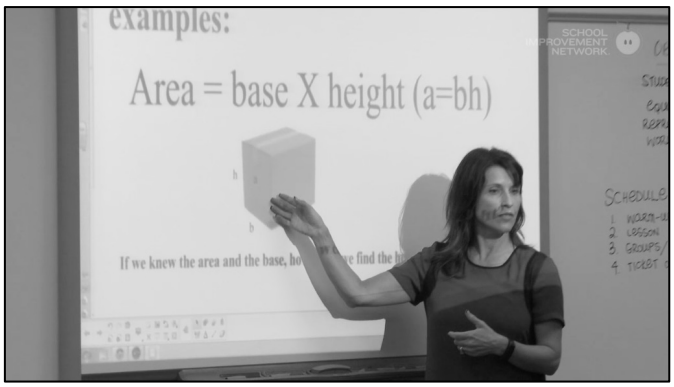
Unknown Variables in Real-World Problems

STEM: Science, Technology, Engineering, Mathematics



STEM Classroom Series

The STEM Classroom Series features lessons that promote understanding of STEM content knowledge, integrate STEM with non-STEM subjects, and increase students' exposure to STEM-related career options.

About This Segment

STEM education challenges students to apply their knowledge of math in real-world situations. In Ms. Jana Anderson's 6th grade math class, students participate in stations focused on solving equations for unknown variables.

Application activities **(complete all that meet your goals for viewing this segment)**

A. Learn more about STEM education

1. In the table on the next page, identify the elements of effective instruction, as well as the elements of effective STEM instruction, that you observed in this lesson.

2. How could the teachers enhance or add to the elements of instruction in their lesson?

3. How could the teachers enhance or add to the elements of STEM instruction?

C. Infuse STEM principles into your own lessons

1. Apply the six questions in the "Replicate this lesson" activity to one of your own lessons.

2. Determine challenges you might face in applying these STEM concepts to your own lesson. How can you overcome these challenges?

B. Replicate this lesson

1. *What are the learning objectives you want your students to achieve?*
   How would you modify the lesson's objectives, outlined in the lesson plan below, for your own students and curriculum? What other objectives, if any, will you set?

2. *What content knowledge do you need to acquire or expand?*
   This lesson has students solve for unknown variables in the equations A=BH and D=RT. What more do you need to learn about these concepts? Visit the Resources to Support Content Knowledge links in the lesson plan section of this guidebook.

3. *How will you create the time and space to engage students in this lesson?*
   How much time will this learning activity take to plan and carry out? How can you integrate the activity into your current curriculum map?

4. *What materials and other resources do you need for this lesson?*
   What materials are needed for this lesson? See the Materials section of the lesson plan. What collaboration is necessary with administrators and other teachers?

5. *How will you assess student learning?*
   In this segment, students complete a worksheet. How else might you formatively assess their learning?

6. *How can you promote a STEM focus in your instruction?*
   What STEM experiences were students engaged in during this lesson? (See the "Elements of Effective STEM Instruction" below.) What are some others that you could include?

Elements of Effective Instruction	Elements of Effective STEM Instruction
- High expectations for all students - Rigorous content - Authentic performance tasks - Real-time assessment adapted to student needs - Student-driven learning - Strong relationships among students and between teacher and students - Equitable, culturally relevant content and practices - Evidence of 21st century skills, e.g. critical thinking, problem solving, collaboration, creativity, communication - Technology that enhances learning - Cross-curricular (interdisciplinary) integration	*In addition to the Elements of Effective Instruction left, effective STEM instruction can include:* - Teachers who develop solid STEM-related content knowledge - Hands-on problem-solving activities that have real-world relevance - Integration of STEM into non-STEM subjects, especially art and design - Use of industry-standard software, tools, and procedures such as the engineering design cycle - Increased awareness of STEM fields and occupations, especially among underrepresented populations - Enthusiasm about further STEM-related learning - Connections between in-school and out-of-school learning opportunities - Industry and higher-ed partnerships that encourage hands-on student exploration of STEM-related careers

Sources: California Dept. of Education. (2015). Science, technology, engineering, & mathematics. Retrieved February 21st, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

President's Council of Advisors on Science and Technology (PCAST). (2010). Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future. Retrieved from the Whitehouse.gov website: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

General STEM Information and Resources

Utah STEM Action Center (n.d.). STEM Utah. Retrieved January 22, 2015, from http://stem.utah.gov/

California Department of Education (n.d.). Science, technology, engineering, and mathematics. Retrieved January 22, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

National Education Association. (n.d.). The 10 best STEM resources: Science, technology, engineering & mathematics resources for preK-12. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics. Retrieved March 23, 2015, from http://www.stemreports.com/wp-content/uploads/2011/06/NRC_STEM_2.pdf

PBS Teachers. (n.d.). STEM education resource center. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

