

MULTI STEM Spring 2019 GLOBE Weather Stations

Auraria

JANELLE JOHNSON DEC 11, 2018 12:27PM

Introductions

SHANNON RIVERS, THE GLOBE PROGRAM JAN 26, 2019 08:21AM

Please introduce yourself!

- Name
- School & Grade
- Preservice or inservice
- New to MULTI?
- Do you or have you used weather or weather stations in your teaching?
- Describe your focal students

Hi! My name is Tara Kimmey and I am a middle school science teacher at Colorado STEM Academy! We have a weather station at my school; but I don't implement its uses. I want to work more towards how I can use it for my Weather Units.

— TARA KIMMEY

Years ago I use weather stations. Loved them, and would like to integrate them back into my class.

— TONY BULLOCK

Hi, I'm Emily Heinrich and I am a 6th grade science teacher at Discovery Canyon Middle School in Colorado Springs. I have not used a weather station, yet. We are in the process of acquiring a weather station for us through our work with GLOBE and MESO. My focal students are both girls and boys who have not experienced science in action in the past and see science as a class where they read from the textbook and complete worksheets.

— EMILY HEINRICH

Tony Bullock Gateway High School 9-11 grade

— TONY BULLOCK

JANELLE JOHNSON DEC 11, 2018 12:27PM

Our definition of STEM

From Outlier Research: "In all cases, it is clear that some of the most valued components of STEM schools are not STEM-discipline specific, but relate to broader, transferrable, lifelong skills...Educational philosophers such as Dewey, Piaget, Vygotsky, and Bruner have advocated for inquiry and constructivist approaches for over a century. They argued

for student autonomy, relevance, collaboration with peers, and learning-by-doing."

JANELLE JOHNSON DEC 11, 2018 12:27PM

MULTI

Funded by NSF

Community based approach--Check out FB and Twitter!

Focus on teacher PD to more effectively engage underserved students

Earth systems science based learning activities--GLOBE (Global Learning & Observations to Benefit the Environment) Workshops & research on implementation

Our research: STEM content, 21st century skills, career pathways

Questions about follow up?

MULTI

A MULTI Approach to Engaging Students and Teachers in Effective STEM Education

MSUDENVER



The GLOBE (Global Learning and Observations to Benefit the Environment) program is focused on finding the impact education has on the Earth's surface temperature and how the surface temperature changes the dynamics of the Earth's atmosphere. Studying the weather cycle is fundamental to understanding how the Earth's systems function within its system. The surface temperature measurements contribute to the global climate model and the understanding of the Earth's system.

JANELLE JOHNSON JAN 18, 2019 11:33AM

GLOBE Student Research

View and upload Student Research Reports, as well as find Resources for Students and Teachers

Student Research Reports - GLOBE.gov

Check out student research reports from around the world! Would you like to have your report added? Click on the graphic to the right to submit your report. Please note that projects can be uploaded in any language!

GLOBE



SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 11:36AM

GLOBE International Virtual Science Symposia

2019 IVSS is accepting reports **NOW** through **April 10!**

2019 International Virtual Science Symposium - GLOBE.gov

Dr. Julie Malmberg from the GLOBE Implementation Office hosted an informational webinar about the 2019 GLOBE International Virtual Science Symposium on Thursday, 25 October 2018. The webinar featured an overview of the IVSS and information about the newly updated virtual badges.

GLOBE

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GLOBE Mission Mosquito campaign

Mission Mosquito - GLOBE.gov

The goal of GLOBE Mission Mosquito is to create an organized citizen science community - primarily through formal education, with targeted outreach to informal education - that will conduct and report local observations using the GLOBE Observer Mosquito Habitat Mapper (GO MHM).

GLOBE

JANELLE JOHNSON JAN 18, 2019 11:37AM

GLOBE Urban Heat Island Effect campaign

UHIE-Surface Temperature - GLOBE.gov

Surface Temperature Campaign is not new to the GLOBE Program. The data collection for the Surface Temperature Protocol Campaign as mentioned on the GLOBE website is being done in December when snow occurs. The campaign will encourage individuals to take daily measurements when doing the atmosphere protocols.

GLOBE

JANELLE JOHNSON DEC 11, 2018 12:27PM

GLOBE: Earth as a System

Perceiving Earth as a system begins when we first feel warmth from sunshine or get wet standing in the rain. Understanding Earth as a system – Earth System Science – requires a quantitative exploration of the connections among all parts (atmosphere, hydrosphere, lithosphere, and biosphere) of the

system. The measurements of The GLOBE Program provide students with the means to begin this exploration for themselves. The processes comprising the global environment are interconnected. Many of the major environmental issues of our time have driven scientists to study how these connections operate on a global basis – to understand Earth as a system.

INTRODUCTION

Why Study Earth System Science?

Perceiving Earth as a system begins when we first feel warmth from sunshine or get wet standing in the rain. Understanding Earth as a system – Earth System Science – requires a quantitative exploration of the connections among all parts (atmosphere, hydrosphere, lithosphere, and biosphere) of the system. The measurements of The GLOBE Program provide students with the means to begin this exploration for themselves.

