

Lesson Title: Comparing Types of Gardening	
Grade Level: 9-12	Subject Area: Environmental Science
Genevieve Dierenga, Wooster High School. Lesson will employ inquiry and guided inquiry element along with a 5E model approach. It can be modified for middle school science classrooms.	Lesson Length: 1 day for intro, 3-6 weeks for the growing portion of the project (other material can also be covered during this time) , 2 block days for processing results.

The Teaching Process

Lesson Overview: students will investigate and compare three methods of growing a specific variety of lettuce.	
Unit Objectives: Students will understand the differences and similarities among traditional in ground growing, aquaponics, and hydroponics. They will conduct a simple experiment to compare the cost effectiveness of the three methods. They will process and then plot the results on a graph. This will give the students 'real world' experience growing food as well as processing data. We will relate food production to a previous unit on populations. The previous unit encompasses human population numbers, the growing population crisis and using data to understand the demographics of the human population. This current unit will build on the population concepts. This project will compare three ways to grow food (Hydroponics, aqua phonics, and soil based) and the data will be used to determine which is most efficient. This can be related to the general concepts of food production for the growing human population.	
Standards addressed: MS-ESS3-I,MS-ESS3-d	
List of Materials Each of the three set ups has similar materials but also requires their own materials. All three - seeds, water In Ground- a plot of land or tubs of soil. Aqua phonics - fish, fish food, set up with pumps and flow device. Hydroponics - tubs, floating device for plants, nutrients to add to water (these can be store bought or can be self-produced using various recipes found on line)	
Phase One: Engage the Learner	
Students are often engaged by food. We will begin by tasting various varieties of lettuce.	
What's the teacher doing? Leading a discussion on the necessity of food and how the human population is growing - yet must eat. The teacher will also pass out the lettuce that the students will try.	What are the students doing? The students engage in discussion about food, people, starvation issues and numbers. They will taste the lettuce and vote on which variety of lettuce we grow tastes the best. The students are also viewing 3 growing set ups.



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Instructional Sequence

Phase Two: Explore the Concept

Students are charged with setting up an experiment as a class. They will discuss and vote as a class as to which type of lettuce they will grow and how they will compare the success of each growing method.

What is the teacher doing?

Teacher will guide students and confirm that students are using valid scientific methods to compare the success of each growing method. Teacher will help students when needed to plant seeds and to maintain the three growing set ups.

What are the students doing?

Students will plant the lettuce and maintain the lettuce. Students will water as needed and will record all inputs into each system including man hours needed to maintain the sit-ups and grow the lettuce.

Phase Three: Explain the Concept and Define Terms

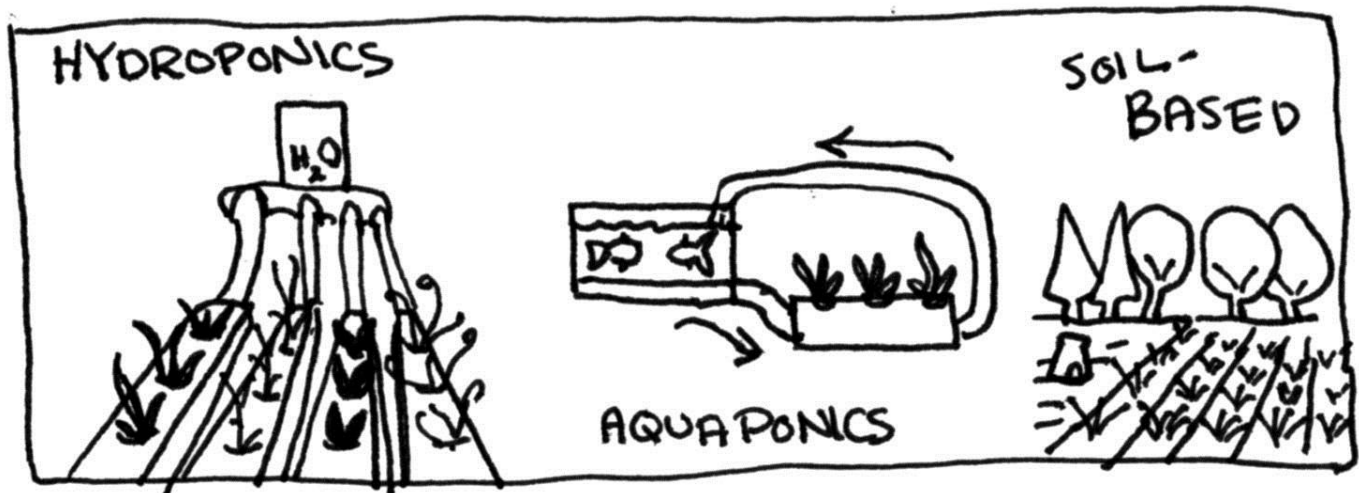
An explanation of how and where each system is really already used will be presented. Also an explanation of how much food is needed, produced and used by various societies and how the human population relates to this food is a critical part of this unit.

What is the teacher doing?

Through lecture, discussion and perhaps a power point presentation the teacher shares various statistics and data about food use and consumption. The teacher encourages students to make connections between the human population crisis and the need for sustainability in food production.

What are the students doing? Students take notes,

participate in discussions, and make connections between how many people there are and how we will continue to feed them all. They will relate this to the three types growing set ups and the need to discover the most sustainable methods of growing food worldwide.



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Phase Four: Elaborate the Concept

After the lettuce has had time to grow (6 weeks max) the students will collect the lettuce and evaluate the success of each growing method. They could do this by weighing the lettuce. But students may determine another way to measure success (taste, quality). They will elaborate by processing and graphing this data. The graph should be clearly labeled.

What is the teacher doing?

Assisting students in collecting data as necessary. Supplying materials such as scales that might be needed to evaluate the quantity and maybe quality of the lettuce produced by each method of growing.

What are the students doing?

Collecting the lettuce and determining the success of each method. Processing and Graphing the data so that the can interpret the success of each method.

Phase Five: Evaluate Students' Understanding of Concept

The final stage of the lesson has a dual purpose. Students will evaluate the success of each method of growing food and will determine which method is best for growing lettuce. They should be able to relate food production to human population in their lab reports. They should include the success of food production and efficiency of each model based on input and output.

What is the teacher doing?

Evaluating student knowledge and contribution to the experiment.

What are the students doing?

Evaluation of the success of each method of growing lettuce.

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