

SECOND GRADE GARDEN BASED CURRICULUM

Table of Contents

UNIT 1: The Aquaponic System

<i>Lesson 1.1 ~ Chinampas: The Origin of the Aquaponic System</i>	<i>3</i>
<i>Lesson 1.2 ~ Aztec Farming and Agriculture</i>	<i>8</i>
<i>Lesson 1.3 ~ The Aquaponic System</i>	<i>12</i>
<i>Lesson 1.4 ~ The Basic Science of the Greenhouse</i>	<i>15</i>

UNIT 1: The Aquaponic System

Unit Summary

In this unit, students will learn about the origins of the aquaponic system including chinampas, farming and agriculture. Students will participate in shared research and writing projects related to the aquaponic system. Students will have various opportunities to create and relate the differences between culture and biodiversity/ climate from the Aztec chinampas.

Note: All lessons in this unit could easily be adapted for use in 2nd and 3rd grade classrooms by using related Common Core standards at those grade levels. Common Core standards in writing are quite similar at these grade levels. Not only can the standards be adapted to these grade levels, but the activities in these lessons are also appropriate for students at the age of 2nd and 3rd grades.

Lesson Summaries:

Lesson 1.1 ~ Chinampas: The Origin of the Aquaponic System

Students will learn about the origin of the Aztec chinampas and the connections between culture and biodiversity/ climate. Students will compose a book describing the origin of the aquaponic system describing how biodiversity connects with the Aztec's culture. Students will participate in collaborative conversations about their data they have gathered.

Lesson 1.2 ~ Aztec Farming and Agriculture

Students will learn about the development of the Aztec farming and agriculture and the survival technics they had to maintain their civilization.

The Aquaponic System

Lesson 1.1 ~ Chinampas: The Origin of the Aquaponic System

Teacher:

Grade Level: 2

Date:

Author: Norma Gonzalez

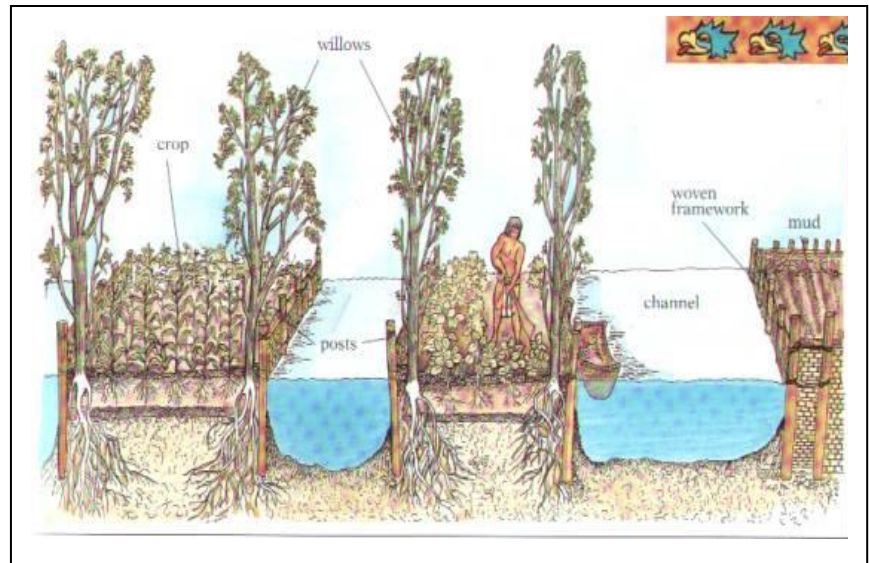
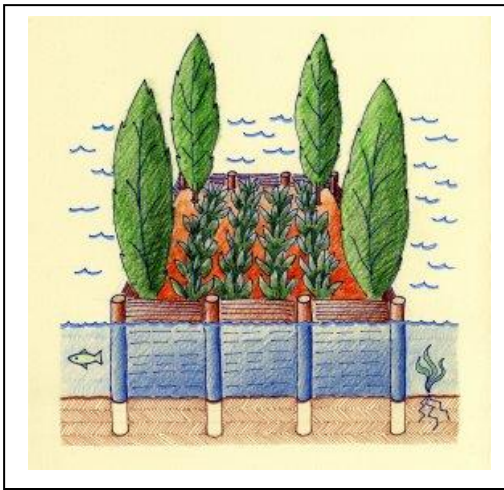
Common Core Standard:	2.W.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
Ecology Objective:	Have students draw connections between culture and biodiversity/climate through learning about Aztec chinampas.
Enduring Understandings and Essential Questions:	Culture: (The resources (language, values, beliefs) people use to perceive their surroundings): The biodiversity and climate of a region are interconnected with the region's culture.
Content Objective:	Students will compose a book describing the origin of the aquaponic system.
Language Objective:	2.SL.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.