The processes comprising the global environment are interconnected. Many of the major environmental issues of our time have driven scientists to study how these connections operate on a global basis – to understand Earth as a system.

Studies of the stratospheric ozone layer involve questions about the processes which create and destroy ozone. Scientists have learned that ozone, a chemical primarily found in a layer centered about 25 km above Earth's surface, is connected to biological activity happening in the soil on Earth's surface. Different chemicals, present in the air in trace amounts, control the abundance of ozone in the atmosphere. The sources of these trace constituents include microorganisms in the soil and water, land plants, and even some animals along with human activity.

Scientists studying climate change are also interested in the connections among the different Earth processes. Some of the trace gases in the atmosphere make it more difficult for heat (infrared radiation) to escape from Earth's surface to space. The amounts of these greenhouse gases found in the atmosphere are tied to the physical, chemical, and biological processes taking place in soil and water and on land. They are also influenced by the circulation of the oceans and atmosphere. To predict the future course of the climate we need to understand this detailed fabric of connections.

Ecologists study the way in which the living and non-living components of an ecosystem interact. Individual organisms and species compete and cooperate with one another. In some cases, interdependence is so strong that different plants and animals cannot

reproduce or even exist without each other. There is a web of life with extensive recycling of nutrients, and each organism plays a role. If one component of the ecosystem is changed the effects ripple through the system.

Scientists do not know all the Earth system connections yet, but they keep working to gain a more complete understanding. GLOBE students can help through data collection and student research. GLOBE students and scientists working together will improve our understanding of the Earth system. As students conduct a wide range of GLOBE measurements (perhaps spread over several school years in multiple grades), they should gain a perception that the environment is the result of an interplay among many processes that take place locally, regionally, and globally on time scales ranging from seconds to centuries. This is a key GLOBE lesson. The learning activities in this chapter help students learn this as they study annual variations in environmental parameters (the Seasons section) and examine the connections among the various phenomena measured in GLOBE on local, regional, and global spatial scales (the Exploring the Connections section).

The Big Picture

The planet we call Earth is made up of five 'spheres', the atmosphere, hydrosphere, lithosphere, cryosphere, and biosphere, connected to each other in a complex web of processes. See Figure EA-I-1. The atmosphere consists of the gases and particles suspended in the air. The oceans, inland water bodies, ground water, and ice sheets (cryosphere), comprise the hydrosphere. The lithosphere refers to the solid earth; the core, mantle, crust, and soil layers (pedosphere). The places on Earth where organisms live are collectively known as the biosphere. Instead of focusing on the individual parts of Earth, Earth system scientists use chemistry, biology, and physics to study the cycles that connect these spheres with each other and with the energy from the sun, which ultimately drives almost all of these processes.

Welcome

Introduction

Protocols

Learning Activities

Appendix

GLOBE® 2014

Introduction - 1

Earth System Science

Earth_as_a_System_Introduction.pdf

PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM JAN 23, 2019 03:34PM

UCAR Center for Science Education (UCAR SciEd)

Engaging all learners to explore and understand our changing world.

UCAR Center for Science Education

From brief encounters with atmospheric science to in-depth research opportunities, the UCAR Center for Science Education works with students of all ages to broaden science understanding.

UCAR

What's the phenomenon/ problem?

JANELLE JOHNSON JAN 18, 2019 11:45AM

Why study the Atmosphere?

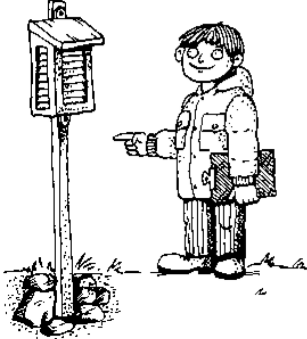
- **Weather** (the air temperature, rain, snow, relative humidity, cloud conditions, and atmospheric pressure and the coming and going of storms);
- **Climate** (the average and extreme conditions of the atmosphere);
- **Energy Budget** (Land-Atmosphere interactions);
- **Atmospheric Composition** (the trace gases and particles in the air).

Each of these characteristics of the atmosphere affects us and our environment.

What we wear and what we can do outside today depend on *weather*. Is it raining? Snowing? Sunny? Cold?

How we build our homes and schools, what crops we grow, what animals and plants naturally live around us all depend on *climate*.

Does rain come mainly in winter or summer or every day? Do we get frost or snow? How long do dry spells last?



Scientists are investigating the atmosphere. They want to understand and predict:

Weather (the air temperature, rain, snow, relative humidity, cloud conditions, and atmospheric pressure and the coming and going of storms);

Climate (the average and extreme conditions of the atmosphere);

Energy Budget (Land-Atmosphere interactions); and

Atmospheric Composition (the trace gases and particles in the air).

Each of these characteristics of the atmosphere affects us and our environment. What we wear and what we can do outside today depend on weather. Is it raining? Snowing? Sunny? Cold?

How we build our homes and schools, what crops we grow, what animals and plants

naturally live around us all depend on climate. Does rain come mainly in winter or summer or every day? Do we get frost or snow? How long do dry spells last?

The composition of the atmosphere affects how our air looks and feels and how far we can see. On days when clouds don't completely cover the sky, does the sky look blue or milky? Does it ever have a brown tint? Do sunsets have lots of red color? All these are dependent on the composition of our air.

