Space for More^{*}

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Abstract

This challenge is designed to encourage students to plan how best to utilize their given land resources in order to maximize efficiency and profit in production over a multi-year period.

1 Challenge: Space For More

Unit: Land utilization Subject: Math

Description: This challenge is designed to encourage students to plan how best to utilize their given land resources in order to maximize efficiency and profit in production over a multi-year period.

Phase I

You have bought a piece of land that is 1,000 square feet in area. There are 3 crops that grow well in the soil type of your land. The following is a record of the previous year's yield per square foot, and local market price per pound of crop.

Crop	Yield per square foot $(lbs/ft2)$	Price per pound to pro- duce (\$/lb)	Price per pound at mar- ket (\$/lb)
Corn	5	15	20
Soybeans	10	5	15
Squash	15	10	15

Table 1

Calculate the profit yield with each crop, per ft2. Have them plot graphs to compare the profits. Phase II

Divide the class into three groups. Have one group design a plan for growing one crop, another two crops, and the third, all three crops. Have each group decide how much land they will use for each crop. Have each group construct a diagram of their plan.

Phase IV

Have each group present the results of their plan. Which plan would they choose?

Phase V

Have each group do the activity again, this time with the added context that each without crop rotation, the yield with halve.

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Phase VI

Have the groups discuss the results after the second year? Has this affected which plan they would choose? Over a long period of time, would they make consistent profit? Would they need to expend more initial resources (including fencing) after the first year?

Phase VII

Based on the potential profits, and the discussion, have each group decide which strategy they would use. Other areas for consideration

- Crop spacing.
- Disease that affects particular crop.
- Fertilization and water use.
- Growing seasons (more than one in a year?)
- Harvest times.
- Rodent control.
- Waste use or disposal. (Can be composted?)

Time Limit: This challenge should take approximately 3 hours

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Competencies
Core Competencies
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• Mathematical Calculations

-Arithmetic [addition/subtraction/

multiplication/division]

- Areas
- -Perimeter
- Representation and Interpretation of Information

-Construct diagrams

- -Construct graphs to compare data
- -Analyze production data and understand what it represents.
- Mathematical Problem-Solving

-Extract elements of mathematical problems from real-life cases -Formulate mathematical solutions to real-life problems

• Business and accounting

-Evaluate profitability Cross-Curricular Competencies

- Decision making.
- Efficiency.
- Establishing goals.
- Critical thinking.
- Research driven discovery.
- Process management.
- Motivate.
- Continual improvement.
- Articulate desired outcome.
- Facilitate and engage effective discussion.

Content

- Learn basic geometry to optimize space efficiency.
- Analyze the cost-efficiency of their given strategy.
- Construct plans that consider area and perimeter calculations.
- Students will be evaluated on their plan for use of space, their projected profit-margins, and their planned use of resources in their designs.

Factors influencing land utilization

- Profit [cost of production vs. commercial price]
- Crop rotation [long term profit projections over various years]
- Initial use of resources [fencing and land]

Open Educational Resources

 $\label{eq:geodesic} Geoboard\ resources:\ area\ and\ perimeter. \\ http://nlvm.usu.edu/en/nav/frames_ \\ asid_283_g_4_t_4.html?open=activities&from=topic_t_4.html \\ Area\ and\ perimeter\ tutorial: \\ http://www.bbc.co.uk/schools/gcsebitesize/maths/shapes/ \\ areaandperimeterrev1.shtml \\ \end{tabular}$