Vocabulary		Materials		
Aquaponics	Tenochtitlan	My chinampa research repost graphic organizer one per student		
Aquaculture		Blank paper for diagrams		
Horticulturalists		Pencils		
Chinampa		Colored pencils		
Origin		Venn Diagrams		
Floating Gardens		Article Titled: Aztec Farming and Agriculture (one per student)		
Aztecs				
Seasonality (If more specificity is required, please note date/time range under season)				
<i>Monsoon</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June
Guiding Questions: How do people, from a specific region, make use of their ecosystem for survival? How do people, from a specific region, learn about their ecosystem? How do people, from a specific region, interact with their ecosystem in an interdependent manner?				

Anticipatory Set:

Ask students to make careful observations of the drawings and to offer an explanation as to what is going on in the drawings. Accept all responses and guide the discussion, if necessary, to the similarities with the aquaponic system. Point out that the same components in these drawings are also in the aquaponic system. They need to be ready to make those connections. Point out that the chinampas were constructed on the water

with reeds to hold the structure together. Then there was a growing medium added for the plants to be planted.



Activity/Investigation:

1. Share with students that they will be investigating and gathering data on the chinampa gardening system and they will compare it to the aquaponic system. Explain to students they will need to know some vocabulary to understand how the chinampa gardening

system was constructed and functioned. To get to know the vocabulary, students will create a four square diagram for each word. In a whole group, students will fill in the information for each word. Provide students with the definition of each word and then allow them to use the word in a sentence and then to create a picture of the word. Allow students to share their sentences as an informal assessment of word meaning attainment.

Word	Definition of the word
Use the word in a sentence	picture

2. Prior to the introduction of the chinampa system ask students to recall the components of the aquaponic system.

- Fish
- Microbes
- Plants

3. Students should be able to state the components and recall what their function is in the aquaponic system.

4. How the chinampa system works:

Explain to the students that the Aztecs were the ancestors of the Mexicans of today. The Aztecs were amazing constructors and creators of many things we still use. For example, they were the creators of corn, a super plant that today is grown all over the world. In this lesson they will learn about the chinampa system of gardening that is the origin for the aquaponic system. The Aztecs were a group of people that migrated down into what today is Mexico. They were a group that came from somewhere in the Four Corners region. They ended up in Tenochtitlan because that is a place where they found water. They had to create a functional place to live. Of course they had to think about how they were going to cultivate food for their survival. Chinampas were a system of agriculture that was created by the Aztecs out of necessity. In Tenochtitlan, the place where the floating gardens (Chinampas) were created, there was varied rainfall, frosts, and lack of soil fertility. Due to these factors, the Aztecs had to create a system of farming that would be effective. Play the short video for the students titled: Aztec Ingenuity. This is a short video that provides a great visual of how the chinampas were built.

5. How are the chinampas and the aquaponic system the same and how are they different? Students will fill out a venn diagram to explain the similarities and the differences of each of the systems.

6. Create on diagram of the chinampa system and one of the aquaponic system.

Their aquaponic diagram must have the following components labeled.

- Fish tank
- Grow bed
- Pump
- Growing media
- Plants
- Fish

- Siphon
- Water
- Nitrate
- Nitrite
- Fish poop
- Ammonia

The diagram of the chinampa system must have the following components labeled. See diagram for example of what the students' diagrams should look like.