GLOBE scientists want several types of atmosphere data from schools to help in their investigations. As a GLOBE student, you can do research on the atmosphere, too. You can investigate your local weather, climate, and atmospheric composition and how these vary from place to place, season to season, and year to year. You will learn more about the air around you.

GLOBE® 2014

Introduction - 1

Atmosphere

GLOBE_Atmosphere_Introduction.pdf

PDF document

PADLET DRIVE

JANELLE JOHNSON JAN 26, 2019 09:16AM

Quick look at Padlet

How to find other resources

Remaking the modules

"Like" the padlet for ease

Other questions?

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 11:49AM

Why study Weather?

On a **day-to-day** basis, we want to know many things about the weather we will encounter today. For example, we might like to know what the air temperature will be and whether it will rain so we can decide what type of clothes to wear; whether we need to take an umbrella with us when we go outside; or if we need to wear a hat and sunscreen to protect us from the sun's ultraviolet rays. We want to be sure the air we breathe is good for us. We want warnings so that we may protect ourselves and our property from severe storms.

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 11:49AM

Why study Climate?

Scientists Need GLOBE Data

People often think that scientists know what is happening in all parts of the world, but this is far from true. There are many regions where scientists have only the most general understanding of environmental factors such as air temperature and precipitation. Even in regions where there seems to be an abundance of data, scientists still do not know how much precipitation and temperature vary over relatively short distances. Official weather monitoring stations have contributed much data for a century or more in some locations while satellite technology has given us pictures of large areas every 30 minutes and global images at least twice daily for decades. Some areas have special monitors of atmospheric gases, and increasingly, airports monitor winds, not only at the ground, but up to heights of several kilometers. Despite all these wonderful efforts, there are gaps in coverage. The atmosphere varies significantly within these gaps, and GLOBE student measurements can improve the coverage for many types of observations. Atmospheric conditions have an important impact on the types of plants and animals that live in a certain area, and even on the kind of soil that forms there. The measurements that students take for the GLOBE Atmosphere Investigation are important to scientists who study weather, climate, land cover, phenology, ecology, biology, hydrology, and soil.

We also want information about the atmosphere on a **longer term** basis. Farmers need to know if their crops will get enough rain. Ski resorts need to know if enough snow will fall. Insurance underwriters for areas struck by hurricanes would like to know how many hurricanes to expect in a given year and how strong they will be when they make landfall. Nearly everyone would like to know what the weather is going to be not only tomorrow or the next day, but next week, and what the climate will be six months, a year, or even ten years from now! People have long said, “Everyone complains about the weather, but no one does anything about it.” Today, scientists are working hard to understand and predict the full range of atmospheric phenomena, from storms to ozone. Atmospheric scientists study not only what is going on with the atmosphere today, but why it was a certain way in the past and what it will be like in the future. While controlling the weather is generally beyond human ability, the collective effects of human activity influence weather, climate, and atmospheric composition. Scientific understanding of the atmosphere and the ability to forecast its future state grows through the application of fundamental laws and extensive observations. Since we care about the atmosphere on scales ranging from the individual farm to the entire globe and on timescales from a few minutes in severe storms to decades for the climate, vast quantities of data are needed.

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 11:52AM

Weather and Climate, the Atmosphere Over Time

Weather and climate are not the same. By weather we mean what is happening in the atmosphere today, tomorrow, or even next week. By climate we mean weather averages, variability, and extremes over time. For example, in a certain city the current temperature may be 25° C; this is weather. If instead we were to look at the weather records for the past 30 years, we might find that the average temperature in that city on that particular day is 18° C (this is climate). We also might find that over this 30-year period the temperature in this city has ranged from as high as 30° C to as low as 12° C on that particular day. Therefore, the present temperature of 25° C is not unusual. When we study the history of Earth's climate, we notice that temperature and precipitation in any given region vary over time and that the composition of the atmosphere has changed. For example, images from certain satellites show that great rivers used to run through the Egyptian Desert. We also know that thousands of years ago, glaciers were present in places like New York City where today air conditioning is routinely used to cope with summer heat. If Earth was so different in the past, can we predict what might happen in the future? Predicting climate is a major goal of Earth Science today.

Information & resources

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 11:58AM

How to study Weather

Perhaps your students study weather. If so, their GLOBE work can become an integral part of this learning. By “weather” we mean the current condition and short-term changes in the atmosphere. Students may be familiar with weather reports and forecasts, and you could introduce the GLOBE protocols by asking them to explain what they think “weather” means. They will probably mention things like the temperature, whether it's raining or snowing, whether it's cloudy, whether it's windy and the direction of the wind. Some students may also mention barometric pressure, cloud types, and humidity. All of these are aspects of what meteorologists mean by “weather,” and all can be measured in GLOBE. Thus, by doing GLOBE measurements, your students can begin to measure, monitor, study, track and forecast the weather.

Here is a suggested sequence for introducing GLOBE measurements through the study of weather.

