SUMMER 2002 TEACH GRANT ACADEMY
Debra Peck
Mequon Thiensville School District

Project Title: The C.E.R.E.S Project: Clouds and the Earth's Radiant Energy System

Grade Level: 11-12 (Can easily be adapted to lower grades)

LoTI Level: 4a

Content: Meteorology-Atmosphere and Clouds, Space Science-Satellites

Context/Abstract

Students will participate in a NASA research project through the Langley Research Center in Hampton, Virginia, entitled **S'COOL**, which stands for Student's Cloud Observations On-Line. The students will become familiar with the background and goals of the C.E.R.E.S. (Clouds and the Earth's Radiant Energy System) instrument system that is flying on the Terra satellite. After becoming proficient at identifying cloud types and altitude, relevant ground and weather conditions, they will provide ground truth measurements to help validate the information gathered by the satellite as it passes overhead. They will then accurately report their observations on-line.

Learner Outcomes/Standards

Learner Outcomes

Students will…

1. Present to the class with the help of a partner and using a graphic on an overhead transparency one of the following introductory topics: Climate Change, Role of Clouds, Measuring Energy from Space, The Earth Radiation Budget Experiment, C.E.R.E.S., Earth Observing Satellites, Ground Truth.
2. Actively participate in presentations by taking notes on topics prepared by classmates.
3. Prepare a Cloud Chart by importing images and text from appropriate web sites into an Inspiration document.
4. Accurately identify cloud types and altitudes after practicing with slides, videodisk images, an on-line quiz, and actual in-class observations.
5. Use local weather data and personal observations to gather current surface condition information.
6. Become familiar with Universal time conversions used in the satellite overpass schedule.
7. Communicate observations on-line using the required format.

Technology Standards

A.8.1 Use common media and technology terminology and equipment
A.8.2 Identify and use common media formats
A.8.3 Use a computer and productivity software to organize and create information
A.8.4 Use a computer and communications software to access and transmit information
A.8.5 Use media and technology to create and present information
B.8.2 Develop information seeking strategies
B.8.4 Evaluate and select information from a variety of print, nonprint, and electronic formats
B.8.5 Record and organize information
B.8.6 Interpret and use information to solve the problem or answer the question
D.12.1 Participate productively in workgroups or other collaborative learning environments

Science Standards

A.8.5 Show how models and explanations, based on systems, were changed as new evidence accumulated
B.8.1 Describe how scientific knowledge and concepts have changed over time in the earth and space, life and environmental, and physical sciences
B.8.3 Explain how the general rules of science apply to the development and use of evidence in science investigations, model-making, and applications
B.8.5 Explain ways in which science knowledge is shared, checked, and extended, and show how these processes change over time
B.12.4 show how basic research and applied research contribute to new discoveries, inventions, and applications
C.8.8 Use computer software and other technologies to organize, process, and present their data
C.8.10 Discuss the importance of their results and implications of their work with peers, teachers, and other adults
C.12.3 Evaluate the data collected during an investigation, critique the data collection procedures and results, and suggest ways to make any needed improvements
D.8.9 Explain the behaviors of various forms of energy by using the models of energy transmission, both in the laboratory and in real life situations in the outside world
D.12.11 Using the science themes, explain common occurrences in the physical world
E.4.5 Describe the weather commonly found in Wisconsin in terms of clouds, temperature, humidity, and forms of precipitation, and the changes that occur over time, including seasonal changes
E.8.1 Using the science themes, explain and predict changes in major features of land, water, and atmospheric systems

E.12.1 Using the science themes, distinguish between internal energies and external energies in the earth's systems and show how these sources of energy have an impact on those systems
G.8.7 Show evidence of how science and technology are interdependent, using some examples drawn from personally conducted investigations

Assessment

The students will be given the following handout at the beginning of the project as an introductory and organizational tool:

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Name________________________
Hour ____ Date ________________

The C.E.R.E.S. Project

Clouds and the Earth's Radiant Energy System

N.A.S.A.'s Langley Research Center

Part 1: Introduction

(5pt) In a group, preview and present one of the segments of the introduction.

(5pt) Briefly summarize the main points of each presentation.

