Phenology Garden

Template with guiding questions
Teacher(s) Name                 JJS
Position                                Classroom teacher
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Grade Level(s)                       6
Content Area                         Science / Math Unit

Time line                                1 day developing understanding of biotic /abiotic factors,1 day designing the testable hypothesis and setting up the lab,1 day designing the criteria sheet for observations, 1 day math lesson on circumference and diameter,2 days planning budget and supply order , 1 day constructing the garden, several days gathering data during the bloom season

Science Lesson

Standards

Earth and Space Science, Grades 6–8
Heat Transfer in the Earth System

Explain the relationship among the energy provided by the sun, the global patterns of atmospheric movement, and the temperature differences among water, land, and atmosphere.
Overview (a short summary of the unit including assignment or expected or possible products)

• Formulate a testable hypothesis.
• Design and conduct an experiment specifying variables to be changed, controlled, and measured.
• Select appropriate tools and technology (e.g., calculators, computers, thermometers, meter sticks), and make quantitative observations.
• Present and explain data and findings using multiple representations, including tables, graphs, mathematical and physical models, and demonstrations.
• Draw conclusions based on data or evidence presented in tables or graphs, and make inferences based on patterns or trends in the data.
• Communicate procedures and results using appropriate science and technology terminology.
• Offer explanations of procedures, and critique and revise them.

Essential Questions

Does climate change advance the growing season on Cape Cod?

What will the collected data reveal about the growing season on Cape Cod?

Assessment

This investigation will introduce students to the nature of original research, increase students’ understanding of scientific and technological concepts, and promote skill development in data collection and record keeping.

For the first year of this experiment, the creation of a ‘student generated data table’ will serve as the final product.

In subsequent years, the analysis of the data will be assessed.

Resources

Students will have access to iPAds, and have sufficient training to easily access web sites to gather pertinent data.
These articles discuss the study of phenology as it relates to climate change.

http://neoninc.org/budburst/phenology_climatechange.php

http://www.climatewatch.noaa.gov/image/2012/high-latitude-growing-season-getting-longer

This video is a review of climate change/global warming factors.

http://www.brainpop.com/science/ourfragileenvironment/globalwarming/

**Instructional Plan**

**Preparation**

The unit of study on phenology will come after students have an understanding of the difference between weather and climate, and have had several lessons on weather. A lab on heat transfer will have introduced students to the concept of unequal heating of Earth’s surfaces. Lessons on global warming, fossil fuel use as a current energy source, and alternatives to fossil fuel use will have been delivered.

**Management**

Students will work in the regular classroom in pairs or alone with iPADs. Students will work out of doors while creating the actual garden and taking measurements during the growing season. Specific species have been selected for the garden to coincide with a usual school calendar.
Instruction and Activities

As facilitator, I have presented the problem and set the parameters. A rubric highlighting the criteria for a final draft proposal of a data table is included here.

Tell students that supplies have been provided to allow for the construction of a living experiment. Explain that the garden which is to be constructed will help successive classes of students gather data over the coming years to help determine if the plants in our growth zone are experiencing an acceleration in their growth cycle. Are their bloom dates advancing from year to year. Does that correlate to reported annual average temperatures for our area?

A map of the school grounds including the locations of plants to be studied will be created either on paper or on iPAD.

Using a spreadsheet program, students will design a physical data sheet onto which observations could be made by successive classes of students in future years, including dates of observations, genus and species, common name, plus specific observable criteria.

Students will use field guides such as Peterson's Guides or electronic apps such as Leaf Snap to identify species of plants.

An electronic link will be established so that the data sheet can be accessed from the class blog (Welcome Aboard A-28). This will enable students to access the data sheet via the school wifi network, record their findings, and upload the information to the internet while in the field. (This is possible within a short wifi range at this sixth grade middle school, but it simulates the way scientists go about their work.)

Students will analyze the data collected in the spring of each successive year to see what variables may have caused any observed changes.

Differentiation

Activities will be modified to provide entry points for all learners.

Student artists, photographers, construction engineers, and researchers will be selected based upon interest and learning style.

Listed below are links to Rubistar rubric generator. As the unit is modified to accommodate the special needs of students, these rubrics can be developed. The knowledge of individuals by their teachers will determine the exact criteria for any rubrics.
Closure and Reflection (Will there be a closing event? Will students be asked to reflect upon their work? Will students be asked to provide feedback on the assignment itself? What will be your process for answering the following questions?

- Did students find the lesson meaningful and worth completing?
- In what ways was this lesson effective?
- What went well and why?
- What did not go well and why?

A map of the school grounds including the locations of plants to be studied was completed, as well as a paper / physical data sheet onto which observations could be made. An electronic link was established to the class blog so that students could use an iPAD to collect data and upload to the web, but only is operational when within range of the school wifi network.

