

MA State Standards addressed by the lesson (Include minimum of two state frameworks goals for this subject and grade level that this lesson aligns to):

- 8.P.5** Identify the slope of a line as a measure of its steepness and as a constant rate of change from its table of values, equation, or graph. Apply the concept of slope to the solution of problems.
- 8.P.6** Identify the roles of variables within an equation, e.g., $y = mx + b$, expressing y as a function of x with parameters m and b .
- 8.P.10** Use tables and graphs to represent and compare linear growth patterns. In particular, compare rates of change and x - and y -intercepts of different linear patterns.
- 8.P.7** Set up and solve linear equations and inequalities with one or two variables, using algebraic methods, models, and/or graphs.

National Education for Sustainability Standards addressed by the lesson (Include minimum of two EfS standards that this lesson aligns to):

- 2.3 Energy Economics** - Students survey their own household energy uses, explore opportunities for increased energy efficiency and conservation, and then calculate potential savings over time. (This standard is deeply embedded in the entire lesson.)
- 3.1 Personal Responsibility** - Students know the difference between actions that they can take themselves and those that require the involvement of other people, organizations, and government. They identify and carry out a personal action that will enhance quality of life in environmental, social/cultural, or economic sectors. (See the homework reflection questions #4-7)

Brief Summary of Lesson (including curricular content and lesson goals):

This lesson looks at writing and solving systems of equations using examples from the field of sustainability and more specifically energy economics. Students will look at the cost of two commonly used household items (namely, light bulbs and computers) over time as systems of linear equations and solve the systems of equations by graphing as well as substitution. Students will learn what a solution to a system of equations is and how it relates to a real-life situation. The real-life situation will afford students the opportunity to explore energy efficiencies and potential costs over time as well as reflect on their personal energy choices.

Stage 1 – Identify desired results**Enduring understandings (what understandings are desired?):*****Mathematical Understanding:***

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships

Sustainability Understanding:

Students recognize the concept of sustainability as a dynamic condition characterized by the interdependency among ecological, economic, and social systems and how these interconnected systems affect individual and societal well-being. They develop an understanding of the human connection to and interdependence with the natural world.

Essential questions (what essential questions will be considered?):

How do elements in a system depend on each other?

How is mathematics used as a tool in the world around us?

Outcomes (what key knowledge and skills will students acquire as a result of this lesson/unit?)***Students will know...***

That initial price is different from overall costs

Students will be able to ...

- Write a linear equation for a real-world situation
- Solve a system of linear equations using graphing and substitution
- Calculate energy costs over time

Stage 2 – Determine acceptable evidence

Performance tasks (what evidence will show that students understand?):

Students will write two equations in the practice and apply section of the homework, and solve by graphing and substitution.

Students will articulate in their analysis/reflection portion of the activity that initial price is not always a good indicator of long-term cost and looking at cost over time will help them in analyzing energy and product choices.

Other evidence (quizzes, tests, prompts, observations, dialogues, work samples):

Class discussion with students

Observations of student groups

Stage 3 – Learning plan

Learning activities (what will students do and what will you, the teacher do, to prepare the students to achieve the desired outcomes?):

Prerequisite Skills and Knowledge:

- Students will already have some knowledge of solving systems of equations by graphing and substitution.
- Students will know how to write an equation for a real-world situation.
- Students will know their ecological footprint and what actions have an affect of altering their footprint.

Possible Misconceptions before and during lesson:

- Buying less expensive items is always cost effective.
- More expensive/higher quality electronics will always use less electricity and create a smaller ecological footprint.

Materials Needed:

- **Electricity Costs/Systems of Equations Worksheet**
- **Graph Paper**
- **Electricity Costs/Systems of Equations Homework**

Procedure:

1. Teacher will briefly review with students the basic skills of solving systems of equations by graphing and substitution. (5 minutes)
2. Students will work in partner groups on Electricity Costs/Systems of Equations Worksheet. Teacher will assist groups as needed and help facilitate learning. (15-20 minutes)
3. As a whole class, students will discuss what they learned. (15-20 minutes)
Some leading questions to use:
 - How might what you learned influence your choices when purchasing light bulbs in the future?
 - What additional factors are not included in the linear model of cost over time that you might want to consider as a consumer?
 - Would these other factors affect you're purchasing decisions? How?
 - How might you use this information to help lower your ecological footprint?
4. Pass out homework and give directions. (5 minutes)