

Areas and Volumes

Module 1

Module 1 Description:

Elementary teachers examine how concepts involving areas and volumes progress from third grade to fifth grade and beyond. The lessons modeled in training integrate mathematics and science. Training begins with a third grade lesson that reinforces methods of determining perimeter and area through a series of activities contextualized through animal and habitat conservation. Teachers work selected questions from and discuss teaching strategies for the third grade lesson in which students move from analyzing regular shape to composite shapes as they move from artificial animal enclosures to wildlife refuges. Training continues with a manipulative-rich fourth grade lesson which reinforces the concepts of perimeter and area using an area game, building a ziggurat, and utilizing topographical maps. Training concludes with a fifth grade lesson on volume of rectangular prisms in which students design a community garden while optimizing for growing area and minimizing for soil requirements given parameters.

Learner Outcomes:

Participants will

- compare expectations for students from third grade math through pre-calculus on the topics of areas and volumes to increase vertical alignment.
- apply deeper content-based knowledge to increase instructional rigor in order to prepare students for middle grades math courses leading to high school courses that lead to college-level calculus in an AP class or university setting.
 - calculate area and perimeter for rectangular and composite figures in real-life and mathematical situations
 - use fractions to represent the area of visible portion of a multi-level structure
 - calculate volume of rectangular prism in real-life and mathematical situations.
 - become familiar with topographic maps and use clay to create a simulated landform
 - develop an optimal floor plan and plant layout for a community garden grow space based on measurements and parameters, design a controlled investigation to explore the factors that affect plant growth and seed germination, and apply area and volume to determine spacing of plants in a garden and soil needs, as required for completion of a budget.
- identify instructional strategies that they can use to assist students in developing the habits of mind that are required for college and career readiness.



Rate of Change: Foundational Understandings Module 2

Module 2 Description:

Elementary teachers examine how concepts that lead to rate of change progress from third grade to fifth grade and beyond. The lessons modeled in training integrate mathematics and science, and teachers work selected questions from and discuss teaching strategies for these model lessons. Training begins with a hands-on third grade lesson in which students create fraction strips for a number line and then explore fraction equivalency. The lesson continues by exploring magnets in both open investigations and through controlled experiments. Teachers then engage in a fourth grade lesson in which students explore grouping and how it relates to division. In using dimensional analysis, they apply their knowledge of multiplication of fractions. In addition, teachers work through and discuss a fifth grade lesson in which students examine a nomadic journey represented by a series of topographic maps to create x- and y-coordinates and graph a side view of the mountain in quadrant I of a coordinate plane and use the graph to answer questions about the journey. Teachers will also see that in the lesson students will also learn about how a mountain can interact with the hydrosphere to create vastly different climates on each side of the mountain.

Learner Outcomes:

Participants will

- compare expectations for students from third grade math through pre-calculus on the topic of rate of change to increase vertical alignment.
- apply deeper content-based knowledge to increase instructional rigor in order to prepare students for middle grades math courses leading to high school courses that lead to college-level calculus in an AP class or university setting
 - label and manipulate fraction strips to identify equivalent fractions and rank fractions in order of value on a number line.
 - investigate magnetism to develop general rules for how magnets interact with each other and other objects and carry out an experiment to see that the magnetic force felt by an object in a magnetic field is dependent on the distance between that object and the magnet.
 - build an electromagnet to explore how they work and their ability to turn on and off when the wire is connected to the battery or not, respectively, and carry out an experiment to see that the strength of the magnetic field for an electromagnet is dependent on the number of coils of wire wrapped around the metal object being magnetized.
 - explore grouping and how it relates to division
 - apply dimensional analysis to convert between units
 - investigate speed as a measure of energy and determine how friction forces affect motion
 - assign and plot coordinates in quadrant I of the coordinate plane.
 - sequence a series of topographic maps in chronological order with justification
 - explore geologic process of plate tectonics in a hands-on modeling investigation
 - measure and compare values from their graphical representation, applying a conversion factor as needed
 - observe the cycle between the liquid and gaseous phases of water in a demonstration
 - understand the concept of a “precipitation shadow” and describe how one forms
- identify instructional strategies that teachers can use to assist students in developing the habits of mind that are required for college and career readiness.



