

Web Unit Plan

Title: Wave of Spring

Description: Students anticipate and track the arrival of spring as they plant tulip bulbs and share observations about growth milestones with other student gardeners throughout the Northern Hemisphere.

At a Glance

Grade Level: 3–5

Subject sort (for Web site index): Science, Math, Social Studies

Subjects: Life Science, Data Analysis, Geography

Topics: Botany, World Geography

Higher-Order Thinking Skills: Predicting, Making Inferences, Drawing Conclusions

Key Learnings: Geographical Concepts, Data Collection and Analysis, Plant Life Cycle and Anatomy, Scientific Drawing

Time Needed: 2 weeks, 45-minute lessons, 3 times per week; 7 months of observation

Background: [Odyssey Story](#) from the classroom in California, United States

Unit Summary

Students track the arrival of spring by growing tulips and sharing their experiences with other tulip-growing classes spanning the Northern Hemisphere. Each participating class collects and posts plant growth data on the Internet. Student groups pair up with buddy classes and share specific tulip growing information through the Internet and e-mail. When students study the emerging data, they begin to see how seasonal climatic factors influence plant growth, and they make predictions about bloom times in the different latitudes. They make specific predictions about bloom dates in comparison with their buddy class and share their findings in a slideshow presentation.

Curriculum-Framing Questions

- **Essential Question**

What changes do you see?

- **Unit Questions**

How are locations affected differently by seasonal changes?

How do seasons affect the way flowers grow?

- **Content Questions**

How do the different parts of a tulip bulb contribute to its growth?

What conditions are needed for growing flowers?

How do seasonal changes in day length affect plant growth?

Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Wave of Spring Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Before Instruction

Visit the [Journey North Web site](#)* and read through the “About This Study” section where students track the blooming of tulips to determine the arrival of spring across the Northern Hemisphere. To participate in the Journey North International Science Project, register your class at this site. Examine all of the site resources. Plan to start the project in fall near bulb-planting time. Your class and all participating classrooms will study and plant Red Emperor tulips. You can find bulb purchasing information on the Journey North Web site.

Create simple plant logs for students to record planting data, observations and reflections, investigation processes, sketches, notes from discussions or films, and answers to essay questions. These logs serve as the basis for assessing content understanding.

Set up buddy classes for each group of students you will have. You can find and contact participating classes through the Journey North Web site. Look to set up a partnership with classes that reside in different time zones so that students may experience optimal learning.

Lastly, set up a *Visual Ranking Tool* project. Go to the Interactive Thinking Tools *Teacher Workspace* on the [Visual Ranking](#) Web site. Create a project where students will list original Journey North garden sites in order of bloom times. This list of garden sites can be found on the Journey North Web site.

Introducing the Project and Using the Visual Ranking Tool (1-2 periods)

Begin the unit by leading a class discussion focused on the Essential Question, *What changes do you see?* Relate the topic to changes students would see in their everyday lives, the weather, the environment, and eventually characteristics of each season. To determine students’ prior knowledge about scientific experimentation, ask them to brainstorm what scientists do when they work. Use this information to help you as you guide students through the investigation process during this project.

Collect vocabulary words from the discussion on the blackboard, creating a word bank for students to use during later writing activities. Next, place students in small groups and show them the [online data table and map](#)* of 13 tulip gardens where gardeners have been planting tulips and collecting data for several years. Direct their attention to the corresponding [tulip garden prediction worksheet](#). Supply students with atlases and have them match each dot on the worksheet map with their list of official tulip gardens.

Pose the following Unit Question, *How are locations affected differently by seasonal changes?* Discuss the garden site locations. Encourage students to share any prior knowledge they have about the climate in the locations. Pose the second Unit Question to the entire class to assess students’ prior knowledge, *How do seasons affect the way flowers grow?* Have students share with their groups their initial thinking about the order in which the garden sites will come into bloom.

