MAPMAKING

Map of New Belgium, Now called New York, New England, and Virginia. John Ogilby and Arnoldus Montanus, 1671. Private Collection.

Map Vs. Chart

Captain Erick Tichonuk, LCMM

Noted Captain and author Roger Taylor wrote *The Elements of Seamanship* in which he provides us with insightful chapters of maritime do's and don'ts. The first is *Keeping the Water Out*, the second, *Keeping from Hitting Anything*. Although avoiding collisions with other vessels is part of "keeping from hitting anything", the backbone of accomplishing the second credo is the nautical chart. It's easy to become confused, but indeed many people incorrectly interchange the words "map" and "chart". While both are planer (flat) representations of part of the earth's surface in a miniature scale, the big difference is what information is emphasized.

Map On a standard road map, land features are highlighted, with particular attention to names and numbers of roads and communities. Bodies of water are typically no more than monotone blue patches with a name printed across the top.

Chart The nautical chart has extreme levels of detail for a body of water to allow the navigator of a vessel to get from point A to point B, all while following Captain Taylor's credo of "keep from hitting anything".

The chart's "extreme levels of detail" become obvious as one begins to study charts and their associated symbols and abbreviations. When looking at a road map, the operator of an automobile would not expect to see cautionary road signs such as "yield" or "curvy road" annotated. And yet the mariner does expect this level of detail on a *chart* - in the form of buoys marking shallow shipwrecks and shoals, or as shaded areas noting congested traffic in ports. Information will go well beyond whether a buoy is just present, but includes what shape, color, number designation, light color and blink pattern it possesses.

One distinguishing feature of a chart is the presence of depth markings. Imagine Samuel de Champlain exploring uncharted waters. He may have had no idea what was around the next corner, but what is far more disconcerting for the mariner is having no idea *what's below his boat*. He knows his boat's *draft* (the distance a boat sticks down into the water). He needs to know how far the ocean, sea, river, or lake bottom is below his vessel to avoid running aground and potentially loosing his vessel (back to "keep from hitting anything" and thus "keep the water out"). As Champlain carefully drew the shoreline to the best of his ability, he would also have one of his seamen taking *soundings*, or depth measurements. The tool used was called a "hand-lead", a conical lead weight tied to a line with markings attached at 6 foot (one fathom) intervals or multiples thereof. The seaman would "heave the lead", lobbing it ahead of the boat. When it struck bottom, he would observe the mark and call out the depth of water which could then be recorded. A depression at the base of the lead filled with tallow (rendered fat) gathered bits of bottom, such as mud or sand, providing information about bottom composition.

Although Lake Champlain appears on many early *maps* the first extensive *charting* didn't occur until the British had secured control from American rebel forces under the command of Benedict Arnold in the fall of 1776. As the American Revolution waged on in other parts of the country, the Royal Navy enjoyed firm control of the lake and relatively little rebel opposition occurred. During this interim, British Captain William Chambers charted the lake with the Royal Navy Fleet in 1779-1780. Chambers not only provided stunning charts of the lake, his commentary of the surrounding countryside functioned in the same way a modern "cruising guide" works for recreational boaters.

Today the laborious process of locating oneself has been replaced with various types of electronic equipment. With sonar, echoes of sound are sent from the unit to create an image of the bottom, providing a wide range of information including depth, bottom composition, and bottom density. Combined with GPS (Global Positioning System) cartographers and oceanographers are able to create highly accurate charts of the world's waterways. GPS's sophistication and accuracy is still based on the same premise as in Champlain's world. To find one's exact location on the planet, the modern mariner uses a "global address system". This system divides the earth in a series of horizontal and vertical lines, known as latitude and longitude respectively. The only difference between Champlain's "global address system" and that of today is the level of accuracy and the tools used to determine location.

Bowditch, Nathaniel. *The New American Practical Navigator, 1802*. Maryland: National Imagery and Mapping Agency, 2002

Chambers, Capt. William, R.N. *Atlas of Lake Champlain, 1779-1780*. Vermont Heritage Press, 1984.

