Teacher's Guide for Real Time Data Activities

Overview

This multidisciplinary Internet-based learning experience has been designed to expose students to real world problem solving through unique uses of instructional technologies. In this project, students will use real time data from the Internet to track a real ship at sea, determine its destination and predict when it will arrive. In addition, they will have the option of monitoring the weather conditions at sea and predicting when rough weather might impact on the ship's arrival time.

These lesson plans has been developed to help you implement this project in your classroom. Each lesson plan has a web site associated with it for students use, handouts, and links to support materials. Besides the traditional parts of the lesson plans (e.g. objectives, materials, procedures, etc.) you will also find suggestions on how to implement the project in a classroom with limited Internet access. The last section of this guide contains suggestions for assessing students who complete the project. It is recommended that you review all of the lesson plans in detail prior to implementing the project in your classroom.

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LESSON #1: What's your problem?

Performance Objective: Students will develop a problem statement based on the project story.

Materials:

- Handout #1: What's your problem? (also available in PDF format, Adobe Acrobat plug-in required)
- OPTIONAL: Internet access to the World Wide Web via a classroom computer or a computer lab
- Pen/pencil

Procedure: The following steps will help you guide your students through the lesson.

1. Introduce the project. Explain to your students that they are going to get a chance to apply some of the things that they have learned in math, science and social studies to a real world problem.
2. Have students read the story.
    - Have the students go to the project web site, access the Real Time Activities and then "Lesson #1: What's Your Problem?". If you have limited Internet access you can just use Handout #1 rather than having your students go online.
    - Distribute Handout #1 "What's your problem?" which includes the project story on it
    - Have them click on the link to the Project Story and give them about 10 minutes to read it.
    - Ask them to think about what problems the story is asking them to solve. Have them re-read it if necessary.
3. **LIMITED INTERNET ACCESS STRATEGY**: Use the Handout #1 which includes the project

story on it. If you have a way of displaying your computer monitor, go to the project web site and access the story. Leave it on the display while the students are reading from the handout.

4. Hold a class discussion. Ask your students to tell you what they think the problems are and why. Some students might not realize that determining the speed of the ship will be important. If this occurs you may want to have them consider a different but related problem. Ask them to imagine that three friends leave their school to go to the local pizza place. One walks, another takes a bike and the third gets a ride in a car. They all travel the same distance but arrive at very different times. You can then ask them why they arrive at different time, the answer being that the speed they were traveling. You can then ask them that if they know where their ship is located and where it is headed what else would they need to know in order to determine when they will arrive in port? The answer: speed.
5. Create a common problem statement. Once you have collected responses from everyone, work with them as a class or in groups to develop a problem statement. Have them record their problem statement in the appropriate section of Handout #1: What's your problem? The important aspects of the problem statement are:
    - Where are they currently located?
    - What is their destination?
    - How fast are they moving?
    - When will they arrive at their destination?
    - What might slow them down or delay them from arriving on time?

Sample Problem Statement: *We need to figure out where we are located right now. We also need to find out what place we are heading to and when we will get there. We think that it might be important to also know the speed of the ship so that we can figure out how long it will take to get to port. It will also be important to keep track of the weather in our area in case a bad storm comes that might delay us from getting to our port on time.*

Homework Suggestion: You can either ask the students to think about what they will need to do to solve the problems they have identified or you can have them work on some practice problems on plotting latitude and longitude coordinates (see Prerequisite Knowledge section in Lesson #2).

LESSON #2: Where on earth are you?

Performance Objective: Students will determine where their ship is located, where it was previously and will plot these positions on a map using latitude and longitude coordinates.

Materials:

- Internet access to the World Wide Web either via a computer in the classroom or computer lab.
- Ship ID Code(s) for the ship(s) the students will be tracking (see section below on "Selecting an appropriate ship").
- Handout #2: Where on earth are you? (also available in PDF format, Adobe Acrobat plug-in required)
- Individual maps for each student showing the area they will be studying. It should have detailed latitude and longitude lines marked on it as well. For example, if you are going to be tracking a ship in the Pacific Ocean off the west coast of the United States you should find a good map of that area of the Pacific Ocean that has latitude and longitude lines marked on it. Several good atlas

can be purchased online, go to the online teacher's guide for links to these books.
- Large world wall map with latitude and longitude lines.
- Pen/pencil

Procedure: The following steps will help you guide your students through the lesson.