In their small groups, allow students to use the *Visual Ranking Tool* to place the garden site locations in the order in which the gardens will come into bloom. Students make informed first predictions about bloom dates, and, to aid their thinking, they can study [UNYSIS online climatic information](#)*. After groups organize

their lists and insert their reasons, have groups compare their lists with other groups' lists in the class. Check student reasons in the tool and take anecdotal observations on students' prediction strategies to determine what scientific inquiry skills need to be addressed in instruction.

As a class, discuss the factors and reasoning that led students to make their predictions, emphasizing clear scientific thinking skills. Seek consensus on a class prediction, and post the class prediction for later reference. This information will be useful to students when they make their predictions in comparison to their buddy classes.

At this time, introduce groups to their buddy classes. Use a map to show students the location of the buddy classes and discuss each buddy class's location in relation to your students' location. Explain to students that they will track the changes they see while growing their tulips and compare their findings to a buddy class's tulip growing. Students use this information to track the coming of spring and present their comparisons in their slideshow presentations in the spring. Because each group has a different buddy class in a different location, the groups will have unique comparisons and notice different changes.

Studying Tulip Bulbs (1-2 periods)

Several days prior to planting, distribute project logs. Show the class a tulip bulb and then pose the Content Question, *How do the different parts of a tulip bulb contribute to its growth?* Have students do a Think-Pair-Share on the question and discuss ideas as a class. Have them record their initial ideas in their project logs. Students use the logs to keep a record as they examine and draw their tulip bulbs and make predictions about how characteristics of individual bulbs might affect growth. They use the log to keep a running record of what changes they see. Tell students that they will use the information to help them make predictions. Check the logs frequently to assess their ability to make good predictions. Use the [observation checklist](#) to monitor student thinking and provide feedback about observations, as well as to assess scientific drawing skills. Address any misconceptions or problems in formal and informal conferences periodically throughout the unit.

Provide one whole Red Emperor tulip bulb and one half of a bulb for each student. Have students examine the bulbs and try to make guesses about which parts of the bulb serve which purpose. Then, hand out the [tulip sketches sheet](#) and allow students to compare the parts of their bulbs with the picture. Explain to students the importance of accuracy and neatness in scientific drawings, providing instruction in the skills they will need to make good drawings. Have students sketch the external and internal structures of the tulip bulb and label the visible parts, using the diagram on the [tulip sketches sheet](#) for reference. (See the [student sample sketches](#).) Have students draw a T-chart graphic organizer in their logs to record each bulb part and describe the function it performs. Use the T-charts to assess students' developing knowledge about the parts of the bulb.

At the end of the session, again pose the Content Question, *How do the different parts of a tulip bulb contribute to its growth?* Ask students to consider whether the size or shape of the bulb might influence bloom times and what kind of observations might be useful to note before planting their bulbs. Have students explain their reasoning and record their answers in their project logs.

Planting the Tulips for Journey North (2-3 periods, then ongoing)

Pose the next Content Question, *What conditions are needed for growing flowers?* Discuss with the whole class. Wild tulips originated in the mountains of Turkey and were cultivated in The Netherlands. Discuss why planting depth is important in cold climates, and why tulip bulbs need to be chilled before planting in areas with mild winters. Demonstrate how to prepare soil and plant bulbs. Introduce the project. Before students begin to work, present the [skills rubric](#) and the [collaboration self-assessment](#). Tell them to use these two documents to set individual and group goals for working together to complete the project successfully. They should also refer to the rubric and assessment throughout the project to make sure they are meeting the expectations of the project.