Falconer, William. *An Universal Dictionary of the Marine.* London: Printed to T. Cadell, in the Strand, 1780. http://southseas.nla.gov.au/refs/falc/title.html

Maloney, Elbert S. *Chapman Piloting & Seamanship.* New York: Hearst Books, 2003.

Taylor, Roger C. *The Elements of Seamanship.* International Marine Publishing, 1986.

http://www.noaa.gov/charts.html

http://gwydir.demon.co.uk/jo/units/sea.htm

Mapping Champlain's Route

LCMM

Grade Level 4-12

Content Areas Social Studies

VT Grade Expectations VT H&SS5-6:11: Students interpret geography and solve geographic problems by…
- Identifying and using basic elements of a map.
- Using appropriate geographic resources to answer geographic questions and to analyze patterns of spatial variation

NY Standards NY Social Studies Standard 3: Geography: Key Idea 1:
- Map information about people, places, and environments
- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models
- Describe the relationships between people and environments and the connections between people and places.

Duration 50 minutes

Learning Goals **Students will use the information given in a primary source narrative to map the route, time and events of the Champlain expedition or 1609.**

Description
1. Discuss Champlain's interest in exploring new territory to add to New France and routes that would connect and protect this area.
2. Pass out an outline map of the Quebec to New York corridor. The teacher should use a transparency of the same map with an overhead projector
3. The teacher or students should read aloud the description of Champlain's trip.
4. Label each identifiable location with a name and date if given in his journal
5. Discuss how Champlain's First Nations companions met the Iroquois around Crown Point and Ticonderoga. Label the features on your map that his guides describe.

Assessments Maps should be checked for accuracy.

Materials/Resources Champlain Journal

Special Considerations An extension of this activity would be to follow the route from Quebec to the Hudson River on Google Earth. This could be followed to get a sense of the modern physical features from different altitudes in the program. Zoom in on the specific features Champlain mentions in his journal.

My Room Map

LCMM

Grade Level 1-8

Content Areas Social Studies, Math

VT Grade Expectations VT H&SS - 11: Students interpret geography and solve geographic problems by…
- Creating a map as a representation of a space
- Identifying and using - basic elements of the map

NY Standards NY Social Studies Standard 3: Key Idea 1: Performance Standard:
- Draw maps and diagrams that serve as representations of places, physical features, and objects
- Map information about people, places, and environments

Duration 50 minutes class, 30 minutes homework

Learning Goals **Students will learn the fundamentals of map making and how maps can be used to represent a space.**

Description
1. Discuss ways in which maps are used and can be helpful.
2. Describe the image of common objects around the room when observed from the top looking down.
3. Have students sketch some sample objects looking down on them.
4. Sketch the shape of your classroom on the blackboard or overhead.
5. Orient the sketch using labels like hall, outside, neighboring classrooms.
6. Sketch in the fixed features of the room (doors, windows, sink, blackboard, coat room, closets.)
7. Sketch in the major furniture.
8. Discuss how someone who did not know the room could use the map to find his/her way around.
9. Have students sketch a map of their own bedroom, a house, or even another setting such as a supermarket.
10. Share student maps having students describe them to the class or to one or two others in small groups.
11. Discuss how all the maps are similar and how they are different.
12. Discuss why a cartographer might choose to include certain elements in detail but not others. What is the purpose of this map?

Assessments Informal assessment appropriate to the skill level of the students.

Materials/Resources Blackboard/Overhead, paper or grid paper

Building an Island

LCMM

Grade Level 4-12

Content Areas Social Studies, Math

VT Grade Expectations VT H&SS 11: Students interpret geography and solve geographic problems by…
- Creating a map as a representation of a space
- Identifying and using - basic elements of the map

NY Standards NY Social Studies Standard 3: Key Idea 1: Performance Standard:
- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models

Duration 50 minutes class

Learning Goals **Students will learn about land forms and water bodies by building a representation of these physical features.**

Description
1. Review basic land forms and bodies of water.
2. Sketch on the board the outline of an island that has at least 10 different land and water forms.
3. Provide students with a paper grid.
4. Have them create their own island outline with at least 10 land and water forms.
5. Mount the outline on a backing board.
6. Use modeling material to build a three dimensional model of their island.
7. Use paints to highlight the land and water forms.