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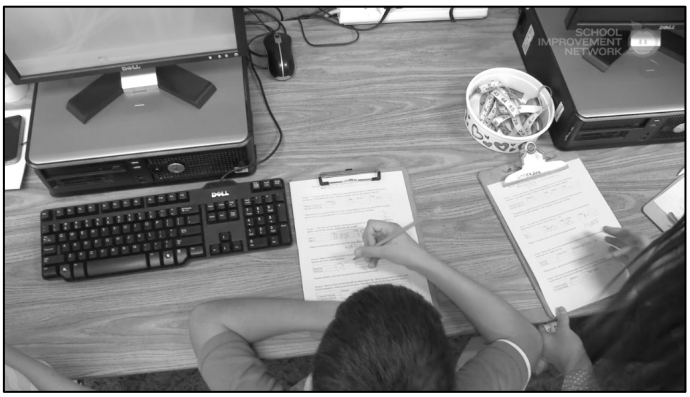


Unknown Variables in Real-World Problems — Lesson Plan

Teacher: Jana Anderson	**Grade/Content Area**: 6th Math
School: Fossil Ridge Intermediate School, St. George, Utah	**Lesson Duration**: 50 min.

Lesson Objective(s)

Students will be able to create tables using known and unknown quantities that represent real-world problems.

Key Concepts and Vocabulary

(See below for online resources that support content knowledge)

- Distance = Rate*Time (D=RT)
- Area = Base*Height (A=BH)
- Substitution
- Variable

Standard Addressed in the Lesson

Write, read, and evaluate expressions in which letters stand for numbers.

Assessment

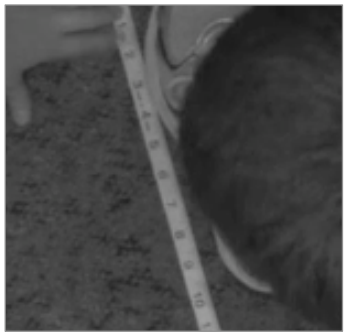
Students will complete a table that calculates equations using inverse operations, and they will also complete a worksheet which requires them to solve for the unknown when calculating distances, rates, and times.

Prior Knowledge

Students are familiar with the use of variables to represent numbers when solving real-world mathematical problems.

Materials

- PowerPoint of equations
- Remote control car or toddler's play vehicle
- Stopwatches
- Different-sized boxes with one edge length and area pre-measured and written on each box
- Measuring tapes
- Masking tape to mark 20 ft. distances on floor
- One worksheet per student (See attached.)



Lesson Procedures

1) Warm Up: Cover concepts taught during the previous week, specifically the formulas A=BH and D=RT. Reinforce the real-world application of the equations.
2) Activity: Pair students, then assign each pair to four groups that rotate through four stations, 3-minutes per station.
    a. Group 1: Record the time for either a remote control car or toddler's vehicle to travel 20 feet, then find the rate of speed using the equation D=RT.
    b. Group 2: Solve for the unknown edge of a box using the equation A=BH.
    c. Group 3: Approximate shoe-size using the equation S=3F-24.
    d. Group 4: Record the time it takes to hop 20 feet, then find the rate of speed using the equation D=RT. (Not featured in segment due to time constraints.)
3) Discussion: Have students share their observations.

Resources to Support Content Knowledge

STEM Utah. (n.d.). Home page. Retrieved November 30, 2015, from http://stem.utah.gov/

San Jacinto College. (2011). Word problems with variables. Retrieved November 30, 2015, from http://stufiles.sanjac.edu/THEA/THEAMathReviewforWebsite/THEAMathReviewforWebsite9.html

Related Video Lessons and Resources

6th grade: Calculating discounts, taxes, and tips in the Mathlandia Mall. Edivate. https://pd360.com/#resources/videos/8143

6th grade STEM: Displaying data in histograms. Edivate. https://pd360.com/#resources/videos/10655

Solving for the Unknown Worksheet

Name:_____

Station 1: One person will race the car. The other will use a stopwatch to measure the time to travel, rounding to the nearest whole second. Trade places and repeat.

	Distance =	Rate	Time
Car Test 1			
Car Test 2			

Describe how knowing the distance and rate of travel can tell you how much time it will take to arrive at your destination. Use an equation to prove your conclusion.

Station 2: Pick a box and use the given information to solve for the unknown variable. Once complete, pick a second box.

	Area =	Base	Height
Box 1			
Box 2			

Predict why a company might need to know the surface area of their packaging. What are the pros and cons of larger packages?

Station 3: Measure and record the length of one boy's shoe and one girl's shoe in inches. Solve the equation below to see if it is more accurate for boys' shoes or girls' shoes.

	S (shoe size) =	3*F (shoe length in inches)	
Boy's Shoe			- 24
Girl's Shoe			- 24

Was the equation more accurate for boys' shoes or girls' shoes? Why?

Station 4: One person will hop a distance of 20 feet. The other will use a stopwatch to measure the time they took to travel the distance, rounding to the nearest whole second. Trade places and repeat.

	Distance =	Rate	Time
Person 1			
Person 2			