For the project, have students complete the following activities:

- Prepare soil by loosening and adding additives, such as bonemeal.
- Plant the tulip bulbs and mark each bulb's location in the planting bed.
- Measure the temperature and submit class planting data to the [Journey North database](#)*.
- Record the following planting information in their logs (students will need this specific information for their slideshows):
 - Date
 - Local latitude and longitude
 - Temperature
 - Planting depth
 - Soil conditions
 - Day length
- Encourage students to reference calendars and maps to formulate predictions about when their tulips will emerge and bloom. Have students record their predictions and explain their reasoning in their logs. For example, I predict my tulip bulb will emerge on ____ (date) because ____ (bulb package indicated this many days).
- Have students formulate predictions about when their buddy class's tulips will emerge and bloom, and make a prediction about whose will bloom first. Remind students that their initial predictions may change as they gather more information.
- Examine planting data from other tulip gardens and look for trends in the data. (*Where are the gardens located that planted earliest? Which gardens are last to plant?*)
- Direct students to pay special attention to the information posted by their buddy class and to e-mail them questions or comments when necessary. Have students record their findings in their logs. They will need this information for their slideshow presentations.

As students work through this process, conduct anecdotal observations on their collaboration skills. Give groups the [conference preparation guide](#) to help them prepare for a teacher-group conference. Question students frequently to monitor their thinking process and findings. Use the information from your notes and these sessions to plan instruction throughout the project to address any problems you notice.

Monitoring Day Length (1 period, then ongoing)

Pose the following Content Question, *How do seasonal changes in day length affect plant growth?* Have student teams track changing day lengths for the different

garden locations. Data can be found in daily newspapers or online at the U.S. Naval Observatory's [Complete Sun and Moon Data for One Day](#)*.

Have students record daily sunrise and sunset data into the [sun and moon spreadsheet](#).

Ask students to examine their data and look for patterns in the spreadsheet table and write down their observations in their logs.

Show students how to create a graph of their data using the chart function of the spreadsheet software. Use the [graph instructions](#) and the [sun and moon sample](#) to help guide the creation of the sample graph. Ask students to follow the same procedure to create graphs of the other garden locations.

Analyzing the Sun and Moon Data

Using the data and charts, have students analyze and compare the graphs to what they noticed when analyzing the spreadsheets. Students will discover that day length is relative to latitude. As garden sites begin posting plant growth milestones, have students gauge whether changes in day length correspond to plant growth at the different sites. Tell students to record their observations and conclusions in their logs.

Collecting and Analyzing the Tulip Garden Data from Journey North (ongoing)

As spring arrives, tulips at lower latitudes begin to emerge and bloom, and at each milestone, classes post their geographic coordinates on the [Journey North sightings Web site](#)*. Print the data from the Web site and distribute it to students, or have them access the data directly. Provide instruction on looking for trends and patterns in data, and ask students to look for trends in the data and complete the following tasks:

- Add colored dots to a large class map to represent the data reported by the gardens each week—a green dot for emerging leaves and a red dot for blooming tulips.
 - Compare the maps to the weekly maps posted at the Journey North Web site.
 - Print and post weekly online maps so the emerging sequence is visible.
- Discuss any trends in the data, and have students make predictions about the data that may be reported the following week.

At this time, again pose the Essential Question, *What changes do you see?* Discuss the moving wave of spring frequently, and have students make inferences about geographic factors that may influence the growth of tulips. Have students record their observations and inferences in their logs.

Collecting and Analyzing Project Bulbs and Investigation Bulbs (ongoing)

When the first leaves emerge, have students begin making regular observations and sketches of their plants in their logs. Have them refer to earlier entries to compare past predictions, and encourage them to make thoughtful revisions in those predictions. For example (after the first class plant emerges), I predicted my tulip bulb would emerge on ____ (date) because ____ (the bulb package indicated this many days). My revised emerging prediction is ____ (date) because ____ (the first bulb in our garden emerged). Students will be including this information in their slideshow presentations along with the information they have recorded in their logs and collected from their buddy classes.