1. Prerequisite knowledge. If your students are not familiar with latitude and longitude you should make sure that they understand what latitude and longitude coordinates are and how they can be used to plot points on the surface of the earth prior to this lesson. You will find resources to help you cover this topic in both the "Hands-on Activities" section and the "Reference Material" section off of the project web site.
2. Selecting an appropriate ship(s). Since the Stowaway Adventure uses real time data from ships at sea it is important to find a ship which is reporting the right data for use in the activity. Since you are now dealing with real world information you will find that it is not always available (e.g. ship might lose communication capabilities). Thus it is very important to prepare for this lesson just prior to implementing it. To select an appropriate ship or ships follow these steps:
    - Decide what area of the world you would like the students to track a ship in (Pacific Ocean off the west coast of the U.S., Atlantic Ocean off the east coast of the U.S., the Pacific Ocean off the Asian coast or the Atlantic Ocean off of Europe). In general the Pacific Ocean off of the U.S. is the easiest area to study but you can select any of the four areas.
    - Go to the project web site and click on the link to the Real Time Activities.
    - Select Lesson #2: Where on earth are you?
    - From the set of Lesson Links, select the ship map for the area your students will be studying.
    - This will bring you to a site that contains a map of the ocean including the coastline of one of the continents. The map is covered with blue, pink and red dots. The blue dots represent ships and the pink and red dots represent buoys. These are REAL ships and REAL buoys which are currently in the ocean and reporting a wide range of atmospheric and oceanic data back to the United States and into your classroom through the Internet. **Important note:** There are times when no ships (blue dots) will appear on the maps due to technical problems. If this occurs wait a few hours and check the site again. If you encounter problems the day you are using the site there is a back up set of data linked from Lesson #2 which can be used.
    - You will need to pick several ships from this map and check them to see if they are indeed submitting enough data for you to track them. Note that there is a four or five letter and number (could be just letters) codes in the bottom right corner of the blue dots. These are the Ship ID Codes.
    - Record the Ship ID Code for three or four ships. Then use your browsers Back Button to return to the Lesson #2 web site.
    - From the set of Lesson Links on Lesson #2, select the Ship Database.
    - At the "Ship Database" site scroll down until you see the text window that says "Enter ID to be searched:." Use your mouse and click on the text window. Then enter in the ID code for your ship. MAKE SURE YOU ENTER IN THE ID CODE IN ALL CAPITAL LETTERS. Then press enter or click on the search button.
    - You will be brought to the "Search Results" page which will display at most, the last 48 hours worth of data from the ship. In order to be able to use the ship in the activity, it will need to be reporting AT LEAST FOUR intervals worth of data. If the ship is reporting enough data, then you can use it in the activity. If not, submit the ID Code for another ship, continue until you find one that is reporting enough data.

- If you have students working in groups you may want to find a ship for each group to track.
- Once you have found a "good" ship(s) for the activity, write down its ID Code so you can use it for the rest of the lessons.

3. Ship ID Code. Explain to the students that there are thousands of cargo ships in the worlds oceans which transport goods between the continents. Discuss the following:
   - Each ships has an unique Ship ID Code which is used to identify it.
   - Ship ID Codes are generally made up of a combination of 4 or 5 letters and numbers (e.g. ELJQ2).
   - Have them record their Ship ID Code on Handout #2: Where on earth are you?
4. Locating the Ship.
   - Have students access the web site for Lesson #2.
   - Instruct them to click on the link to the correct ocean map and explain what the different symbols on the map represent. Point out where the Ship ID Codes can be found and have them see if they can locate their ship.
5. **LIMITED INTERNET ACCESS STRATEGY**: Use display system to show the ocean map to the students and explain what the symbols on the map represent. Have them work in groups and have a representative from each group come up to the front of the room and locate the ship on the display. They can return to their group and point out its approximate location on their paper maps. While each group works at the computer the other groups could be working on developing latitude and longitude, map or speed calculation skills. There are worksheets on these topics in the "Reference Materials" section off the main project web site.
6. Accessing Data from the Ship. Next students will need to access the online database to retrieve data that the ship has submitted over the past couple of days.
   - Once on the Lesson #2 web site have your students scroll to the bottom and click on the button labeled "Ship Database."
   - Once on the web site have them scroll down and enter the ship ID Code into the text window. Remember to have them type the code in using ALL capital letters.
   - Have them hit enter or click on "search."
   - Once they get the "Search Results" back, have them scroll down and record the current position as well as the last FOUR or more previous positions of the ship by writing down the latitude and longitude coordinates listed for each time interval. They should record this data along with the date and time for each position on Handout #2: Where on earth are you?
   - **Important Note:** The latitude and longitude coordinates are expressed as decimals and that negative latitude numbers indicate a south latitude, positive latitude numbers indicate north latitude, negative longitude numbers indicate west longitude and positive longitude numbers indicate east longitude.
7. **LIMITED INTERNET ACCESS STRATEGY**: Have the students work in groups and assign a different ship to each group. While each group works that the computer the other groups could be working on developing latitude and longitude, map or speed calculation skills. There are worksheets on these topics in the "Reference Materials" section off the main project web site.

