

Fun with Flow Lesson Plan

Students learn dimensional analysis while exploring the flow of history on the Wekiva River.

Lesson Summary: Students learn unit conversion by dimensional analysis while exploring topics related to Timucuan Indians and the flow of the Wekiva River.

Grade Level: 8

Time Allotted: 2-4 hours

Performance Objectives

Math

Big Idea 3

Analyze and summarize data sets.

MA.8.S.3.1

Select, organize and construct appropriate data displays, including box and whisker plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships.

Supporting Idea 6 Number and Operations

MA.8.A.6.4

Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems.

Language Arts

LA.8.2.2.1

The student will locate, use, and analyze specific information from organizational text features (e.g., table of contents, headings, captions, bold print, italics, glossaries, indices, key/guide words).

LA.8.2.2.2

The student will synthesize and use information from the text to state the main idea or provide relevant details.

LA.8.3.5.1

The student will prepare writing using technology in a format appropriate to audience and purpose (e.g., manuscript, multimedia);

LA.8.6.2.2

The student will assess, organize, synthesize, and evaluate the validity and reliability of information in text, using a variety of techniques by examining several sources of information, including both primary and secondary sources;

Social Studies

SS.8.G.5.1

Describe human dependence on the physical environment and natural resources to satisfy basic needs in local environments in the United States.

Science

SC.8.E.5.10

Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.

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Prior Knowledge

Students will need to remember basic algebra and have some experience with real-world units of measure.

For background information about the Timucuan people, visit this link:

<http://fcit.usf.edu/florida/lessons/timucua/timucua1.htm>

For instructions on how to create graphs using Microsoft Excel, visit these links:

[Demo: Create charts in Excel 2007](#). Accessed July 2011. Microsoft, Inc.

[Video: Create a chart \(or graph\)](#). Accessed July 2011. Microsoft, Inc. (*Applies to Microsoft Office Excel 2003*).

Topic Overview

Using data tools from the Orange County Water Atlas, students will download flow data for the Wekiva River and consider it in a variety of ways, including

1. calculating how many water bottles per second and per hour pass a point in the river at high and low flow
2. practicing conversion of cubic feet per second (cfs) to liters per second (L/s) and to liters per hour (L/hr), and
3. determining whether they could paddle a Timucuan canoe into high water flows.

To get practice with more advanced unit conversion, they will do a dimensional analysis lesson.

Key Vocabulary

cfs

Cubic feet per second, a measure of flow.

Liter (L)

A metric measure of volume – 1 L of water weighs 1 kilogram.

Milliliter (mL)

One thousandth of a liter. Abbreviated mL and often pronounced “mil”, milliliters are used in science and also in medicine, even in the US.

Stream flow

A measure of the volume of water passing by a certain point in a river or stream.

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Timucua

A group of Native Americans that lived in south Georgia and North Florida, who were wiped out after European contact by disease, slavery and warfare.

Water level

Height of the surface of a body of water above a known reference. For rivers, water level varies along the river's course, while for ponds/lakes it is relatively constant.

Materials

- Computers with internet access

Resources

The following resources are available on the Orange County Water Atlas:

[U.S. Geological Survey Streamgaging Fact Sheet](#), 2007

Other resources:

Illustration: Dugout Canoe (Jacques le Moyne / Theodore de Brye, from a trip in 1564)

http://www.csulb.edu/~aisstudy/woodcuts/001_001_0004_1335.jpg

Timucua Indians (National Park Service)

<http://www.nps.gov/timu/historyculture/timucua.htm>

Wekiva Springs State Park

<http://www.floridastateparks.org/wekiwasprings/>

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Procedure

Engage/Elicit

Have students consider a map of Orange County with just rivers and roads on it (don't tell them what is shown). This map can be easily created using the **Orange County Water Atlas** mapping tool and turning off all the layers but the expressways and water features. You can have them create it themselves, project it for them, or use the Print option to make a paper copy.