Creating a Slideshow

Tell the class that they are going to create slideshow presentations that answer the following Essential, Unit, and Content Questions:

- *What changes do you see?*
- *How are locations affected differently by seasonal changes?*
- *How do seasons affect the way flowers grow?*
- *How do the different parts of a tulip bulb contribute to its growth?*
- *What conditions are needed for growing flowers?*
- *How do seasonal changes in day length affect plant growth?*

Student groups use information from their buddy class, information they have collected in their logs, and information from the Journey North Web site to create a slideshow that illustrates the changes they saw (see attached [slideshow example](#)). Students will address the Essential Question, *What changes do you see?* in relation to tulip growth and seasonal changes. Pass out the [slideshow scoring guide](#) to go over project expectations. Check for understanding and give students ample time to complete the assignment. Make sure students refer to the slideshow scoring guide while completing the assignment. Guide and assist students as needed. Invite another class, parents, and any other school faculty to view the slideshow presentations. When students have completed the presentation, ask them to use the [skills rubric](#) and the [collaboration self-assessment](#) to reflect on their learning and collaboration throughout the project

Small Group Slideshow Presentation Requirements

Inform groups that each slideshow should include the following seven slides:

- Title slide
- Slide that shows the group's predictions
- Slide that compares information between the group's city and their buddy class's city, including but not limited to latitude and longitude, average spring day length, average spring temperature, and the months spring begins
- Slide that lists planting conditions, including date, temperature, planting depth, soil conditions, and day length
- Slide that reports what happened in the tulip growing investigation
- Slide that reports the results of predictions with an explanation
- Slide that addresses the Essential Question, *What changes do you see?*

Wrapping Up

To check for understanding, hold a post-unit class discussion. Allow students to revisit the *Visual Ranking* lists that they created at the beginning of the unit along with the class prediction. Have them revise their *Visual Ranking* lists based on the changes they have seen. Discuss the class prediction as well, and revise if necessary. Pose the Essential Question again, *What changes do you see?* Ask for specific examples from the tulip investigation to support their answers to the Essential Question. As a final reflection, have students write an essay about what they learned about tulip growth, the coming of spring, the changes they saw, and how scientists

investigate the world around them. E-mail the essays to the students' buddy classes. Tell each student to choose a favorite slide to print and include in their portfolio next to the reflective essay.

Prerequisite Skills

- Have students practice using compass directions for several weeks before starting the unit. Ask students to use a compass to find north, south, east, and west in the classroom, and post signs. Find everyday opportunities to use compass directions within the classroom, such as asking the northern person in each group to collect the homework or directing students to pick up a new worksheet on the southwest counter.
- Use textbooks, maps, and globes to teach or review relevant geographical terms and concepts, such as equator, North Pole, South Pole, prime meridian, hemisphere, lines of latitude and longitude, and coordinates.
- Build student awareness of temperature fluctuations by taking daily early morning and mid-afternoon temperature readings for a week. Show students how to record temperatures on line graphs and discuss patterns.
- Ensure that students are familiar with computers and have experience using e-mail and presentation software.

Differentiated Instruction

Resource Student

- Pre-teach vocabulary and provide a list of vocabulary with simple definitions
- During every class discussion, add vocabulary words to a word bank on the blackboard
- Work with a resource specialist to provide support in areas of need, perhaps with writing the investigation report or mastering latitude and longitude
- Set expectations for cooperative work so that all group members are engaged and their contributions valued

Gifted Student

- Encourage the student to try a parallel investigation with a bulb from a different plant species
- Provide access to scientific botanical drawings and encourage the student to complete additional drawings of tulip growth or other plants
- Have the student address the more difficult tulip challenge questions posted weekly on the Journey North Web site (see [Journey North challenge questions](#)*)

English Language Learners

- Pre-teach vocabulary with picture books about plants and gardening
- Provide a list of vocabulary with simple definitions and pictures
- During every class discussion, add vocabulary words to a word bank on the blackboard
- Use first language tutors during the latitude and longitude lessons