1. Cloud and contrail measurements are the easiest place to start. They require only a cloud chart and the human eye. Two learning activities are good to do before

beginning the actual cloud cover and cloud type protocols:

- Observing, Describing, and Identifying Clouds
- Estimating Cloud Cover: A Simulation

2. In order to submit your cloud cover and cloud type observations, you need to define an Atmosphere Study Site and submit site definition data to GLOBE. You may want to do this before you set up the instrument shelter, so that if you experience delays in getting your shelter set up, you can still define your site and submit your cloud data.
3. You also can begin taking aerosols, water vapor, relative humidity, surface temperature, and barometric pressure readings without having the instrument shelter.
4. Current temperature measurements can also be taken without the instrument shelter. When you are able to install the instrument shelter you will be able to take and submit daily maximum and minimum air temperature measurements.
5. Taking and submitting liquid precipitation measurements requires the installation of a rain gauge on a post, but you can measure snow depth, liquid equivalent, and pH without the installation of the rain gauge.
6. If you use certain automated weather stations, you can add wind speed and direction to your set of GLOBE data following these protocols.
7. You must check the calibrations of your instruments (thermometers, barometer or altimeter, sling psychrometer) before you begin.

Try your hand at forecasting. One interesting way for students to use the data they collect is to try to make weather forecasts using their own data and to compare their forecasts to those of professional meteorologists. Who is more accurate? What data are most helpful in making a prediction? What additional data do the professionals use that are not available to students? There are many interesting questions that can be pursued.

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 12:02PM

How to study Climate

Climate is another major topic that your students may study and that can be explored using GLOBE measurements and data. "Climate" is the long-term trend of the atmosphere and other variable aspects of the environment. There is an old saying, "*Climate is what you expect. Weather is what you get.*" Climate refers to averages and extremes of temperature, clouds, precipitation, relative humidity and their annual patterns. Through looking at GLOBE data from their own school and from other sites around the world, students can begin to gain an appreciation for climate patterns and what

causes them. They can notice seasonal trends, variations based on latitude, and variations based on proximity to large bodies of water. By using the GLOBE student data archive, students can compare the climate of their school, nearby schools, and schools in widely varying spots around the globe. Students can take it as a challenge to build a long-term database that describes the climate of their locality. Most newspapers publish monthly summaries of the weather and compare them to climatic expectations. If not, then consult the meteorologist at your local airport or radio/TV station. These climatologies can provide the basis for interesting discussions of what is "normal" for your locale. Has it been a wetter than normal month? Hotter? Cooler? Cloudier? Using their GLOBE data and local climatic information, students can begin to answer these questions and think about how their climate may be changing. To study climate your students will use the same atmosphere protocols as for weather, except they need not measure or look up barometric pressure. Routine measurements of daily amounts of precipitation and maximum and minimum air temperatures are critical for climate study. Measurements of soil temperature and moisture and of phenology are also important in studying climate. The temperature of water bodies and when they are dry or frozen are also useful. Students can think about and debate which of the GLOBE measurements are most important for describing the climate. In order to study climate using GLOBE measurements, you will want your students to access data from other schools using the GLOBE Web site. GLOBE provides graphing tools online and the ability to download a school's data as a table that can be imported into other data analysis programs such as a spreadsheet.

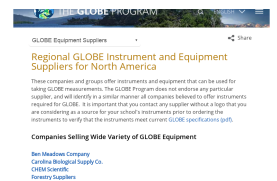
JANELLE JOHNSON DEC 11, 2018 12:27PM

GLOBE Resources

GLOBE Resources

This list of links and notes are resources from GLOBE that may be helpful to your overall GLOBE work.

PADLET



JANELLE JOHNSON JAN 18, 2019 12:02PM

What happened to the scientific method?

"This approach often obscures or distorts the processes of inquiry as they are practiced by scientists. Practices, such as reasoning carefully about the implications of models and theories; framing questions and hypotheses so that they can be productively investigated; systematically analyzing and integrating data to serve as evidence to evaluate claims; and communicating and critiquing ideas in a scientific

community are vital parts of inquiry. However, they tend to be missed when students are taught a scripted procedure designed to obtain a particular result in a decontextualized investigation. Furthermore, these higher-level reasoning and problem-solving practices require a reasonable depth of familiarity with the content of a given scientific topic if students are to engage in them in a meaningful way. Debates over content versus process are not in step with the current views of the nature of science.... Science is seen as a fundamentally social enterprise that is aimed at advancing knowledge through the development of theories and models that have explanatory and predictive power and that are grounded in evidence. In practice this means that content and process are deeply intertwined."(NRC, 2012b, p. 127)

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 12:04PM

GLOBE Teacher's Guide

The GLOBE Teacher's Guide is an online collection of background information, science protocols (data collection procedures), and learning activities organized by Earth spheres: Atmosphere, Biosphere, Hydrosphere, and Pedosphere (Soil).

The GLOBE Program® Teacher's Guide



2014

GLOBE_Teachers_Guide_introduction.pdf

PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 12:06PM

Elementary GLOBE

Elementary GLOBE is designed to introduce students in grades K-4 to the study of Earth system science.