- Canal
- Sticks that hold up the chinampa
- The mud that is used to hold the sticks together
- Fish
- Plants
- Nutrients

7. Research essay on the origin of the aquaponic system.

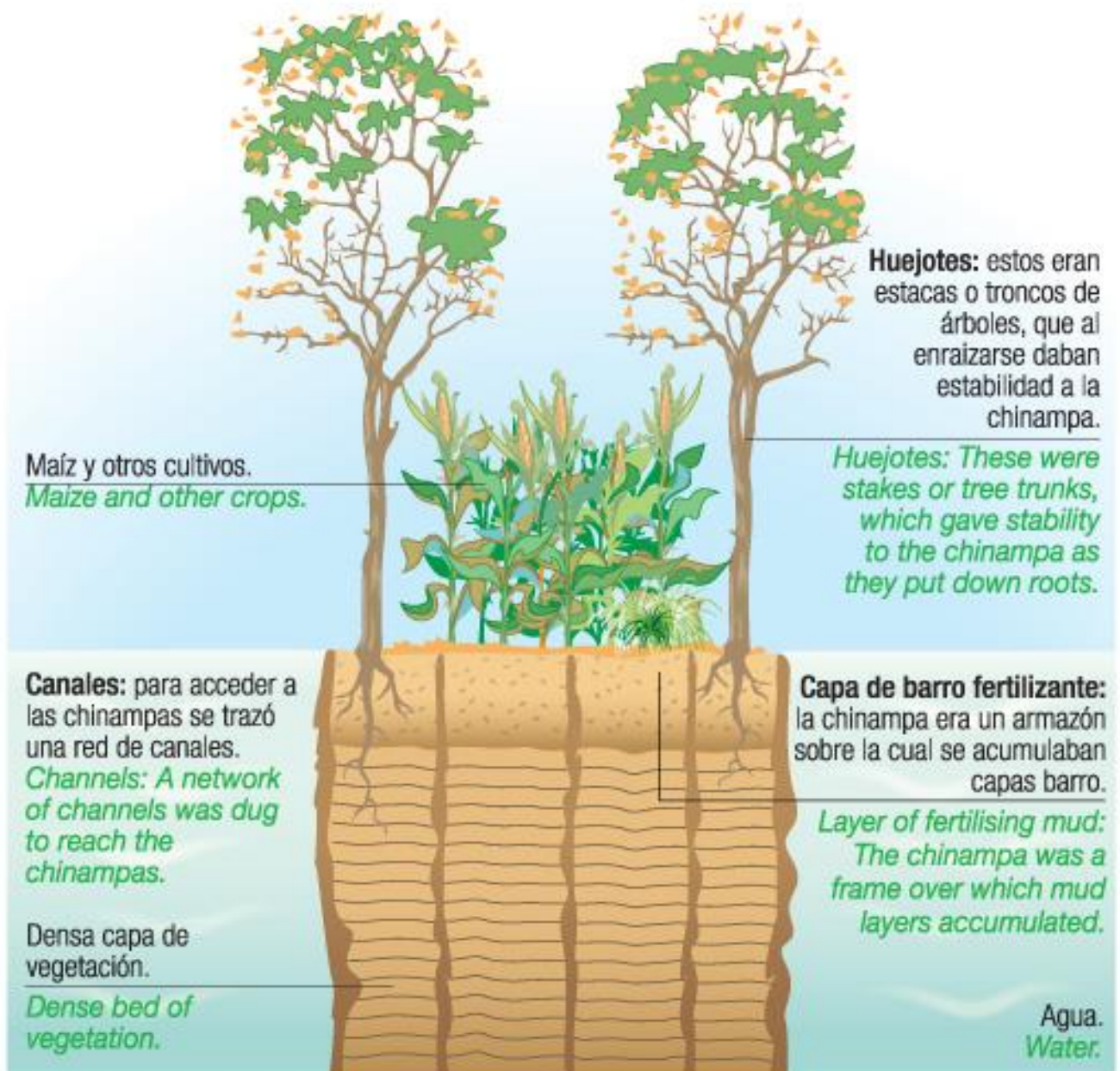
Students will fill in the information on their research essay template. Students will read the article on Aztec Farming to help gather information for their research report. Students should highlight important information about the chinampas and specific information for their graphic organizer. Students should write a rough draft of their report. Students can peer edit or the teacher can conference with each student and edit essays together. Students will write a final copy. Allow students to share their reports with a partner.

Las chinampas

The chinampas

Eran verdaderos jardines flotantes, con los que se lograba rescatar zonas para cultivo en las partes bajas de los lagos.

These were real floating gardens which made it possible to create areas for cultivation in the shallow parts of the lakes.