Now ask students to take a mental trip back in time about 1000 years. Toss out a few historical references for perspective, such as:

- Ancestral Pueblans (Anasazi) were building classic period cliff dwellings in the North American southwest.
- Mayans were abandoning their cities in Central America.
- Vikings were "discovering" the North American northeast.
- Macbeth was killing the King of Scotland
- Italian architects were building a reasonably straight tower in Pisa.
- Europeans would not set foot in Florida for another half-century.

Once they have settled back in time, have them write down ways that the map of Orange County might looked different back then. If you like, students can share some of these with the rest of the class.

Explore

The most notable difference on the map is the roads – we take all of Florida's roads and bridges for granted today, but 1000 years ago it was forest, scrub, rivers and lakes. Travel for the peoples in Florida 1000 years ago would have been a lot more difficult, and much of it was done on the waterways.

The Wekiva River is a significant waterway connecting to the St. Johns River. The Wekiva is both spring fed and a significant watershed, so its water levels fluctuate. Have the students download flow data from the Wekiva River using the **Orange County Water Atlas** data tool. To perform a download of Wekiva River flow data:

1. On the Orange County Water Atlas home page, select the **Data Download Tool** from the dropdown menu. Read the disclaimer and click **Accept**.
2. Step 1: Choose **Surface Water Hydrology** and click Submit.
3. Step 2: Select the **Water Atlas** and **Water Body Name** check boxes and click Submit.
4. Step 3: Type **Wekiva River** and click Submit.
5. Step 4: Click **Give me all station data**.
6. Step 5: Click **Download File**. Save the file to your computer.

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Once they have the data on their computers, they can use Microsoft Excel or an equivalent program to graph the data to help them visualize its meaning.

Then have them consider how the fluctuating flow levels might have affected travel 1000 year ago. This can be done in groups or individually. Two important factors are 1) enough water to float a heavy dugout canoe and 2) a slow enough pace that progress can be made upstream as well as downstream.

Many students are unaware that Florida had numerous Native American tribes before Spanish contact, none of which remain today (the Seminoles came considerably later).

Explain

Explain to students that scientists use gages that measure the flow of water at a particular point in the river by measuring the height of its surface, the area of its cross-section, and the speed of the water passing that point. (See the US Geological Survey Streamgaging Fact Sheet, listed in the Resources section, for an explanation of how this is done.)

Have students go through the Dimensional Analysis handout (below). This takes them through the process of unit conversion with examples.

Then have students perform dimensional analysis on the actual flow of the Wekiva River. Is there a way to convert cfs in to more meaningful units? How about water bottles per second? Or swimming pools per minute? Could the Timucua have paddled their heavy canoes on the Wekiva? Be sure to show them the **Dugout Canoe** image from 1564, and let them explore more resources such as **Timucua Indians** from the National Park Service.

Extend

Have the students explore the **Orange County Water Atlas** mapping tool layers and consider other differences between the present and 1000 years ago. An obvious one would be land use – none of the urban category would be present, although there were certainly villages. More subtle ones would include:

- Effects of fire (We have a complicated relationship with fire today, but wildfires are suppressed near development. However, archaeologists believe many Native Americans actively used fire to manage the land.)
- Effects of climate change (1000 years ago the Medieval Warming Period affected climate in Europe and North America – we have probably surpassed those temperatures now).

Extend (Optional Field Excursion)

There are several potentially interesting trips to be made to the Wekiva, including the very popular headsprings at **Wekiva Springs State Park**, which has trails and swimming. Canoe or kayak rentals and tours are available (from nearby concessionaires; for information, inquire at Wekiva Springs State Park), allowing students to experience river travel by canoe or kayak firsthand.

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Exchange/Evaluate

You can collect and evaluate:

1. Students' initial list of ways Florida might be different 1000 years ago
2. Students' consideration of how fluctuating flow might affect river travel
3. Students' dimensional analysis calculations
4. Students' speculation about other differences on the map between now and 1000 years ago
5. Students' dimensional analysis conversions of the Wekiva River data.

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