Teacher Implementation Guide

An overview of the resources and background necessary to implement
Elementary GLOBE in K-4 classrooms

Becca Hatheway and Lisa S. Gardiner



www.globe.gov/elementaryglobe

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Elementary_GLOBE_implementation_guide.pdf

PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM JAN 23, 2019 02:14PM

3D-PAWS

The GLOBE Program and 3D-PAWS (**3D Printed Automated Weather Stations**) are partnering to collect real-time weather data in participating GLOBE communities.

To visit 3D-PAWS, click below

Home

Many surface weather stations across the globe suffer from incorrect siting, poor maintenance and limited communications for real-time monitoring. To expand observation

networks in sparsely observed regions, the 3D-PAWS (3D-Printed Automatic Weather Station) initiative has been launched by the University Corporation for Atmospheric Research (UCAR) and the US National Weather Service International Activities Office (NWS IAO), with support from the USAID Office of U.S.



GOOGLE

UCAR SciEd - GLOBE Data Explorations

GLOBE Data Explorations are classroom activities to help students learn how to analyze GLOBE environmental data while also learning atmospheric science concepts and geography.

GLOBE Data Explorations | UCAR Center for Science Education

GLOBE Data Explorations are classroom activities developed by the UCAR Center for Science Education, a GLOBE Partner, to help students learn how to analyze GLOBE environmental data while also learning atmospheric science concepts and geography. The nine activities were reviewed by science educators and staff at the GLOBE Implementation Office and field tested by teachers.

UCAR



GLOBE Advanced Data Access Tool (ADAT)

The GLOBE Program's [ADAT](#) allows you to find and retrieve GLOBE data using different search parameters.

(no login required)

Labs, Data Collection, Weather Activities

MULTI Measurement data

we'll use this Google Sheet to collect & visualize responses in-workshop

edit

283 KB file

GOOGLE DOCS



3-5 LEGO activity

(used with below)

[Elementary GLOBE: Climate Module - Weather Adds Up to Climate activity](#)

With Our Climate!

Weather Adds Up to Climate

Purpose

- To help students gain experience describing and reporting weather and learn how weather patterns over a long period of time are used to describe the climate of a location.

Overview

This activity consists of five parts that occur over the course of a school year. In Part 1 of this activity, students are introduced to different ways to describe weather. In Part 2, students record weather observations each day in bar graphs made out of interlocking plastic cubes. In Part 3, at the end of each month, students summarize the information in bar graphs. In Part 4, at the end of the school year, students use the data they collected to describe the patterns of weather through the year. In Part 5, students compare regions with different patterns of weather (climate).

Student Outcomes

Students learn how senses and instruments can be used to describe weather and that patterns of weather over a long time are called climate.

NGSS PE K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.

NGSS PE 3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

NGSS DCI ESS2-D: Weather and Climate

NGSS Crosscutting Concept: Patterns

NGSS Science and Engineering Practices:

- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information
- Engaging in an Argument from Evidence

CCSS.MATH.CONTENT.1.MD.C.4 Represent and interpret data.

CCSS.MATH.CONTENT.2.MD.D.10 Represent and interpret data.

CCSS.MATH.CONTENT.3.MD.B.3 Draw a scaled bar graph.

Time

This activity spans the school year.

- Part 1: One (45-50 minutes) class period
- Part 2: 3-5 minutes each day throughout the school year
- Part 3: Half a class period (20 minutes) each month
- Part 4: One class period (45-50 minutes) at the end of the school year
- Part 5: One class period (45-50 minutes) at the end of the school year

Level

Elementary (most appropriate for grades K-4)

Materials

- Elementary GLOBE book: *What in the World Is Happening With Our Climate?*
- Weather Adds Up to Climate Activity Sheets 1-5*
- Interlocking square plastic cubes (such as Duplo®, Unifix®, or Snap Cubes®)
- Two wood blocks approximately 10 inches long and slightly wider than the plastic cubes
- Hot glue gun
- Weather category labels (page 6)
- Thermometer for measuring air temperature
- Scientists Working Together Rubric*
- Glue sticks
- Scissors
- Three-ring binders
- Colored pencils
- Rulers
- Camera

The GLOBE Program Weather Adds Up to Climate - Page 1 Climate

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Weather_Adds_Up_to_Climate.pdf

PDF document

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3-5 Postcard activity

(used with above)

[UCAR Center for Science Education: Climate Change Activities - Climate Postcards](#)

Climate Postcards

Elementary students learn about the climate zones of the world by interpreting graphs and identifying climate zones described in postcards.

UCAR CENTER FOR SCIENCE EDUCATION



6+ The Systems Game

[UCAR Center for Science Education: The Systems Game](#)

The Systems Game

Introduction

Systems thinking is an important concept in both the physical and social sciences. It requires an understanding of the various parts and subparts of a system in order to understand the relationships within the whole. In this game, students either are a part of a system or serve as scientists tasked with observing and making sense of the system's motion rule that it's "parts" are following.

Credits

- This activity was written and adapted by Teresa Eastburn of the UCAR Center for Science Education in the early 2000s. Variations of the activity have been used in both formal and informal settings for many years although rarely in science until Eastburn's adaptation. The original author of the game is unknown. Many date the growth of systems thinking back to the work of Jay Forrester, a professor at MIT in 1956 whose research advanced the field of system dynamics.

