OBSERVING A NAVEL ORANGE (1 & 2)



CA SCIENCE STANDARD

Investigation/Experimentation

- I&E6a Differentiate observations from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- I&E6b Measure and estimate the weight, length, or volume of objects.

PURPOSE

IN NAVEL ORANGES, STUDENTS WILL:

- Observe and describe the physical properties of Navel and Valencia Oranges.
- Use measuring instruments to gather data about Navel and Valencia Oranges.
- Compare and record observations about both oranges.
- Dissect both types of oranges and observe differences and similarities.

BACKGROUND FOR THE TEACHER

Oranges

The orange (specifically, the sweet orange) is the fruit of the citrus species *Citrus* × *sinensis*. Orange trees have been the most cultivated tree fruit in the world since 1987.

Orange trees are widely grown in tropical and subtropical climates for their sweet fruit. Like most citrus plants, oranges do well under moderate temperatures—between 15.5 and 29°C (59.9 and 84.2°F)—and require considerable amounts of sunshine and water. Perfect weather conditions in California for the Washington Navel to grow. Another significant element in the full development of the orange is the temperature variation between summer and winter and, between day and night. In cooler climates, oranges can be grown indoors.

The orange tree is an evergreen, flowering tree with an average height of 9 to 10m (30 to 33ft.). Its oval leaves, alternately arranged, are 4 to 10cm (1.6 to 3.9in) long and have crenulate margins. Although the sweet orange presents different sizes and shapes varying from spherical to oblong, it generally has ten segments (carpels) inside, and contains up to six seeds (or *pips, Valencia variety*) and a porous white tissue – called pith or, more properly, mesocarp or albedo — lines its rind.



Navel Oranges

Navel oranges are characterized by the growth of a second fruit at the apex that protrudes slightly and resembles a human navel. The size of the navel is medium to large and seedless. It is a well-colored deep orange. The rind is medium-thick that is somewhat tender. The surface coarsely pitted and moderately pebbled. The flesh (carpels) color is deep, texture firm, and moderately juicy with rich flavor. They are primarily grown for human consumption for various reasons: their thicker skin makes them easy to peel and they are less juicy.

Their widespread distribution and long growing season have made navel oranges very popular. In the United States, they are available from November to April, with peak supplies in January, February, and March.

Valencia Oranges

The orange is medium to large, oblong to spherical; no navel and few seeds. The rind is thick, tough, and leathery; surface smooth to faintly pebbled. Juice is abundant and the flavor is good.

The Valencia tree is vigorous, somewhat upright, large and prolific. The total heat requirement for maturity of the Valencia orange is so high that only in the hottest regions is it satisfied prior to the succeeding bloom. In the United States, this usually occurs in Florida, the Lower Rio Grande Valley of Texas, and the low elevation desert areas of Arizona and California.

Parcel Requirement

One of the requirements for Mediana City Park is to plant and maintain a navel orange tree. Understanding the science and background of growing and identifying a navel orange is very interesting for students. Students try to understand how a navel orange tree grows since there are no seeds in a navel orange.

TEACHING CHILDREN ABOUT ORANGES

Children begin every science experience with some prior knowledge about the topic. In the case of oranges, students have some experience eating them, peeling them, or drinking orange juice. Knowing about students' prior knowledge can help the teacher guide the investigation about the orange and build upon or refine what they already know. A wellplanned investigation enables students to change naïve understandings into sound scientific understandings.

How students learn has been the topic of numerous discussions, books, and symposiums. According to Dr. Lawrence F. Lowery, Emeritus Professor of UC Berkeley and creator of FOSS (Full Option Science Systems), students learn through three formats.