Homework Suggestion: Have the students take home the data they collected and ask them to finish plotting the rest of the data points (at least four previous locations). They should label each point with the date and time that it was recorded. Have them note any information that might help them solve their problems.

LESSON #3: What's your destination?

Performance Objective: Students will plot the location of their ship on their map, determine what direction the ship is headed in and in what city it will dock (port-of-call).

Materials:

- Internet access to the World Wide Web via a computer in the classroom or a computer lab
- Handout #3: What's your destination? (also available in PDF format, Adobe Acrobat plug-in required)
- Ruler
- Individual maps from Lesson #2
- Large wall map
- Pen/pencil

Procedure: The following steps will help you guide your students through the lesson.

1. Plotting the Ship's Position
    - Using the latitude and longitude data that was recorded, have the students plot both the **Current Position** AND **Previous Position #4** on their desk-size map. Make sure that they label each position (use "C" for current and "P4" for previous position #4).
    - Ask the students to then figure out what direction is the ship heading? (north, south, east, west, northwest, etc.) They will need to understand that the ship moves FROM its Previous Position TO its Current Position. If they reverse this the direction they determine will be opposite of the actual heading of the ship.
    - Record the direction on Handout #3.
2. Observations and discussions: Ask the students to make some general observations of how the ship is moving. Spend a few minutes going over the questions on Handout #3.
3. Determine what city or port-of-call you are headed towards
    - On the smaller desk-sized map have the students draw a straight line, using their ruler, that starts at the Previous Position (marked "P4") and goes through the Current Position (marked "C"). Extend the line past the Current Position mark until the line intersects the land.
    - Assuming that the ship will sail in a straight line the place where the line intersects land is the place where the ship will dock. Have the students circle this area on their map and label it "port-of-call".
    - Record the name of the country that the destination is located in on Handout #3.
    - In many cases, the place where the line intersects the land will not precisely correspond to a particular shipping port. To determine exactly which port or city the ship is headed towards the students will need to search a database of world shipping port. Have them follow the link to the World Sea Ports database. At that site you can either click on the map on the country your ship will dock in or enter in the name of the country in the second search window on the left-hand side.
    - After selecting a country they will get a list of all of the major shipping ports that are located in that country. Have them look at the map again and see if one of the cities near the area that was circled is listed in the database search results. Select the port which is closest to the area that was originally circled. Record the name of this city on Handout #3 on the lined labeled port-of-call.
    - OPTIONAL: By clicking on the link to the port-of-call from the World Sea Port web site

students can get additional information about the port and surrounding areas.

4. Drawing some conclusions. Once the students have been given some time to record their answers, hold an informal discussion with them to talk about what they have learned so far and how this information can be used to solve the initial problems they outlined. See if they can figure out how to use the information they have collected to answer as many of the initial questions as possible.

Homework Suggestion: Have your students review the problem statement they came up with at the start of the project. Have them answer as many of the initial questions as they can and write them down. In particular they should be able to determine where they are and where they are going. They should also be able to indicate that the speed of the ship is relatively constant.

LESSON #4: Faster than a speeding slug

Performance Objective: Students will determine how far they have traveled between locations, how long it took to travel that distance and the speed of the ship.