Assessments Project Assessment Rubric

Materials/Resources Enlarged grid ruled paper, modeling material (clay, salt and flour, sawdust and wheat paste, etc.)

Special Considerations The number of physical features can be adjusted depending upon the sophistication of the students.

Mapping an Island

LCMM

Grade Level 4-12

Content Areas Social Studies, Math

VT Grade Expectations VT H&SS 1: Students interpret geography and solve geographic problems by…

- Creating effective geographic representations using appropriate elements to demonstrate an understanding of relative location, location, size
- Identifying and using basic elements of the map (e.g., cardinal directions and key).
- Using grid systems to locate places on maps and globes

NY Standards NY Social Studies Standard 3: Key Idea 1: Performance Standard:

- Draw maps and diagrams that serve as representations of places, physical features, and objects
- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models

Duration 50 minutes class

Learning Goals **Students will learn about map making by creating a flat representation of a three dimensional model.**

Description

1. Students will need their own or a sample model of an island mounted on a grid.
2. Provide students with a blank grid ruled to the same scale.
3. Discuss how the outline of each square of the island model grid can be transposed onto the blank ruled sheet using one to one correspondence.
4. Have students sketch an outline map of the island.
5. Have students label the major land and water forms.
6. Use water colors or markers to accentuate the land and water forms.
7. Discuss what was easy and difficult about making their island maps.

Assessments Mapping Assessment Rubric

Materials/Resources Island Model, Grid Paper, Markers or Paint

Special Considerations The grid for the island model and corresponding map should be sized for the sophistication of the students, larger squares for younger students and smaller for older students.

Sounding Box

LCMM

Grade Level 4-12

Content Areas Social Studies

VT Grade Expectations VT H&SS 11: Students interpret geography and solve geographic problems by…
- Identifying and using basic elements of a map.
- Using grid systems to locate places on maps and globes.

NY Standards NY Social Studies Standard 3: Geography: Key Idea 1:
- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models.

Duration Center activity for individual or small group work

Learning Goals **Students will learn to use systematic measurements to describe the shape of an unseen object**.

Description
1. The teacher will prepare a "Sounding Box." This is a box of a convenient size and shape with a grid laid out on the top. Pin holes should be punched through the box at the intersection of each line in the grid. An object should be placed in the box so that it cannot shift its position.
2. Give students a worksheet with a grid that corresponds to the grid on the surface of the box top.
3. Have students use a wire probe to measure the depth from the top of the box to where it strikes "bottom."
4. Students will mark the depth with their finger on the probe and then measure this depth using a ruler.
5. The measured depth will be recorded on their worksheet at the corresponding grid intersection.
6. Once students have measured all the depths on the grid, they should connect the points with common measures.
7. Based on the bottom profile they create with their soundings map, they can hypothesis about what the object in the box may be.
8. After all groups have completed the activity and speculated on the shape of the hidden object, the box should be opened and the teacher should lead a discussion on the extent to which the sounding maps were able to describe the actual object.
9. This activity can be repeated as many times as desired with objects of increasing complexity.

Assessments Informal Assessment of students' understanding and effort.

Materials/Resources Sounding box, wire probes, rulers, grid worksheets, variety of objects, tape

Special Considerations This activity is best done as an instructional center. Some instruction on measuring with a ruler may be necessary. Unless a very large box is used, it is recommended that students measure in millimeters to avoid the complexity of fractions.

Chart Comparison

LCMM

Grade Level 4-12

Content Areas Social Studies

VT Grade Expectations VT H&SS 11: Students interpret geography and solve geographic problems by…

- Constructing and reading a variety of effective representations of the earth such as maps, globes, and photographs
- Identifying and using basic elements of a map.
- Using grid systems to locate places on maps and globes.