THREE FORMATS FOR TEACHING – LEARNING

- Concrete (Real Stuff): First hand experience or activities. Multisensory input. Most powerful of all teaching. Payoff is great. E.g. Riding a real elephant at the circus. See it, feel it, smell it, and hear it's sounds are first hand experiences.
- Representational (Pictorial): Second hand experiences or activities, advantage is to manipulate variables. Surface, superficial level. Most of your knowledge is second hand – through videos, photos, and TV programs, etc. Payoff is greatly enhanced if first hand experience is present.
- 3. Symbolic (Text): Last-hand experiences and close reading. You don't read what you don't know. "Power of Reading" You must have something (concept) in your knowledge that brings to the page. Reading comes from experience. It is in the person, it triggers knowledge that you already know. There is nothing on page that is going to teach you unless you have the concepts. Manipulating or shaping the mind can be arranged by excellent and quality writers to get the people on the same frame or ideas. More time is put into text than any other subject and results have not increased or have not helped other content areas.

Studies show that prior knowledge goes from first hand experience to second hand experience and learning is multiplied enormously. Lastly,

symbolic has the least impact if the student does not know the concepts being read.

Having students experience handling a real orange only enhances their learning. It also helps them to imagine what the first California orange growers experienced in handling the first navel orange.

CRITICAL COMPETITORS

Having a second object to compare and contrast is where learning happens. Observing the characteristics of the two real objects is key to learning. Make comparisons and contrasts to learn more about each object. A single object does not teach you new knowledge, it will not teach you anything you already know. There must be a critical competitor to be able to retain knowledge of the compared objects. All measurements are best learned through critical competitors, making comparisons of the known and the unknown. Once the concept is established, the clearness of the vocabulary is learned.

INQUIRY/SCIENCE PROCESS SKILLS

Learning the science process skills is essential for scientists. These are the tools that scientist use in conducting investigations. In most investigations, the sense of taste is not often used. However, in this investigation of observing oranges, students will get a chance to taste their science experience. The following are the most used inquiry/science process skills used today:

- 1. **Observe** Use the 5 senses and combination of senses. Multisensory methods are most important. Most powerful and only way to reach the brain is through the five senses. Teach kids to observe for details, carefully, and the use of habit of mind. Kids naturally observe. Tools and apparatuses (microscopes, telescopes, Mars Rover) extend the human senses.
- 2. **Communicate** Humans are special in transferring information from one person to another. For students, teach them how to communicate in a fruitful manner.
 - Describing, speaking sound.
 - Formulating operational definitions.
 - Recording, tabling, writing.
 - Researching the literature, reading, referencing.
 - Picturing, drawing, illustrating,
 - Graphing.

- Unique to humans-We can communicate through generations. E.g., The writings of Newton communicate to us today and future generations. Humans span generations. Animals only communicate with their present generation (only their lifetime). In one hour, 500 books have been created. Publications are important, not often done in education.
- 3. **Compare** All measurements, mathematics, are comparison and critical competitors.
 - Making general comparisons or comparisons from different points of view.
 - Making numerical expressions.
 - Estimating
 - Weighing,
 - Measuring areas, volumes, and pressures.
- 4. **Organize** (Categorizing) Although these are hard-wired since birth, however, these need some concepts or details to be used properly.
 - A1 <u>Seriating</u>: has order, in a <u>linear fashion</u> based on the object itself, built in the properties of the materials, content in science is seriated; E.g. sharp to dull, rough to smooth, Moh's Scale, Beaufort Wind Scale.
 - A2 <u>Sequencing</u>: linear order but <u>has time in</u>. E.g. Water cycle, Rock cycle; not all cycles are circular, many are linear. Life Cycle is linear - the adult butterfly does not go back into the egg.
 - B1 <u>Grouping</u> put things together by one single property.
 - B2 <u>Classifying</u>: 2 or more properties are grouped. Comparisons are made when classifying. It is deeper, use of multiple properties. Grouping and Classifying are not synonymous. They each have a different brain operation.
 - Ordering, Sorting, matching, grouping: is putting things together by one property.
- Relating The grand ideas in science and math is how facts, words, and concepts (must have) relate to each other. E.g. Insects, mosquitoes, locusts; Medical students, doctors, and grave robbers; rain, snow, precipitation; vertebrates, mammals, frogs; fish, sharks, whales.
 - Identifying a problem, formulating questions.