Materials:

- Internet access to the World Wide Web via a computer in the classroom or a computer lab
- Handout #4: Faster than a speeding slug (also available in PDF format, Adobe Acrobat plug-in required)
- Individual maps from Lesson #2
- Large wall map

Procedure: The following steps will help you guide your students through the lesson.

1. Prerequisite knowledge. If your students do not have experience calculating the speed of a moving object you should cover this with them prior to this lesson. See the "Hands-on Activities" and "Reference Material" sections for resources that will help you cover this topic.
2. Go over the homework. Based on the information they had they should have been able to determine the following:
    - where their ship is currently located
    - it is traveling roughly a straight line course
    - if they extend a line along the path the ship is traveling they can predict what port it is headed towards
    - what their ship's destination is (port-of-call)
    - that the ship seems to move at a fairly constant speed
3. Discuss the next steps. Before going on hold a discussion with the class about what else needs to be calculated. Have them figure out what data they need to collect in order to determine the approximate speed of the ship. Before moving on they should all recognize that they will need to determine the distance the ship has traveled and the time it took to travel that distance in order to calculate the speed of the ship.
4. Determine distance traveled. The students will now use a web site to calculate the distance the ship has traveled between its two last known locations. Alternatively, you could have them determine the distance traveled by measuring the distance between the points they have plotted on their maps and using the scale on the map to calculate the actual distance traveled. This second method is a good way to practice basic map skills but tends to be less accurate. To calculate the

distance traveled using the web follow these steps:
- From the Lesson #4 web site, click on the link for the "Distance Calculator."
- Scroll down on this web site and enter in the coordinates for the two positions.
- On the "To" line enter the **current position** and on the "From" line enter in **previous position #4.** It is VERY important not to confuse these two positions. Remember that the ship will move FROM its **previous position** TO its **current position**.
- **Make sure to follow the proper syntax when entering the coordinates**. You should place the latitude coordinates first followed by the longitude. Make sure to use capital letters to designate direction and NOT positive and negative numbers. So, you would enter in a position of 44.5 degrees (North) Latitude by -156.3 (West) degrees Longitude, as: **44.5N 156.3W**
- Click on the button at the bottom that says "Look it up." This will bring them to a new screen that will show the distance between the two positions, measured in miles, kilometers and nautical miles.
- Have the students record the distance traveled between the two positions on Handout #4: Faster than a speeding slug
- **LIMITED INTERNET ACCESS STRATEGY**: Again break the students up into groups. While one group is at the computer getting their data the other students can work on a set of word problems on how to calculate the speed of moving objects. When one group is done they can return to their desks while another goes up and accesses the data. They should complete the exercises before they go on to calculate the speed of their actual ship. If groups have been assigned different ship and ship ID Codes then they can each calculate their ship's speed. There are worksheets and practice materials in the "Reference Materials" section.

5. Determining travel time. Have the students look back at Handout #2: Where are earth are you? They should find the time and dates listed next to each set of position coordinates. Have them note and time interval between the **current position** and **previous position #4**. This is the amount of time it took the ship to travel between its previous positions and the current position. Have them record this data on Handout #4: Faster than a speeding slug.
6. Calculating the speed of the ship. Using a basic speed equation [Speed = Distance/Time] students can now calculate the speed of the ship in miles per hour. Have them make this calculation and record their findings on Handout #4: Faster than a speeding slug. If you want you can then have them calculate the speed in kilometers per hour and nautical miles per hour (knots).

Homework Suggestion: Have students exchange ship data with another group OR get data from another ship. Ask them to do the same calculations they did for their first ship for the second.

LESSON #5: Are we there yet?

Performance Objective: Students will determine how far away they are from port and when they will arrive.

Materials:

- Internet access to the World Wide Web via a computer in the classroom or a computer lab
- Handout #5: Are we there yet? (also available in PDF format, Adobe Acrobat plug-in required)
- Individual maps from Lesson #2
- Large wall map

Procedure: The following steps will help you guide your students through the lesson.

