Lesson Title	Farming and Geometry
Length of Lesson	2 days
Created By	Shane A Irvin and Dr. Joel O. Paz
Subject	Geometry, General Science
Grade Level	9^{th}-12^{th}
State Standards	5a. Apply multiple strategies and representations, including area models, to solve probability problems.
DOK Level	DOK 2
DOK Application	Inquire, Solve, Apply, Probability
National Standards	Understand and use formulas for the area, surface area, and volume of geometric figures, including cones, spheres, and cylinders
Graduate Research Element	The research involves both the implementation of GIS/GPS technologies but also considers the discussion of water conservation.

Student Learning Goal:
The learning goal for this lesson is for the students to apply the concepts of area and volume into realistic situations such a farming and water resources. The students will be championed with a goal to figure out the "perfect situation" for watering croplands given a specific volume of water and how much water each pipe on the irrigation system releases. The students will then use the knowledge gained on volume and convert down to how much area that will be. Once the students do this conversion, the students will have to determine the best way to water the crops. The teacher can then provide another challenge to the students by specifying specific crops, how much water they need and what percentage of land must be used for each crop. This challenge will force the students to rethink what areas need water more.

Materials Needed (supplies, hand-outs, resources):
Hand-out with provided information, video of watering regimes through GIS technologies, writing utensils, PowerPoint

Lesson Performance Task/Assessment:
The assessment and performance task for this lesson is to see that the students can properly go from area to volume and back in all situations including real world situations. The students will work through what they have been doing with area and volume conversions. The teacher can bridge to the GPS and GIS connections if wanted.

The intensions of the lesson are to show how react to each other. While recently covering GPS and GIS technologies with the same group of students, this lesson will be understood by the class with little background preparations. The students will review what they remember from the GPS/GIS lesson if previously taught.

For the assessment, the students will figure out the "perfect situation" for watering croplands given a specific volume of water and how much water each pipe on the irrigation system releases. The students will then use the knowledge gained on volume and convert down to how much area that will be. Once the students do this conversion, the students will have to determine the best way to water the crops. The teacher can then provide another challenge to the students by specifying specific crops, how much water they need and what percentage of land must be used for each crop.

Lesson Relevance to Performance Task and Students:
With an introduction to volume and the former unit being area, this lesson fits perfectly in the real world applications of volume and area conversions and how both build on one another. The lesson will have the student practice conversions between area and volume while also letting the student figure out how to convert back to area from volume.

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Anticipatory Set/Capture Interest:
The anticipatory set will be that of Mississippi crops. The corn, soybean, and cotton props will then lead into the discussion on how much water and fertilizer each one needs and how they get it. The students will be asked the

Guided Practice:
The guided practice will be a discussion and a description on how GPS and GIS technologies do this. The goals of the lesson will be discussed with the students asking for their individual inputs of what they predict some of the outcomes to be. The students will then be able to draw a "schematic" on the estimated land to water use. This will lead to the discussion on how the GPS technologies actually accomplish specified watering regimes by showing the provided video.

Independent Practice:
The students will be championed with a goal to figure out the "perfect situation" for watering croplands given a specific volume of water and how much water each pipe on the irrigation system releases. The students will then use the knowledge gained on volume and convert down to how much area that will be. Once the students do this conversion, the students will have to determine the best way to water the crops. The teacher can then provide another challenge to the students by specifying specific crops, how much water they need and what percentage of land must be used for each crop. This challenge will force the students to rethink what areas need water more.

Remediation and/or Enrichment:

Remediation:

In situations that remediation is needed the student can see the instructor for one on one tutoring. The student can also be paired with a high performing student with full understanding of the lesson.

Enrichment/Extension:

All of these extensions depend on the students' ability and knowledge of the subject matter. The student will have the opportunity to get more specific with the topic by discussion on potential area and volume changes by changes in elevation of the land.

Check(s) for Understanding:

The students will be asked the following questions along with their work being checked.

What specifics go into figuring out where the water needs to go?

How does the machinery accomplish specific water loads to certain areas?

Who didn't know about this prior to this lesson?

Farming has a whole new WOW factor, am I right?

Closure:

The closure of the lesson will emphasize the face value of what they are learning in geometry. It will show them that even though it looks boring on the outside, their knowledge may one day be used to solve the next water crisis.

Possible Alternate Subject Integrations:

Earth Science, Trigonometry

Teacher Notes:

See PowerPoint and attached videos. Owned by Soil and Water Engineering. Fangmeirer et al 2006. Thomson Delmar Learning