The Aquaponic System

Lesson 1.2 Aztec Farming and Agriculture

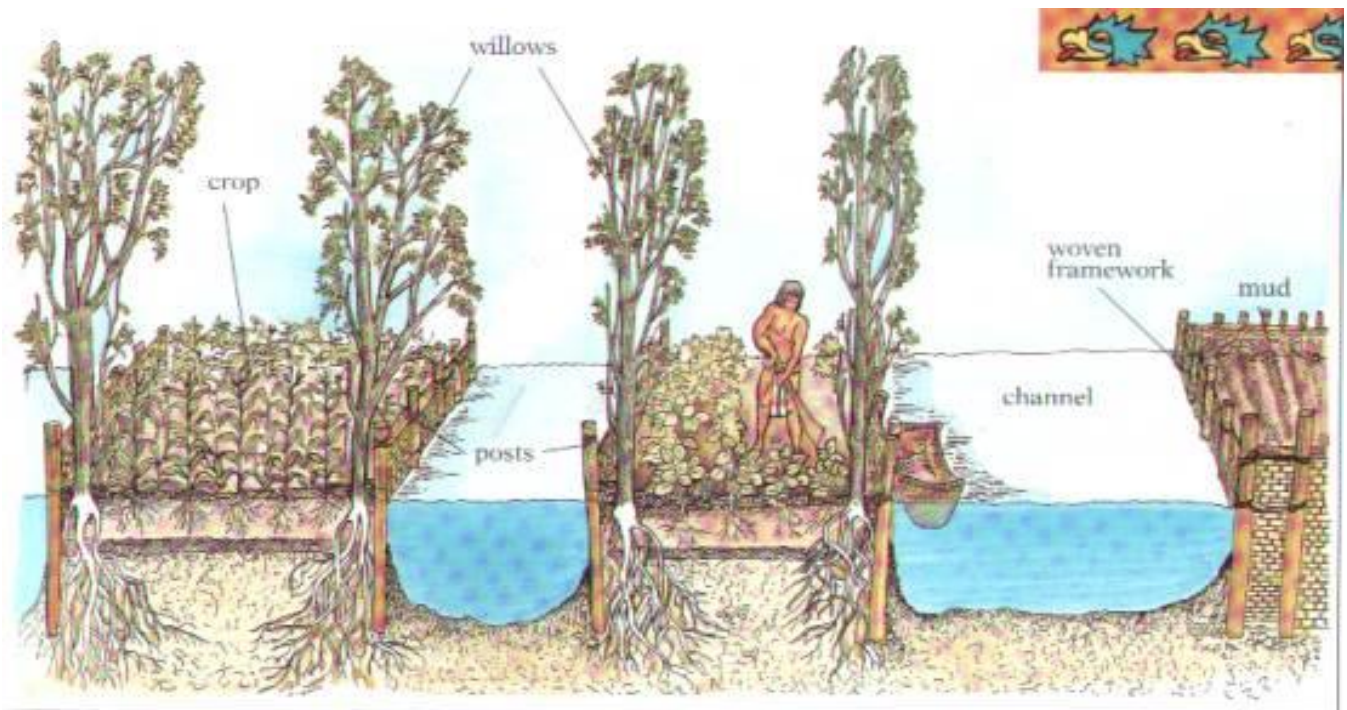
By: Anthony Aguad

Once a group of people grows too large to sustain itself through hunting alone, it becomes necessary for that group to settle in a specific location and begin to grow its own food. Agriculture was essential to the Aztec life since it, not only enabled the survival of their civilization, but stimulated their economy. The amount of food that needed to be produced to sustain such a vast empire required the implication of multiple farming strategies. The Aztecs invented and perfect many different farming methods. They developed intricate irrigation systems, employed slash and burn technique to clear land, spread fertilizers in order to improve the content of the soil, and even cut terraces into the hillsides to create more viable farmland. However, the most important innovation that was made by this civilization, in terms of agriculture, was the chinampas.



Chinampas, translated as “floating gardens”, was a particularly ingenious method of farming innovated by the Aztecs. These chinampas are believed to have fed anywhere from one-half to two-thirds of the population. They are, however, not literally floating gardens. Chinampas are actually strips of land surrounded by canals dug into the marshes and swampland. Mud that the Aztecs dredged from the canals was piled onto large mats made from woven reeds. They tied these mats to posts that had already been firmly planted in bottom of the lake so that they would remain stationary. Once this was done, the men planted willow trees were planted at the corners of the mats in order to permanently hold them in place. The roots of these trees would grow rapidly until they adhered to the lakebed.