Rate of Change: Foundational Module 3

Module 3 Description:

Elementary teachers examine how concepts involving graphical displays progress from third grade to fifth grade and beyond. The lessons modeled in training integrate mathematics and science. Teachers work selected questions from and discuss teaching strategies for the third grade lesson in which students create a foldable study guide that guides them through the development, analysis, and evaluation of picture graphs, bar graphs, and line plots using real world examples and context. In the lesson, students use their understanding of the graphical displays to examine the similarities and differences of weather, seasons, and climates globally. Training continues with a fourth grade lesson in which students examine sensory inputs in both humans and earthworms and are then tasked with applying the math skills involved with creating graphical displays. Training concludes with a fifth grade manipulative-rich lesson in which students explore how much of the planet is covered by water, how much of the water is drinkable, and how we can conserve water. Within this activity, teachers will explore how students model each experiment or activity, perform mathematical calculations, create graphs and tables, and analyze the data to support their predictions and conclusions.

Learner Outcomes:

Participants will

- compare expectations for students from third grade math through pre-calculus on the topics of areas and volumes to increase vertical alignment.
- apply deeper content-based knowledge to increase instructional rigor in order to prepare students for middle grades math courses leading to high school courses that lead to college-level calculus in an AP class or university setting
 - use real world scenarios and data to create graphical displays such as picture graphs, bar graphs, and line plots.
 - use graphical displays including bar graphs to solve “how many more” and “how many less” problems.
 - use graphical displays to compare and contrast different cities weather, seasons, and climate.
 - investigate ways earthworms sense the world around them and describe physical characteristics of earthworms using line plots.
 - predict how much of the earth is covered by water or exposed land and perform an experiment to confirm their prediction.
 - create a model to represent the amount of salt water and freshwater on Earth.
 - create a model to represent the breakdown of the amount of freshwater on Earth as ground water, surface water, and glaciers and ice caps.
- identify instructional strategies that teachers can use to assist students in developing the habits of mind that are required for college and career readiness.



Rate of Change: Building Connections Module 4

Module 4 Description:

Participants will work through a series of cross-curricular lessons that integrate the concepts and strategies from training. Using the work of N. Scott Momaday, teachers will explore lessons that bridge the content areas of English language arts, social studies, mathematics, and science through a unit that demonstrates how one topic can be woven through multiple content issues.

- The skills addressed in English language arts include drawing conclusions, making inferences, justifying with evidence, and writing descriptive and expository texts.
- The skills addressed in social studies include analyzing elements of visual and written source materials and evaluating multiple primary source materials.
- The skills in mathematics include applying mixed numbers in problem-solving situations and using average speed and a given time span to calculate distance.
- The skills addressed in science include observation and research from the exploration of the students' local environment. The final product will be creating field guide pages for flora and fauna, which students "discover."

Learner Outcomes:

Participants will

- compare expectations for students from third grade math through pre-calculus to increase vertical alignment.
- engage in and complete cross-curricular lessons to explore making conceptual connections between content areas.
 - interact in discussions of strategies for integrating standards across disciplines.
 - identify best practices for incorporating standards across disciplines.
- apply deeper content-based knowledge to increase instructional rigor in order to prepare students for middle grades math courses leading to high school courses that lead to college-level calculus in an AP class or university setting.
 - apply mixed numbers in problem-solving situations.
 - measure a path on a map and estimate distance traveled based on a scale.
 - use average speed and a given time span to calculate distance.
- identify instructional strategies that they can use to assist students in developing the habits of mind that are required for college and career readiness.