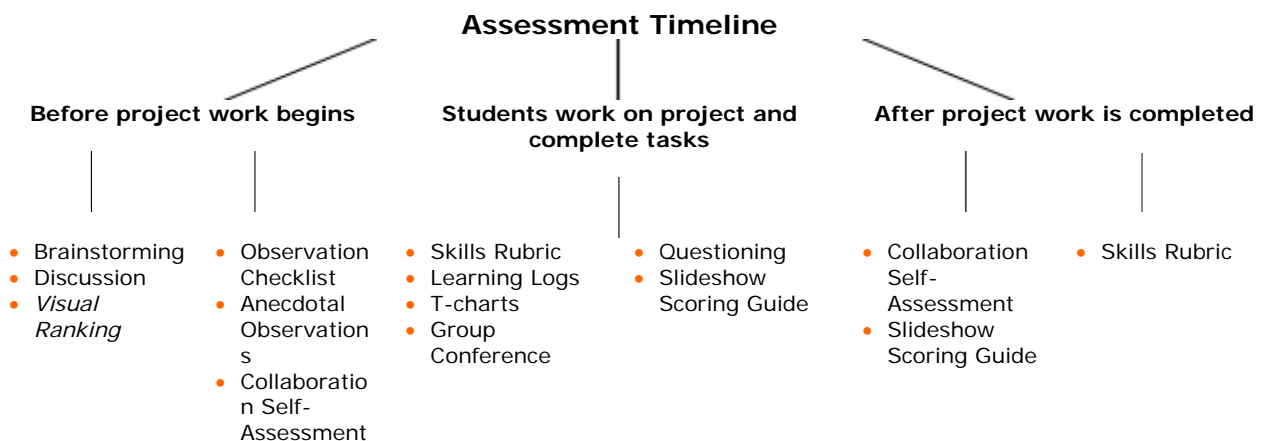
- When possible, group the student with bilingual student

Credits

Lucinda Surber is a fourth-grade teacher at Barron Park Elementary School in Palo Alto, California. Visit the Room 17 Class Web site www.lucinda.net/surber*. Her class was featured in *An Innovation Odyssey*, a collection of stories of technology in the classroom, Story 268: [The Wave of Spring](#).

Things You Need (Highlight box)

Assessment Plan



To determine students' prior knowledge of plant growth and the scientific inquiry process, conduct a brainstorming session, recording students' responses. Note discussion responses to assess students' prior knowledge about the climates around the world and the relationship between seasons and plant growth.

As students complete the *Visual Ranking* activity, note the reasons they enter for their ranking and take anecdotal observations on their thinking strategies. Before students begin the project, present the [skills rubric](#) and the [collaboration self-assessment](#). Tell them to use these two documents to use what they learn to set individual goals and to set goals as a group for how they will work together to complete the project successfully.

While students use their logs to record their data, drawings, and thinking, check the logs frequently to monitor students' scientific inquiry skills, thinking processes, and understanding of plant growth and seasons. Regularly check the T-charts recorded in student logs to assess students' developing knowledge. The [observation checklist](#) and anecdotal observations describe how students are thinking and what they are learning as they plant and record data about their tulips and receive information about their buddies' tulips. A [conference preparation guide](#) helps students prepare for a teacher-group conference during the project. This conference provides information about student progress and understanding, as does frequent individual and group questioning throughout the unit. As students synthesize what they have learned to produce a slideshow presentation, they use the [slideshow scoring guide](#) to guide their work. When the slideshow is completed, students fill out a [collaboration self-assessment](#) looking back on how well they worked with the group throughout

the project. After their rankings in *Visual Ranking* are revisited at the end of the unit, students use the [skills rubric](#) to assess their learning.

Targeted Content Standards and Benchmarks

California State Content Standards

Science Standards, Grade 4

Science Standards

Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations.

- Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- Formulate and justify predictions based on cause-and-effect relationships.
- Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.

Life Science

- Understand that all organisms need energy and matter to live and grow.
- Recognize that living organisms depend on one another and their environment for survival. In a particular environment, some kinds of plants survive well, some survive less well, and some cannot survive at all.