Grade Level

- This activity is most suitable for students in both middle and high schools. To use this activity with younger students, simplify the rule that is given to students. For example, students can be instructed to walk five steps then fold and unfold their arms repeatedly. Avoiding the word "system" and instead instructing participants that they must uncover the motion rule that the participants are following is also helpful before discussing the concept of systems thinking when it is developmentally appropriate to do so.

Time Required

- Two 50-minute class periods to allow for adequate preparation in advance of the activity and reflection following it.

UCARSciEd_TheSystemsGame.pdf

PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 12:27PM

Using GLOBE's ADAT

So you want 3D-PAWS data...

edit

220 KB file

GOOGLE DOCS



SHANNON RIVERS, THE GLOBE PROGRAM JAN 25, 2019 03:46PM

3-5 Combined Activity

+ K-4 LEGO activity

+ K-4 Postcards activity

edit

245 KB file

GOOGLE DOCS



Weather Activities Feedback

SHANNON RIVERS, THE GLOBE PROGRAM JAN 25, 2019 06:10PM

WEATHER ACTIVITY: GUESS THE TEMPERATURE

- What worked, did not work for the activity?
- How might this activity work for focal students?
- Does the activity meet your current teaching goals and standards?

I thought it was a great intro to the basic data gathering of your senses. The data table was instant feedback that helped.

— TONY BULLOCK

JAMILA ROCKETTE JAN 25, 2019 06:10PM

WEATHER ACTIVITY: WEATHER ADDS UP TO CLIMATE

- What worked, did not work for the activity?
- How might this activity work for focal students?
- Does the activity meet your current teaching goals and standards?

JAMILA ROCKETTE JAN 25, 2019 06:11PM

WEATHER ACTIVITY: CLIMATE POSTCARDS

- What worked, did not work for the activity?
- How might this activity work for focal students?
- Does the activity meet your current teaching goals and standards?

JAMILA ROCKETTE JAN 25, 2019 06:11PM

WEATHER ACTIVITY: THE SYSTEMS GAME

- What worked, did not work for the activity?
- How might this activity work for focal students?
- Does the activity meet your current teaching goals and standards?

Nice, very nice. There were many applications to this activity. I like how it promotes observations, patterns, and deductions.

— TONY BULLOCK

Protocols to augment weather stations

SHANNON RIVERS, THE GLOBE PROGRAM JAN 23, 2019 03:28PM

GLOBE Weather Protocols

including:

- Aerosols
- Air Temperature
- Barometric Pressure

- Soil Moisture / pH / Temp
- Surface Ozone
- Water Vapor

<https://www.globe.gov/web/globe-international-stem-network/overview/gisn-members>

WRENTWEET DEC 11, 2018 12:27PM

National Center for Atmospheric Research (NCAR)

At NCAR, they don't forecast the weather. They get inside the weather, climate, and surrounding environment to understand it better. They study the Sun, air chemistry, how the atmosphere interacts with the land and oceans, and how we change and are changed by weather and climate.

Check Out Their Website:

<https://www.youtube.com/watch?v=PVNDI29n8kI>

<https://ncar.ucar.edu/> — MARY COLEMAN

JANELLE JOHNSON DEC 11, 2018 12:27PM

NGSS Appendix C

College & Career Readiness

Welcome, Janelle Johnson [[Log Out](#)]



Welcome, Janelle Johnson [[Log Out](#)]

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Appendix C: College and Career Readiness

Postsecondary education is now seen as critical to ensure the nation's long-term economic security, to respond to the transformation in both the nature and number of current and projected jobs, and to enable social mobility. Yet, alarmingly, the United States has fallen from ranking 1st among industrialized nations in both high school completion rates and the percentage of adults with a 2- or 4-year degree (OECD, 2012a, p. 26). On the 30th anniversary of the *Nation at Risk* report, key indicators point to our nation being more at risk than ever (Kirwan, 2013):

- Sixty percent of U.S. jobs are predicted to require some form of postsecondary education by the end of the decade (Georgetown University Center on Education and the Workforce, 2013).
- The U.S. Department of Labor notes that companies have reported more than three million job openings every month since February 2011 because of an absence of applicants with the skills to fill these positions (Woellert, 2012). The National Science Foundation also reports that there are currently between two and three million unfilled positions in the STEM areas of science, technology, engineering, and mathematics.
- The shortfall in STEM employees is likely to increase. The Department of Commerce shows that in the past 10 years, STEM jobs grew at three times the rate of non-STEM jobs, a trend likely to continue and accelerate (Langdon et al., 2011).

Postsecondary education also increases an individual student's chances for a decent, well-paying job. The unemployment rate for recent high school graduates without a college degree was more than 30 percent, while for recent college graduates, it was under 6 percent (Shierholtz et al., 2012). And in terms of earnings, a holder of a bachelor's degree is likely to realize a million dollars more over a lifetime than an individual with only a high school diploma. More troubling is a grim reality underlying these statistics: a child born into a family in the lowest quartile of income has a less than 8 percent chance of earning a postsecondary degree. The Organisation for Economic Co-operation and Development (OECD) observes that children of less-educated parents in the United States have a tougher time climbing the educational ladder than in almost any other developed country (OECD, 2012a, p. 102). The American dream that one's birth circumstances do not control one's destiny is fast slipping away.