NY Standards NY Social Studies Standard 3: Key Idea 1: Performance Standard:

- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models

Duration 50 minutes

Learning Goals **Maps are constantly being revised and updated. In this activity students will compare the similarities and differences between Samuel de Champlain's chart of the Kennebec River in Maine, a recent chart of the same area, and a satellite image.**

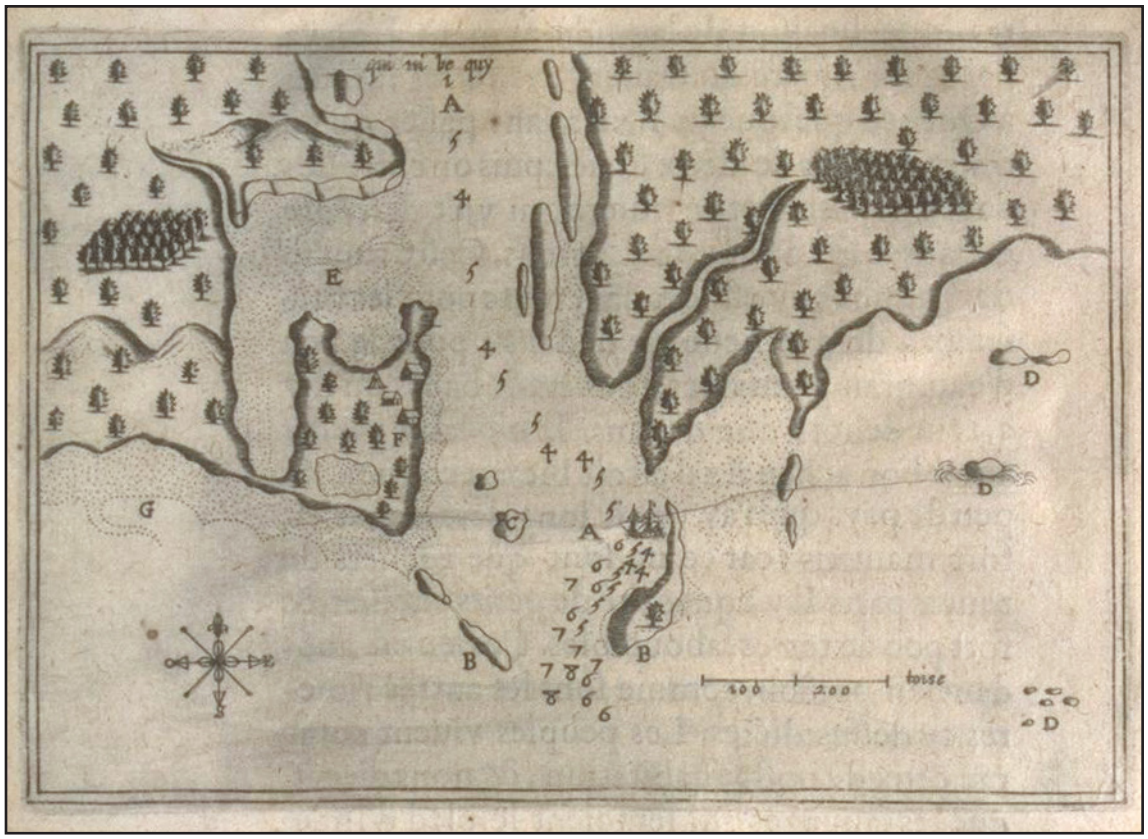
Description

1. Discuss how early charts were made by connecting know reference points with estimates of the shape of the land between.
2. Distribute copies of the charts.
3. Divide students into work groups of two or three to identify features on the charts that are similar and those that are different. Have students mark the portions of the charts that are in agreement.
4. Following the work period, use the overhead to project the chart for the class. Have work groups share the areas that they thought were in agreement. Discuss any disagreements among work groups and mark the overhead chart with the consensus of the class.
5. Ask why students think the early cartographers were able to represent certain features more accurately than others.