1. Prerequisite Knowledge. As with the last lesson, lesson #5 is best done with students who have experience calculating the speed of moving objects and using the speed of an object to determine how long it will take to travel a known distance.
2. Determine how many miles (or kilometers) are left in the voyage. The last step is to determine how much distance they have left to travel in the voyage.
    - From the Lesson #5 web site click on the link to "Distance Calculator".
    - This time enter in the current position on the "From" line and the destination on the "To" line. Students can simply spell out the name of the place they are headed (e.g. San Francisco, CA or Yokohama, Japan) using the syntax indicated on the web site (city, state or city, country for those located outside the U.S.).
    - Once the students click on "Look it up" they will be given the distance between their **current position** and their **destination or port-of-call.**
    - Students should record the remaining distance on Handout #5: Are we there yet?
3. Calculate arrival time. Now that students know how fast the ship is moving and how far away they are from their port-of-call they can estimate how long it will take to reach their destination.
    - Since speed indicates, in this case, how many miles the ship moves each hour and they know how many miles they have to travel we can determine how many hours it will take.
    - Giving students an example can help them understand this concept. One example might be to ask them to picture a student walking to school at 1 Mile per Hour. This means that for each hour the student would walk one mile. If the school was 10 miles away it would take the student 10 hours to reach it. The math of this would look like Time = Distance/Speed = (10 miles)/(1 mph) = 10 hours.
    - Using the same speed equation but just rearrange to solve for time we have the following equation: Time = Distance/Speed. Using this students can determine the number of hours or days left in the voyage.
    - Then by adding this travel time onto the current time they can predict when the ship will arrive in port.
    - Student should record the arrival time on Handout #5: Are we there yet?
4. Solving the problem. The final activity is to have the students put all of the pieces together and solve all of the problems presented in the original problem statement. On Handout #5 have your students complete the final section. They should re-state the problem statement and describe in their own words how they went about solving it. The final portion should be a solution statement outlining the solutions they came up with for the project.

Sample Solution Statement: *After tracking the ship over several time intervals we were able to determine that it is headed to X and is X miles away from the port. Since the ship is traveling at X mph it should take another X hours to get to our destination. This means that we should arrive at approximately X on X.* Student calculations should be shown as well.

Optional Extension Activity: Since this is real time data coming from real ships the only real method for check to see if the student has picked the correct destination and arrival time is to track the ship until it reaches port. If time allows you can have student track the ship each day until they can determine where it docks and the time it took to arrive in port.

LESSON #6: Rain Delay

Performance Objective: Students will determine what the weather conditions are around their ship and decide if the conditions could impact on their voyage.

Materials:

- Internet access to the World Wide Web either via a computer in the classroom or a computer lab
- Handout #6: Rain Delay (also available in PDF format, Adobe Acrobat plug-in required)
- Individual maps from Lesson #2
- Large wall map

Procedure: The following steps will help you guide your students through the lesson.

1. Observing weather satellite images. Students will first view a real time weather satellite image showing cloud cover above the ocean that their ship is located in. Follow these steps:
    - From the Lesson #6 web site click on the link to satellite image which corresponds to the area which the students are studying.
    - Once images load up have students identify areas which they feel represent storms or atmospheric conditions which might present dangers to their ship.
    - In particular, they should note any spiral cloud formations that seem to turn in a counterclockwise direction. These often represent low pressure system and generally produce foul weather.
    - They should note the approximate location of any areas that appear to be storms and mark them on their own maps.
2. Observing effects of atmospheric disturbances on the surface of the ocean. It is often hard to determine what effect a given atmospheric disturbance may be having on the surface of the ocean. The following steps will allow students to determine if a storm that they noted the presence of in step #1 is actually a threat to surface ships.
    - From the Lesson #6 web site click on the link to "Ocean Wave Conditions".
    - This image displays the height of ocean waves in all of the worlds oceans.
    - Use the color-coded key at the bottom of the image to interpret what the colors on the image represent.
    - Have the students identify the regions where they noted the atmospheric disturbance.
    - Have them note any significant surface disturbances which might be the result of the turbulent atmospheric conditions.
    - Any waves of 25 feet or higher would pose a threat to the cargo ships which are being tracked.
3. Drawing conclusions. Hold a class discussion and have the students consider and respond to these questions.
    - Did you see any relationship between where you noted the atmospheric disturbances and the areas of large wave action? If so, what might this be caused by?
    - Do you think that your ship will be effected by the storms?
    - Do you think that you should adjust your arrival time based on the weather observations you have made?
      Would you recommend that the captain change course?