The last decade has seen an emerging consensus that effective preparation for student success in postsecondary education and careers includes a strong background in science. In particular, the best science education seems to be one based on integration of rigorous content with the practices that scientists and engineers routinely use in their work—

NGSS_appendix_C_college_and_career_readiness.pdf

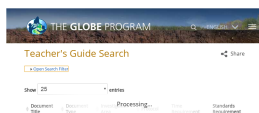
PDF document

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Teacher's Guide Search - GLOBE.gov

Partners and Country Coordinator Tutorials (restricted)

GLOBE



Career Connections

SHANNON RIVERS, THE GLOBE PROGRAM JAN 18, 2019 12:31PM

RCMRD Space Challenge 2017: Kenya (video)

Students in Kenya utilize 3D-PAWS to inspire local action, develop career pathways and contribute to the global climate conversation



RCMRD Space Challenge 2017

by SERVIR Global

YOUTUBE

WRENTWEET JAN 18, 2019 12:32PM

GLOBE International STEM Network Members (GISN)

The GLOBE International STEM Network (GISN) is an international network of STEM professionals (Science, Technology, Engineering, Mathematics) that work with GLOBE students around the world conducting science. STEM professionals mentor students and teachers, present scientific ideas, and/or collaborate on scientific research. Each relationship between a STEM professional and a GLOBE school is unique, and is determined by the STEM professional and the school.

Check Out The Website for Career Connections:

Upcoming GLOBE Opportunities

JAMILA ROCKETTE JAN 25, 2019 05:56PM

STUDENT RESEARCH SYMPOSIA

[GLOBE Student Research Symposia](#), Travel Funding Deadline, Feb.1

SRS [Sign Up](#) for Email List.

2019 SRS [Dates & Locations](#)

JAMILA ROCKETTE JAN 25, 2019 05:58PM

MARCH MOSQUITO MADNESS PROFESSIONAL DEVELOPMENT, Friday March 15

Educators are invited to apply to participate in a GLOBE full day professional development workshop. Hosted by GLOBE, MULTI STEM, and The Bug Chicks, the "March Mosquito Madness" professional development is a full day workshop that will provide networking opportunities, discourse on teaching science to diverse students, training on the GLOBE Mosquito Habitat Mapper App, and hands on training experience on how to incorporate bugs into your science teaching. Based in Portland, Oregon, you won't want to miss this limited arthropod training opportunity by The Bug Chicks!

March Mosquito Madness [Professional Development Application Link](#)

JAMILA ROCKETTE JAN 25, 2019 06:00PM

2019 GLOBE IVSS

GLOBE [International Virtual Science Symposium](#), Report Deadline, April 10

JAMILA ROCKETTE JAN 25, 2019 06:01PM

2019 GLOBE ANNUAL MEETING

GLOBE [Annual Meeting](#), July 14-18, Detroit

JAMILA ROCKETTE JAN 25, 2019 06:13PM

GLOBE MISSION MOSQUITO CAMPAGIN

[GLOBE Mission Mosquito Campaign](#)

The goal of GLOBE Mission Mosquito is to create an organized citizen science community - primarily through formal education, with targeted outreach to informal education - that will conduct and report local observations using the GLOBE Observer Mosquito Habitat Mapper ([GO MHM](#)). Using the mobile app, citizen scientists identify potential breeding sites

for mosquitoes, sample and count mosquito larvae, and with optional equipment, examine and photograph a specimen to identify its genus.

JAMILA ROCKETTE JAN 25, 2019 06:16PM

Trees Around the GLOBE Campaign

Trees Ar

JAMILA ROCKETTE JAN 25, 2019 06:18PM

Urban Heat Island Effect Campaign

[Urban Heat Island Effect Campaign](#)

The purpose of this investigation is to discover how the land cover of the ground affects its surface temperature. But, that is not the only reason to participate in the field campaign. The main research question that needs to be answered is "How does surface cover affect surface temperature?" Students can set up research studies at their own school such as looking at the difference between paved and unpaved areas, such as a grassy area. More schools are taking surface temperature observations, therefore students can investigate how surface temperature changes between schools. They could look at elevation, latitude and longitude, urban versus rural, proximity to water, etc. There are many research questions possible with surface temperature. Students could also look at how cloud cover or humidity affect the surface temperature.

Current and Future Needs Evaluation, Weather & Weather Stations

JAMILA ROCKETTE JAN 25, 2019 06:21PM

Designing Effective Science Instruction Practice Guide: Identifying Important Content

Designing Effective Science Instruction Practice Guide: Identifying Important Content

Component: In order to plan for effective science instruction, teachers must first identify instructional goals and communicate them to students. They drive the planning of instruction and assessment. Short-term goals derived from the instructional goals and learning progression are described in terms of success criteria. These guide the learning while students are engaged in the learning goals.