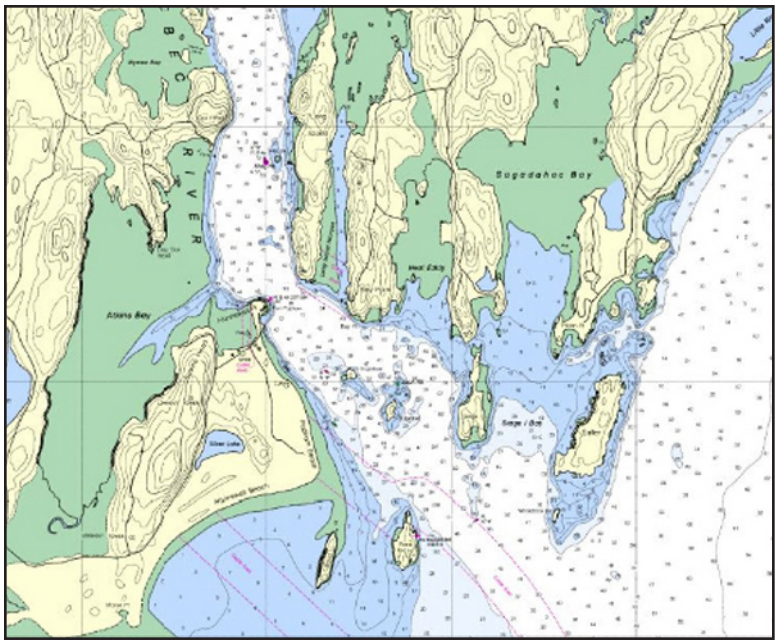
Assessments Informal assessment of participation and understanding of key ideas.

Materials/Resources Copies of Champlain's chart, NOAA chart, Google satellite image, markers, overhead projector, transparencies

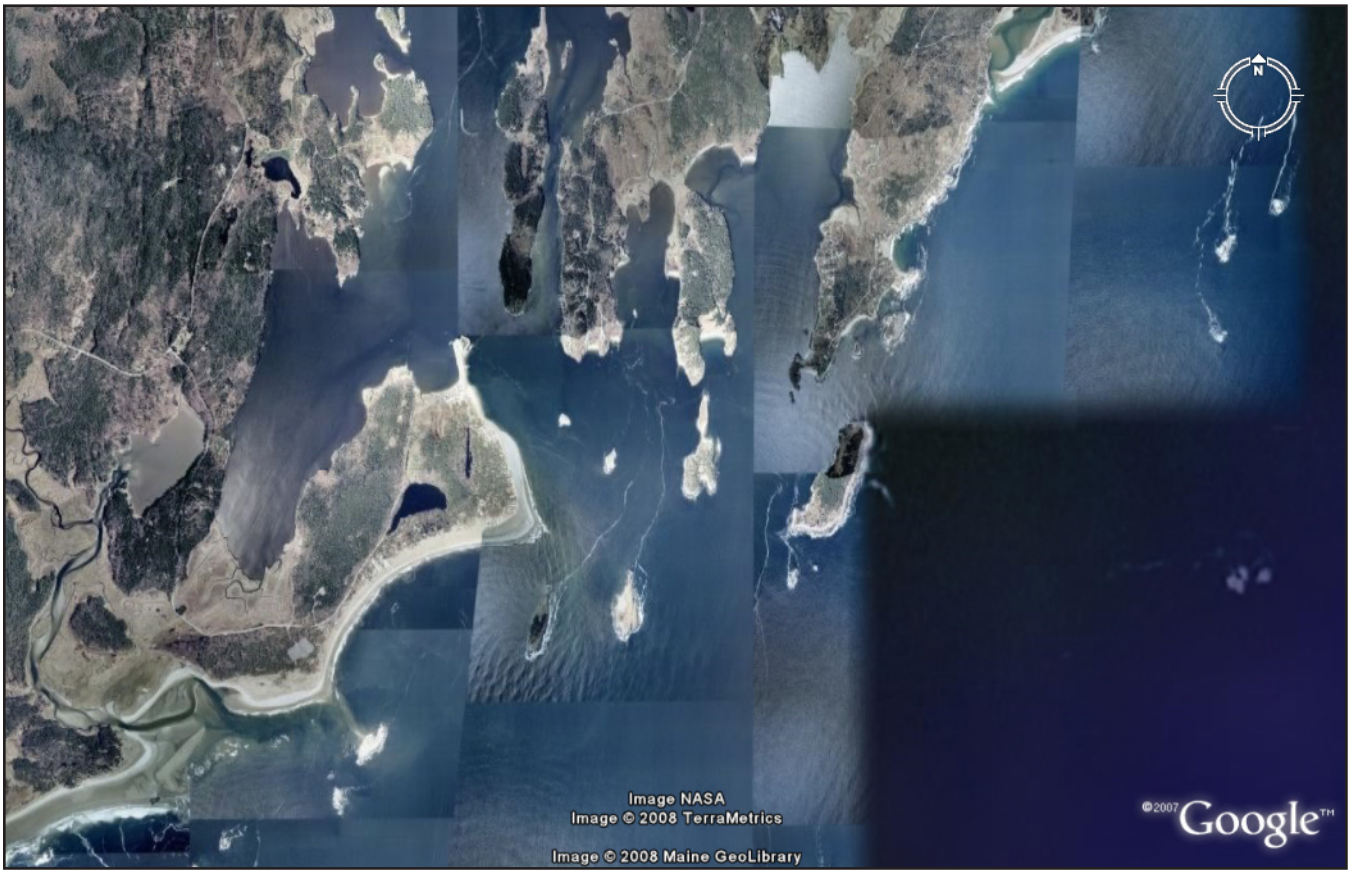
Special Considerations Chart analysis and preparation for discussion could be done independently.



