
  (B) compose a report explaining positive and negative aspects of one of the examples of societal change;
  (C) develop a timeline covering the last ten years depicting the change in a selected career choice,

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;
(4) The student evaluates skills for personal success. The student is expected to:
  (C) use a problem-solving model and critical-thinking skills to make informed decisions;
  (F) identify skills that can be transferable among a variety of careers.
(6) The student demonstrates an understanding of personal financial management. The student is expected to:
  (A) compare the advantages and disadvantages of different types of banking services;
  (B) simulate opening and maintaining different types of bank accounts;
  (C) simulate different methods of withdrawals and deposits; and
  (D) reconcile bank statements, including fees and services.

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(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: 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;

(5) The student understands personal financial management and recognizes the value of personal fiscal responsibility. The student is expected to:

(A) compare and contrast different types of banking services;

(B) open and maintain different types of simulated bank accounts;

(C) practice different methods of withdrawing and depositing funds;

(D) reconcile bank statements, including fees and services;

TEKS: Mathematics

(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;

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(B) select and use appropriate forms of rational numbers to solve real life problems including those involving proportional relationships;

(C) approximate (mentally and with calculators) the value of irrational numbers as they arise from problem situations (such as □, □2);

(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;

(C) evaluate a solution for reasonableness; and

(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) Patterns, relationships, and algebraic thinking. The student identifies proportional or non-proportional linear relationships in problem situations and solves problems. The student is expected to:

(A) compare and contrast proportional and non-proportional linear relationships; and

(B) estimate and find solutions to application problems involving percents and other proportional relationships such as similarity and rates.

(4) Patterns, relationships, and algebraic thinking. The student makes connections among various representations of a numerical relationship. The student is expected to generate a different representation of data given another representation of data (such as a table, graph, equation, or verbal description).

(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; and

(B) find and evaluate an algebraic expression to determine any term in an arithmetic sequence (with a constant rate of change).

(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;

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(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
(B) evaluate the effectiveness of different representations to communicate ideas.

(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

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:
(A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;
(B) design and implement comparative and experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
(E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(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:

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(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;

(7) Earth and space. The student knows the effects resulting from cyclical movements of the Sun, Earth, and Moon. The student is expected to:

(A) model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons;

(B) demonstrate and predict the sequence of events in the lunar cycle; and

(C) relate the position of the Moon and Sun to their effect on ocean tides.

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,

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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
X	Generating and testing hypotheses
X	Cues, questions, and advanced organizers

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Sixth Grade

Subcategory	Standard ID	Standard Description
The Number System	6.NS.2	**Fluently divide multi-digit numbers using the standard algorithm.**
The Number System	6.NS.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
The Number System	6.NS.5	**Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real world contexts, explaining the meaning of 0 in each situation.**
Expressions and Equations	6.EE.6	**Use variables to represent numbers and write expressions when solving a real world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.**
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.**
Expressions and Equations	6.EE.8	Write an inequality of the form x > c or x < c to represent a constraint or condition in a real world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

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Subcategory	Standard ID	Standard Description
Expressions and Equations	6.EE.9	**Use variables to represent two quantities in a real world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.**

Seventh Grade

Subcategory	Standard ID	Standard Description
Ratios and Proportions	7.RP.3	**Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.**
Expressions and Equations	7.EE.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05 a means that “increase by 5%” is the same as “multiply by 1.05.”

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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?**
Expressions and Equations	7.EE.4.B	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. b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.

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Eighth Grade

Subcategory	Standard ID	Standard Description
Functions	8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
Functions	8.F.3	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.
Functions	8.F.5	**Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.**

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