Attribute	Understand about it	Exploring it	Striving to implement it	Practicing it actively	Masterying it
Identifying Big Ideas and Key Concepts	- My content is aligned with science standards to focus on clear learning goals. - I rely on the learning goals found in the textbook to plan my lessons and assess that the content aligns to standards.	I am aware of the science standards for my state/district and know that my learning goals should align with them to help students make progress with big ideas.	I am beginning to plan my units to align with state or specified standards. I am using these documents to determine learning goals related to big ideas and key concepts for my lessons.	All my curricular units align with national state-district standards. I share the learning goals with the students as they are clear about the important standards-based content.	- I align my unit learning goals to national state-district standards. - My students are clear about what they need to learn and can articulate the learning goals.
	- I develop my content knowledge and understanding related to science topics. - I have a college degree, and feel adequately prepared to teach. - I follow the content in the textbook.	I tap into peers, resources or others that can help when I feel my content is lacking.	I ask colleagues and review textbooks for ideas when planning my unit content. I also Google some of my favorite sites for ideas.	Before planning a unit, I consult references, peers and others that can help me, and take courses or workshops to make sure I have the necessary content knowledge.	I consult references, peers, and experts when planning my unit to update my content and pedagogical content knowledge and learn about emerging content.
	- I request for standards and benchmarks and create a curriculum map for planning purposes to show how content is connected. - I pay attention to the facts and vocabulary addressed by the book. - I use the learning goals from the book. - I don't worry about making connections between content because the book is sequenced to do that already.	- I can identify the facts and vocabulary I want my students to know. - I struggle with the language used in educational standards since it is so broad, and have difficulty understanding what it means I should teach. - I have used a curriculum map template to plan one unit.	- I know the facts, concepts, and vocabulary I expect my students to know by the end of the unit. - I am trying to break large ideas into smaller learning elements but don't always result in students understanding the big idea or key concepts. - I have curriculum maps to show how content is connected for some of my units.	- I identify facts, concepts, vocabulary, and processes during my planning and consistently share them with my students. - The sequenced key concepts and individual learning goals from the basis of the units and lessons that are appropriate. - I have curriculum maps for each unit to show how content is sequenced.	- I identify facts, concepts, vocabulary, and processes for my students and regularly include emerging content connected with the curriculum. - I continually review and revise unit curriculum maps to show how content is connected and the relationships between units. I make them available for others.
Evidence					

1 | Page

Designing_Effective_Science_Instruction.pdf
PDF document
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JAMILA ROCKETTE JAN 25, 2019 06:22PM

Understanding Weather - Word Document

Understanding Weather

The purpose of this exercise is for us to better understand what you are currently doing with regard to teaching weather in your school. If you do not actively teach weather at your grade level, please provide responses to these questions based on what other teachers in your school or district are teaching that prepare students for these content/practices (elementary) or build on these ideas (high school). We will use this information to better understand the needs that educators have and how we can plan for GLOBE and the 3D PAWS to be useful resources to meet your needs.

1. Your School/District:
2. Your Grade Level(s):

Middle School Content/Practice	Current Instruction and Future Needs	Successes and Challenges with Focal Student
The motions and complex interactions of air masses result in changes in weather conditions		
How unequal heating and rotation of the Earth cause patterns of atmospheric circulation		
Describe the cycling of water through Earth's systems driven by energy from the sun		
Develop, use, and revise models to predict/describe a phenomenon		
Analyze and interpret data to provide evidence for phenomena		
Use graphical displays of large data sets to identify temporal or spatial relationships		

Understanding_Weather.docx
Word document
PADLET DRIVE

Reflection: Application with Focal Students

JANELLE JOHNSON DEC 11, 2018 12:27PM

How can you apply today's content or approaches?

What would you need to modify for this to work with your focal students? How do you think they would respond?

TARA KIMMEY JAN 26, 2019 12:09PM

My students are struggling with the idea of 'doing' and transferring it to 'understanding'. When I introduce a concept to my students, they go through the motions of the activity; but I am trying to 'bridge the gap' to them understanding the what, who, and how. I liked today's activity and game. This gave me better ideas on how to implant hands on activities that will peak their engagement. Once they are engaged, they will want to continue to learn. My goal is to get them to the point where they feel comfortable discussing their findings; which will lead to a better understanding and mastery.

Weather / 3D PAWS PPT

JAMILA ROCKETTE JAN 26, 2019 12:09PM

PowerPoint Presentation Weather & 3D PAWS Professional Development

 The GLOBE Program

MSU MULTI STEM Professional Development
3D-Printed Automated Weather Stations (3D-PAWS)




Photo credit: Daniel Miller

Sponsored by:  Supported by:    Implemented by: 

3D_PAWS_GLOBE_MULTI_STEM_Professional_Development_Jan
PDF document
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Feedback & Evaluation

JANELLE JOHNSON DEC 11, 2018 12:28PM

Upcoming sessions

Save the date!

February 23 at Auraria

March 9 in Pueblo region

GLOBE Mosquito Training March 15

GLOBE IVSS & SRS--May 17 & 18th in Mescalero, NM

Discover STEM Career Expo-March 16

Two day summer institute June 5 & 6

In-Person Workshops - GLOBE.gov

GLOBE Training available across
multiple Science Protocols around the
world

GLOBE



JANELLE JOHNSON JAN 25, 2019 06:36PM

Evaluation

<https://www.surveymonkey.com/r/MULTI-Jan-26-2019>