Lessons on global warming were delivered. Final outcomes included magnetic “bumper stickers” advertising the ills of fossil fuel consumption, power point presentations, paintings of sources of alternative forms of energy, and students joining a school Green Team.
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Genus / Species</th>
<th>First Bloom Date</th>
<th>Full Bloom Date</th>
<th>Last Petal or Leaf Drop Date</th>
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<tbody>
<tr>
<td>Daffodil Peace garden</td>
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<td>Daffodil “A Wing East”</td>
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<td>Daffodil “A Wing West”</td>
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<td>Hyacinth Peace Garden</td>
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<td>Hyacinth “A Wing East”</td>
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<td>Crocus Peace Garden</td>
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<td>Rhododendron</td>
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<td>Common Lilac</td>
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Standards:

**Apply geometric concepts in modeling situations.**
1. Use geometric shapes, their measures, and their properties to describe objects.

**Find arc lengths and areas of sectors of circles.**
5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius.

**Understand ratio concepts and use ratio reasoning to solve problems**
Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Overview

Students will calculate the amount of materials needed to construct a phenology garden in the shape of a circle with a 10 foot diameter, and a peace sign imbedded within.

**Essential Questions** (What essential question or learning are you addressing? What would students care or want to know about the topic? What are some questions to get students thinking about the topic or generate interest about the topic? What questions can you ask students to help them focus on important aspects of the topic? What background or prior knowledge will you expect students to bring to this topic and build on?)

What is the relationship between circumference and diameter?
What is the relationship between circumference and ratio?
What is the relationship of the circumference to the diameter in the actual project?
How accurate were the measurements during construction of the garden?
What is the area of the interior of the garden?
What is the budget for the construction of the phenology garden?
**Assessment** (What will students do or produce to illustrate their learning? What can students do to generate new knowledge? How will you assess how students are progressing (formative assessment)? How will you assess what they produce or do? How will you differentiate products?)

Students will solve problems related to circumference, diameter, and area as they create a plan to build a phenology garden.

**Resources** (How does technology support student learning? What digital tools, and resources—online student tools, research sites, student handouts, tools, tutorials, templates, assessment rubrics, etc—help elucidate or explain the content or allow students to interact with the content? What previous technology skills should students have to complete this project?)

In science class, students have previously studied climate change, global warming, and greenhouse effect.

**Instructional Plan**

**Preparation** (What student needs, interests, and prior learning provide a foundation for this lesson? How can you find out if students have this foundation? What difficulties might students have?)

Students' knowledge of multiplying with decimals has been pretested. Instruction/remediation has been delivered. Post tests have been administered.

**Management** (How and where will your students work? Classroom, lab, groups, etc?)

Students will work in the regular classroom in pairs or alone with iPADS.

**Instruction and Activities** (What instructional strategies will you use with this lesson? How will your learning environment support these activities? What is your role? What are the students' roles in the lesson? How can the technology support your teaching? What engaged and worthwhile learning activities and tasks will your students complete? How will they build knowledge and skills? Will students be expected to collaborate with each other and others? How will you facilitate the collaboration?)

Students will work with manipulatives to find a connection/correlation between circumference and diameter. Students will measure and then enter onto a table the circumference of 8-10 random cylindrical objects and their diameters. Divide circumference by the diameter using a calculator and record results. Determine any patterns.
Students will be given the formula for finding the circumference of a circle. Students will then try again to measure the circumference and diameter more accurately trying to get to pi. Students will practice finding circumference and diameter using the [http://www.ixl.com/math/grade-6](http://www.ixl.com/math/grade-6) website (Z 20 -Z 28 section). Students will calculate the actual circumference of the garden using 10 feet as the diameter. Students will be provided with the MA DESE approved formula card. The guidelines for the garden will be presented stating that the garden is to be 10 feet in diameter, with a peace sign and the perimeter made of fieldstone, soil to be 6 inches in depth, covered by 2 inches of mulch, to include 450 daffodil bulbs at a rate of approximately 5-6 bulbs per square foot, over a fabric weed block. Students will design on paper the layout of the garden and calculate the supply needs. Students will access the local Agway website and begin to develop a budget for the garden as specified above; stone perimeter, stone peace sign imbedded in the circle, soil compost mulch, bulbs, shovels, gloves and weed reducing fabric.

**Differentiation**

Various jobs will be assigned according to student learning styles and required accommodations. Selected students will have their circumference / diameter problems simplified.

**Closure and Reflection**

The students will construct the garden. Measurements will be taken to determine how effective their planning was. Are there extra materials? Was the requested bulb density met?

The garden was begun at 12:12 on 12/12/12. The garden was completed on 12/14/12. Small groups of 15:1 were manageable. Aides provided additional support for larger classes. Introducing the student jobs indoors before going out was a good idea. Students assumed their roles as perimeter setters, soil managers, civil engineers, planters, fertilizers, photographers, and recorders. The day was a perfect day for the physical activity at hand with a clear sky, light wind and a temperature of 45 degrees. The outdoor hands on experience coordinated nicely with the previous indoor math lessons.