Chinampas allowed the Aztecs to overcome the greatest of problems in terms of agriculture in this marshy climate. The temperature at night would drop low enough to cause frost to form on the plants. The rain was so unpredictable that it was unreliable as a source of nourishment for crops. This made the chinampas the perfect system. The fact that the fields of crops were only about a meter or so above the water allowed the soil to always be rich with moisture. Should that not be enough, the irrigation from all the canals that were dug to create the chinampas would supplement the benefits derived from the crops proximity to the water. The water also moderated temperatures at night decreasing the likelihood of destructive frost forming on the crops.



The process for cultivating the crops was very simple, yet effective. The fertility of the soil was maintained by regular addition of compost, vegetation, and rich silt from the bottom of the canals. The farmers would first place the seeds in a specially designed seed-bed that provided the seeds with the perfect environment to sprout. After germination, the farmers would plant the seedlings in the fields. This procedure for crop-cultivation normally took place year-round. Often considered a disadvantage, the Aztecs did not have any animals to aid them in their farming. However, the system developed by the Aztecs did not require the use of animal labor. All that they did need was very soft land in order to grow their crops utilizing the tools that they had at their disposal. This is just another reason why the chinampas were so useful-- the soil was so soft that all that was needed was a plain, wooden stick for digging and a simple, wooden hoe in order to plant and harvest all the crops that they needed to sustain their society.

The chinampas were used for the majority of the Aztecs crops-- avocados, chili peppers, beans, squash, tomatoes, and, most importantly, corn. Corn was vital to the Aztecs because it was their main product since it was the easiest crop to grow in the region. The roots of the crops extended deep into the chinampa and fed off of the water supply located directly beneath. Thanks to the

design of these chinampas, there was an endless supply of nourishment for the Aztecs' crops. Sadly, very few of these chinampas still exist due to the increased urbanization of Mexico. Fortunately, there are a few examples of this great agricultural feat, such as the famous tourist attraction, the Floating Gardens of Xochimilco. Boats passing through are filled with tourists looking to see what all the fuss is about with these “floating farms.” Every year people get in line, with tour boats packed in, side by side, in order to witness the chinampas for themselves.

<http://www.youtube.com/watch?v=vgr2tQoGVFE&feature=related>



Another technique that was employed by the Aztecs was known as “slash and burn”. This farming strategy involved cutting down trees in a specific location and then burning the area. Afterwards, farmers would come through and plant their crops in the now clear landscape. This is largely known as Mayan technique, but the Aztecs utilized it just as effectively.



<http://individual.utoronto.ca/esjones/images/slashburn.jpg>

Another key aspect of the Aztecs' diet was marine life. Fisherman used nets made from the fibers of the maguey cactus to catch a plethora of marine life, such as fish, turtles, and ducks, in order to feed their growing population.

Agriculture plays one of the most important roles in any society, perhaps even the most important role. People need to eat. Since farming relies so heavily on the weather and the environment, producing enough crops, consistently, to satisfy a population is difficult. Because of this, the Aztecs' ingenuity with their chinampas was necessary for survival. They devised a system that, although labor-intensive, gave them the resources they needed to sustain their empire.

Closure Question:

Think-Pair-Share

Aztec people had great things to contribute to our society today. How is the chinampa system of gardening a great contribution to our society today? Write your response and be ready to share with a buddy.

Teacher Reflection:

The Aquaponic System

Lesson 1.3 ~ Aquaponic System

Teacher:
Author: Norma Gonzalez

Grade Level: 2

Date:

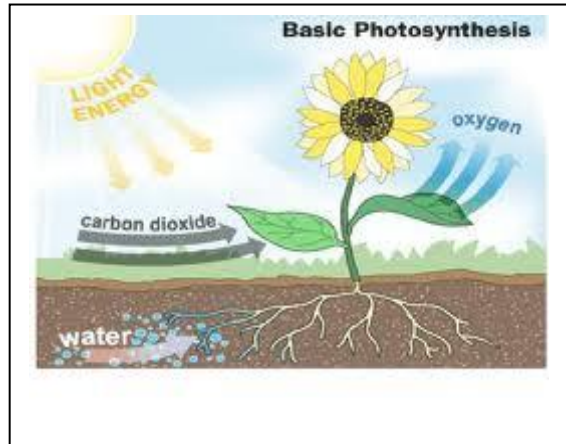
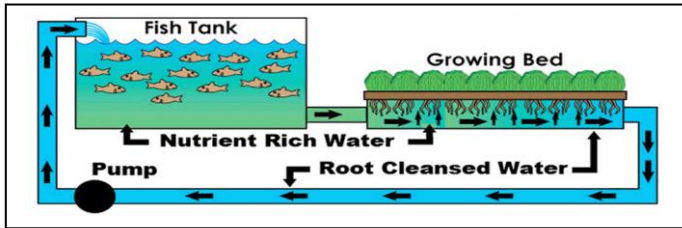
Common Core Standard:	2. W.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
Ecology Objective:	Promoting ecological systems thinking through aquaponics examination.
Enduring Understandings and Essential Questions	Interconnectedness (being joined or related): Organisms and their environments are interconnected; changes in one part of the system will affect other parts of the system.
Content Objective:	Students will compose a book describing how the aquaponic system works.
Language Objective:	2. SL.1 Participate in collaborative conversations with diverse partners about grade two topics and texts with peers and adults in small and larger groups.

Vocabulary		Materials
Aquaponics	nitrates	Power point presentation
Aquaculture	nitrites	Student blank books
Hydroponics	microbes	Line paper
Symbiotic	ammonia	Pencils
Excretions	system	crayons
by-products		
nitrogen-fixing bacteria		

Seasonality (If more specificity is required, please note date/time range under season)				
<i>Monsoon</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June

Guiding Questions: What might be the most effective way to garden in an environment where the climate is controlled to ensure growth?

Anticipatory Set:



Which of the systems shown in these diagrams is the most effective method of gardening in your opinion? Why? Allow students to think about the question and to observe the diagrams and then have them write their responses. Next allow students to share their opinions with a buddy. Finally allow students to share their responses with the class.

1. Share with students that they will be investigating and gathering data on the gardening system in the controlled environment house (also known as the "greenhouse"). Explain to students they will need to know some vocabulary to understand how the gardening system in the "greenhouse" works. To get to know the vocabulary, students will create a four square diagram for each word. In a whole group, students will fill in the information for each word. Provide students with the definition of each word and then allow them to use the word in a sentence and then to create a picture of the word. Allow students to share their sentences as an informal assessment of word meaning attainment.

Word	Definition of the word
Use the word in a sentence	Picture

2. Prior to getting into the science of the aquaponic system, the students will fill out a KWL chart to elicit prior knowledge about the aquaponic system since it is in the greenhouse. Explain to the students that they have probably been in the green house and have seen the aquaponic garden every day at school, and that they probably know something about it. Pass out a KWL graphic organizer to all students. First they will get some time to fill out the "K" section, that is what they know. Allow time for them to fill it out. Then have the students get with a buddy and share with each other what they wrote. After some time, allow the students to share out loud with the class and record some of the responses on a class KWL chart. The give students time to fill out the "W" section or the "I wonder" section of their KWL chart. Have the students work independently for a few minutes and then they can share their responses with a buddy. Also allow students to share out loud their responses to the "W" section and record them on the class KWL chart. Finally explain to the students that they will fill in the "L" section after they compose the book.

3. Students will compose a book that explains how a basic aquaponics system works. The book format can vary but must have 10 pages. The power point presentation will allow the teacher to guide the student in the content of the book as each slide will be a page in their book.

Share with the students that they will view a presentation on the basic science of how an aquaponics system works. Explain to the students that they are to write the important information on each page of their book and they are to create an illustration to further explain the content on each page.

Go through the power point presentation with the students, allowing for plenty of time to write the information on each page and to create an illustration.

When students are finished with their book they should read the book to two other people who do not know how the aquaponic system at Manzo functions.

4. Following the completion of the book, allow students time to fill out the “L” section of their KWL. Explain to them that they probably have a better understanding of how the “greenhouse” system works and that they can record their learning in the “L” section. Allow for ample time so that students can work independently on that section. Then allow time for students to share their new learning with a buddy. After plenty of time for sharing with a buddy, allow student to share their responses out loud with the class. Finally record the new learning in the “L” section of the class KWL.