Math Standards

Statistics, Data Analysis, and Probability

Students organize, represent, and interpret numerical and categorical data, and clearly communicate their findings.

- Identify the mode(s) for sets of categorical data and the mode(s), median, and any apparent outliers for numerical data sets.
- Interpret one- and two-variable data graphs to answer questions about a situation.

Mathematical Reasoning

Students make decisions about how to approach problems.

- Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

National Council of Teachers of Mathematics Curriculum Focal Points and Connections

As of 2006, the National Council of Teachers of Mathematics (NCTM) released math curriculum focal points to describe an approach to curriculum development. The approach focuses on areas of emphasis in each grade from prekindergarten through

grade 8. ([Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics*](#))

This Unit Plan meets the following curriculum focal points and connections:

Focal Points

- Grade 4: Measurement: Developing an understanding of area and determining the areas of 2-dimensional shapes
- Grade 5: Geometry, Measurement and Algebra: Describing 3-dimensional shapes and analyzing their properties, including volume and surface area

Connections

- Grade 3: Data Analysis: Construct and analyze frequency tables, bar graphs, picture graphs, and line plots and use them to solve problems
- Grade 4: Data Analysis: Continue solving problems using frequency tables, bar graphs, picture graphs, and line plots. Develop and use stem-and-leaf plots.
- Grade 5: Data Analysis: Analyze double-bar and line graphs and use ordered pairs on coordinate grids

Social Studies Standards

Students demonstrate an understanding of the physical and human geographic features that define places and regions in California.

- Explain and use the coordinate grid system of latitude and longitude to determine locations of places in California and on Earth.
- Distinguish between the North Pole and South Pole, the equator and the prime meridian, and the hemispheres, using coordinates to plot locations.

Student Objectives

Students will be able to:

- Understand why climate and seasons differ across latitudes and change over time
- Use latitude and longitude coordinates to find locations
- Understand how climate and seasons affect plant growth
- Learn the basics of scientific illustration
- Collect, organize, display, and analyze data
- Plan and carry out an investigation to test a hypothesis
- Analyze trends in data to refine predictions
- Develop and deliver a presentation based on investigation

Materials and Resources

Printed Materials

- Atlases used for locating latitude and longitude
- Maps of the Northern Hemisphere for locating buddy classes and other participating classes

Supplies

- Red Emperor tulip bulbs (one per student for planting, and one per group for dissection)
- Thermometer for measuring outside temperature

- Bulb planter for growing tulips
- Colored pencils or crayons for realistic shading on scientific sketches
- Large map of North America for class monitoring of tulip data
- Garden catalogs with pictures of tulips for ELL students and others

Internet Resources

- Journey North
www.learner.org/jnorth*
To receive weekly e-mail updates and participate in the online database, register your class at this site
- Journey North Tulip Data
www.learner.org/jnorth/fall2003/tulip*
Anyone can access the online data on the Journey North Tulip page
- U.S. Naval Observatory's Complete Sun and Moon Data for One Day
http://aa.usno.navy.mil/data/docs/RS_OneDay.html*
Displays information about changing day lengths in different locations
- A Rambling Romp through Tulip History
www.bulb.com*
Offers a brief history of the origin of the modern tulip
- UNISYS Online Climatic Information
http://weather.unisys.com/surface/sfc_con_temp.html*
Shows current temperature and weather conditions throughout the United States
- *Visual Ranking Tool*
www.intel.com/education/visualranking
To set up a *Visual Ranking* project for your class

Other Resources

Technology—Hardware

- Computer with Internet connection for access to Journey North Web site and research
- Color printer for weekly tulip maps
- Connection to TV monitor for group discussion of the tulip data maps

Technology—Software

- Web browser for Internet research
- E-mail software to correspond with buddy classes
- Presentation software for creating and presenting slideshows