- Hypothesizing.
- Controlling and manipulating variables, testing.
- U.S. Teaches facts not relationships. Other countries teach both. "Quality of the Argument (Story)" on your understanding of your concepts - Time of reference determines how to place something in a Venn diagram. All graphing is relationships. Interpret the graphing. Quality of the story in the relationships. E.g. Animals – 2 colors. Zebras - To be seen, they advertise; Lioness – Hidden, hide.
- Relational stories in science are most remembered and beautiful.
- 6. Inferring -
 - Generalizing, synthesizing, evaluating.
 - Using indicators, predicting.
 - Using explanatory models, theorizing.
 - Inferences are distant from you, remote in time and space. Making wise judgments based on evidences and detail observations. Requires a detail of knowledge of the person or subjects background. The human mind can go to places we cannot see or touch. For example, Dinosaurs lived a long time ago. How do we know? 6th, 7th grade inferences kick in students.
- 7. **Apply** General plan. A team of experts is needed.
 - Using knowledge of technology.
 - Inventing, creating.
 - Constructing.
 - Growing, raising.
 - Collecting.
 - Used more in the adult level. This is more complex.

These seven are needed for inquiry science.

In observing navel oranges, students will use measurement tools to get quantitative analysis of the Navel and Valencia oranges. Although farmers don't necessarily measure diameter, mass, and circumference of each orange they pick, however, taking these measurements is an important process in student learning.

Students are curious and look forward to using tools to conduct science investigations. They also like to take things apart. Taking apart an orange is what students will do. Eating the investigation by the students will be enjoyed even more.

MATERIALS

LESSON 8: OBSERVING NAVEL ORANGES (PARTS 1 AND 2)

FOR EACH STUDENT

- 1 Navel Orange Observation Worksheet
- 1 Navel Orange Measurement Worksheet
- 1 Set of colored pencils or crayons
- 1 Science notebook or science journal

FOR EACH GROUP

- 1 Washington Navel Orange
- 1 Valencia Orange
- 2 Paper plates or napkins
- 1 Meter tape
- 1 Hand lens
- 1 Plastic knife
- 1 FOSS Balance/cups with gram pieces
- Latex gloves and hand wipes (from Breakfast in the Classroom) for each student

FOR THE LESSON

- Chart paper for Vocabulary and Concepts
- Markers
- LCD Projector

GETTING READY

LESSON 8: OBSERVING NAVEL ORANGES (PARTS 1 AND 2)

1. Schedule The Investigation

The lesson will take about 30-45 minutes to complete.

2. Obtain Navel And Valencia Oranges

Purchasing oranges by the bag is less expensive than individually. Costco, SAM'S Club, or bulk purchase stores have lower prices and better quality than regular food markets.

3. Practice Using The Hand Lenses

Hold the lens in one position about 2 cm from the eye and move the orange closer until it comes into focus.

4. Prepare Vocabulary Chart And Concept Chart

Have charts ready for new vocabulary and concepts concerning the orange.

5. **Prepare FOSS Balances**

Make sure balances have the balance pointer, two cups, and gram pieces.

6. Have A Materials Station Set Up

Have a central materials station where designated students can retrieve and return needed materials.

7. Copy Worksheets

Have both worksheets ready for each student

GUIDING THE LESSON

LESSON 8: OBSERVING NAVEL ORANGES (PARTS 1 AND 2)

1. Accessing Prior Knowledge

Ask students "What do you know about oranges?" You may record student answers on the board rather than on chart paper. Some will say they don't like them.

2. Focus Question: What Are The Main Physical Properties Of The Navel Orange?

The focus question guides the students in making their observations and understanding the physical properties of both oranges.

3. Arrange Students Into Groups of 2 or 3

Having small groups helps students to collaborate and share observations that one might not have thought of. They can help each other when make making measurements.