1) The Big Question: Climate Change

2) One Big Variable: The Role of Clouds

3) Measuring Clouds and Energy from Space

4) 1980's: ERBE

5) 1990's and Beyond: CERES

6) A Little Bit About Satellites

7) The Need for Ground Truth

Part 2: Cloud Charts

(16pt) Create a cloud chart, using Inspiration, that contains illustrations and information to help you identify by name and altitude each of the 11 cloud types on the report form. Organize your chart into three groups by altitude: low, mid, and high level clouds. Import your information from the following sites.

For illustrations use:

http://asd-www.larc.nasa.gov/SCOOL/cldchart.html

For facts and descriptions use:

http://www.weather.com/glossary/

Part 3: Observation and Reporting

(10pt) Demonstrate mastery of cloud identification.

(10pt) Become familiar with the reporting protocol and participate independently in the gathering of data to provide ground truth information for the project.

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Teacher feedback will be a continuous component in each of the steps of the project. Peer support in completing the technical requirements will be encouraged. The rubrics below will be used as each step is completed for grading purposes.

Grading Rubrics for the three components

<u>Part 1 Introduction Presentation (5pt)</u>

1 0 Participates equally in the presentation
2 1 0 Completely explains topic in understandable language
2 1 0 Uses the overhead transparency correctly to complement oral presentation

<u>Part 1 Introduction Summarizations (5pt)</u>

5 3 0 Main points of each presentation are completely recorded

<u>Part 2 Cloud Charts (16pt)</u>

3 0 Clouds are correctly grouped according to altitudes
3 0 Inspiration links are logically and correctly placed
5 3 0 Cloud images are correctly imported into Inspiration document
5 3 0 Descriptive text is correctly imported into Inspiration document

Part 3 Cloud Observation and Identification (10pt)

10 8 6 Correctly uses cloud chart to accurately identify cloud types and altitude on
assigned observing day

Part 3 Reporting (10pt)

3 0 Reports to observation area at the correct time
7 5 3 Independently gathers and reports data

Tools

1. To register for the project and find all supporting information and materials go to:

http://asd-www.larc.nasa.gov/SCOOL/particip.html

2. Inspiration 6.0

3. Cloud slides or other cloud images to practice identification

4. Introductory topics and images for overhead transparencies are found at:

http://asd-www.larc.nasa.gov/SCOOL/whyback.html

5. The on-line cloud quiz is at: http://www.ncdc.noaa.gov/jmdocs/clouds.html

6. Cloud images can be imported from:

http://asdwww.larc.nasa.gov/SCOOL/cldchart.html

7. Cloud facts and descriptions can be imported from:

http://www.weather.com/glossary/

8. Report forms

9. Overpass schedule

Tasks/Products

After registering with the S'COOL project out of NASA's Langley Research Center at the web address given in the previous section the following schedule will be implemented:

Day 1

Small groups will be assigned one of seven introductory topics to present to the class. After 15 minutes to become familiar with their subject matter and plan their strategy, each of the groups will present their information to the rest of the class who are responsible for taking notes on the major points.

Day 2

In the computer lab the teacher will introduce and demonstrate the basic directions for using Inspiration to create a cloud chart. The students will start designing their chart and importing images and information.

Day 3

The students will finish and print their cloud charts.

Day 4

Teacher will introduce the report form. The students, using their cloud charts, will practice making observations and practice completing the form using actual data.

Day 5 (15 minutes)

The students will practice making cloud identifications from slides presented by the teacher. The class will then practice making real observations, completing the report form from actual data.

Day 6 (15 minutes)

The students will practice making cloud identifications from videodisk images presented by the teacher. The class will then practice making real observation, completing the report form from actual data.

Day 7 (15 minutes)

The students will practice their skills by completing an on-line cloud identification quiz. The class will then practice making observations as a group for the last time before being assigned a partner and an observation date by the teacher based on the Terra satellite overpass schedule.

Day 8 – 30

Students in pairs independently observe, gather surface data, and report information on-line to the S'COOL project. The teacher consults with students responsible for each day's observations and provides access to needed meteorological data.

Differentiation

Different learning needs are provided for at many points and in many ways throughout this project. Students work at different times individually, with one partner, in small groups and as a whole class. They read, synthesize, present, organize, record and report new information from conventional sources and actual data that they gather and generate themselves. They access web sites to gather virtual information and go outside to observe live and in person, rain or shine. They participate in supervised classroom settings and function independently to match the satellite overpass schedule. The variety of activities and the authenticity of the research being conducted provides a validity that appeals to the vast majority of students.