Samuel de Champlain's chart of the mouth of the Kennebec River.



NOAA Chart of the mouth of the Kennebec River.



Google Earth© satellite image of the mouth of the Kennebec River.

Mapping from the Horizontal

LCMM

Grade Level 4-12

Content Areas Social Studies

VT Grade Expectations VT H&SS 11: Students interpret geography and solve geographic problems by…

- Constructing and reading a variety of effective representations of the earth such as maps, globes, and photographs
- Identifying and using basic elements of a map.
- Using grid systems to locate places on maps and globes.

NY Standards NY Social Studies Standard 3: Key Idea 1: Performance Standard:

- Draw maps and diagrams that serve as representations of places, physical features, and objects
- Understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models

Duration 50 minute Introduction and independent or small group Work Center

Learning Goals **Students will learn how difficult it was for early map makers to represent an overhead view of the Earth needed for a map when they were limited to what they could see from standing at sea level.**

Description

1. Discuss the problems of early map making without photography, GPS, airplanes or satellites.
2. Provide basic instruction on the use of Google Earth, especially how to tilt the image and move according to compass direction.
3. Use a computer projector to demonstrate how the image of landforms change depending upon elevation and angle of view.
4. Choose a location and tilt the elevation to about 1000 feet above sea level. Instruct students on how to look for key landmarks from the horizontal view and to estimate their relative distance from each other. Demonstrate on the blackboard how points of land that stand out or overlap can be used as references points.
5. Once key reference points are established, demonstrate how the map maker draws in the unknown areas by estimating the shape from the reference points and the view of the land as s/he sees it.
6. Once the demonstration map is sketched in, tilt the Google Earth image so that the actual shape of the land and water forms are revealed.
7. Discuss with students the features that they got right and those that were misrepresented.
8. Set up a computer lab or work center so that students can work individually or in small groups to repeat the same process on an unknown region. The teacher should choose a region of local interest or geographic diversity. All students can take turns mapping the same location before the actual shape is revealed, or each group can choose a different location.

Assessments Informal assessment based on participation and understanding of key ideas.

Mapping from the Horizontal (Cont'd)

Materials/Resources

Access to computer with Google Earth software, computer projector, blackboard, paper and pencils

Special Considerations

The mastheads of even modern ships are rarely more than 100 feet above sea level. However, the three dimensional image available from Google Earth is distorted beyond use much below 1000 feet. Although the basic challenges are the same, students should understand that early navigators had an even more difficult time working from sea level and often passed right by important features of the New World that would not be discovered until later.