4. Distribute Both Navel And Valencia Oranges

Have students handle both oranges. They should smell it, feel the texture of the rind, look at the apex or the navel, and compare sizes and shapes. This is a perfect opportunity for the teacher to bring out and record on chart paper new vocabulary. Students remember new vocabulary during hands-on, inquiry activities rather than front loading.

Note: Emphasize the navel, since this is one main physical property of this type of orange.

5. Distribute Both Worksheets on the Navel Orange Observation

The worksheet is where students can record their observations and collect qualitative data. This is another opportunity for the teacher to bring out new vocabulary while students are making and recording

their observations. Have students begin collecting data and record their findings on the worksheet.

6. Have Groups Get Necessary Supplies From The Materials Station

Each group should designate a materials manager to get the measuring tools for their observations. See materials needed from the Materials list for each group.

7. Distribute Worksheet Navel Orange Measurements

This worksheet is where students record the quantitative data of both oranges by taking some measurements. This is another opportunity for the teacher to bring out new vocabulary while students are making and recording their observations. Have students continue collecting data and recording their findings on the worksheet.

8. Cut The Oranges In Half

Have students cut both oranges in half from the stem to the navel. Using the magnify glass, students observe the inside of the oranges and record data. This type of cut will show the middle and the baby oranges in the navel. It will also show that the navel orange is seedless and the Valencia orange has seeds. The three main physical properties of the navel are 1.) Navel 2.) Baby oranges, 3.) Seedless, and 4.) Thick rind. For the Valencia, the main physical properties are 1.) Seeds, 2.) No navel or baby oranges, 3.) Juicy, and 4.) Thin rind. Have students record observations on the Navel Orange Observation worksheet. Record on observations and concepts (physical properties) on concept chart concerning both types of oranges.

9. Eating The Investigation

Students may cut the oranges into equal pieces for their group and eat them. They observe which orange is juicier and sweeter. **Save the seeds** from the Valencia oranges for a future science investigation.

10. Clean Up, Review Vocabulary, And Concept Charts

You may save the rind with albedo for a decomposition lesson.

VOCABULARY The following key science terms are developed in this investigation: Navel Carpels, flesh Pips or seeds Pith, mesocarp or albedo Rind Meter tape Mass Diameter Circumference Citrus Apex Subtropical **CONCEPTS:** The following are key concepts of both oranges: Navel All navel oranges are seedless and have a baby orange (or mutation) inside at the apex. The rind is medium-thick and tender that makes them easy to peel and less juicy. Valencia The Valencia orange has no navel and some seeds. Juice is abundant and great for orange juice. In addition, the flavor of the Valencia is sweet.

Next Day, Part 2 of Navel Oranges

11. Show The Slide and Videos <u>https://www.youtube.com/watch?v=mo9wn62Utyl&feature=playe</u> <u>r_embedded</u> https://www.youtube.com/wa tch?v=-YTUYYgfsqA

https://www.youtube.com/watch?v=vs2GBRjt418 https://www.youtube.com/watch?v=TQgVFq-7kEs

12. Read The Handout On The History of the Navel Orange

http://books.google.com/books?id=4aAlwYckYJwC&printsec=fro ntcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Pages 2 and 4 – These pages give primary source information of the beginning of the navel orange and introduction of the navel orange into the United States of America.

Date:	
	_

NAVEL ORANGE MEASUREMENTS



MEASUREMENTS

	Washington Navel	<u>Valencia</u>
1. Circumference		
Instrument Used		·
2. Diameter		
Instrument Used		
3. Mass (Weight)		
Instrument Used		

Date:	

NAVEL ORANGE OBSERVATIONS

Draw the outside of your Navel and Valencia Oranges.

Observations (Critical Competitors)

DISSECTED NAVEL AND VALENCIA ORANGE

Draw the inside of your Navel and Valencia Oranges.

Observations (Critical Competitors)