Closure Question:

Think-Pair-Share

Pose the following question for students to reflect on: What might happen to this system if one component is missing? For example, what if the water did not get clean of the nitrites? Allow two minutes for students to think about the question. Next allow students two minutes to write their responses. Finally, have students turn to a buddy and share their responses.

Teacher Reflection:

The Aquaponic System

Lesson 1.4 ~ The Basic Science of the "Greenhouse"

Teacher:

Grade Level: 2

Date:

Author: Norma Gonzalez

Common Core Standard:	<p>2. W.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).</p> <p>2.L.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade two reading and content, choosing flexibly from an array of strategies.</p>
Ecology Objective:	Promote systems thinking, connecting climate and biodiversity in greenhouse setting.
Enduring Understandings and Essential Questions:	Interconnectedness (being joined or related): Organisms and their environments are interconnected; changes in one part of the system will affect other parts of the system.
Content Objective:	Students will create a book that explains the system of controlled environments for effective plant growth.
Language Objective:	2. SL.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.

Vocabulary		Materials		
Temperature control Humidity Carbon dioxide ventilation conduction convection radiation		Pencils Colored pencils Blank book with 8 pages any format Presentation titled: Controlled Environment For Effective Plant Growth Lined paper		
Seasonality (If more specificity is required, please note date/time range under season)				
<i>Monsoon</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June
Guiding Questions: How is climate and biodiversity interconnected?				

Anticipatory Set:



Display the picture for all students to see. Pose the following statement: I wonder how the "greenhouse" system works? Why do plants grow so healthy and fast in there?

Ask the students to ponder the statement and the question. Allow them time to reflect on it.

Quick Write:

Give the students a few minutes to respond in writing to the statement. Allow several students to share their responses.

Explain to the students that they will be creating a book that outlines the basic science about "greenhouses."

Activity/Investigation:

1. Share with students that they will be researching the science of the controlled environment house and how it works as a system. Explain to students they will need to know some vocabulary to understand how the controlled environment system in the "greenhouse" works. To get to know the vocabulary, students will create a four square for each word and fill in the appropriate information in each section per word. Allow students to share their sentences as an informal assessment of word meaning attainment.

Word	Definition of the word
Use the word in a sentence	picture

2. Prior to getting into the science of the "greenhouse" the students will fill out a KWL chart to elicit prior knowledge about the "greenhouse" since it is a part of our school's court yard. Explain to the students that they have seen the greenhouse probably every day at school and that they probably know something about it. Pass out a KWL graphic organizer to all students. First, they will get some time to fill out the "K" section, which is what they know. Allow for time to fill it out. Then have the students get with a buddy and share with each other what they wrote. After some time, allow the students to share out loud with the class and record some of the responses on a class KWL chart. The give students time to fill out the "W" section or the "I wonder" section of their KWL chart. Have the students work independently for a few minutes and then they can share their responses with a buddy. Also allow students to share out loud their responses to the "W" section and record them on the class KWL chart. Finally, explain to the students that they will fill in the "L" section after they compose the book.

3. Students will compose a book that explains the basic science of a controlled environment for effective growth system. The book format can be any format but must have 10 pages. The power point presentation will help the teacher guide the students in the creation of the book, as each slide would be a page in their book. Share with the

students that they will view a presentation on the basic science of how a controlled environment system works. Explain to the students that they are to write the important information on each page of their book and they are to create an illustration to further explain the content on each page. When students are finished with their book, they are to read the book to two other people who do not know how the controlled environment system at Manzo functions.

4. Following the completion of the book, allow students time to fill out the “L” section of their KWL. Explain to them that they probably have a better understanding of how the “greenhouse” system works and that they can now record their learning in the “L” section. Allow for ample time to have students work independently on that section. Then allow time for students to share their new learning with a buddy. After plenty of time for sharing with a buddy, allow student to share their responses out loud with the class. Finally record the new learning in the “L” section of the class KWL.

Closure Question:

Pose the following question for students to reflect on. What might happen to this system if one component is missing or if it was changed? For example what if the greenhouse was made of some glass but not all glass? Allow two minutes for students to think about the question. Next allow students two minutes to write their responses. Finally have students turn to a buddy and share their responses.

Teacher Reflection: