GLOBE MULTI STEM Summer 2019 Institute

Water in the Southwest: Dissolved Oxygen

JANELLE JOHNSON MAY 28, 2019 04:33PM

Introductions

JANELLE JOHNSON JUN 20, 2019 09:13AM

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 JUN 04, 2019 06:55AM

Please introduce yourself!

- Name
- School & Grade
- Preservice or inservice
- New to MULTI?
- How is water included in your curriculum?

My name is Tara Kimmey and I am a Middle School Science Teacher. I teach level 5-7. I have been taking MULTI classes since Fall 2018. I teach the water cycle and water filtration within a specific Ecosystem/Biome. — TARA KIMMEY

Jamie Jay Summers - Colorado STEM Academy, level 3 - Brand new to MULTI.- We focus on weather and the observable changes it can make in our world. — JAMIE JAY SUMMERS

JANELLE JOHNSON MAY 28, 2019 04:36PM

Quick look at Padlet

How to find other resources
Remaking the modules
"Like" the padlet for ease
Other questions?

JANELLE JOHNSON MAY 28, 2019 04:33PM

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 JUN 04, 2019 07:21AM

MULTI

Funded by NSF
Community based approach--Check out FB and Twitter!
Focus on teacher PD to more effectively engage underserved students (AST)
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 Urban Heat Island Effect-Surface Temperature Field Campaign is focused on looking at the impact urbanization has on the Earth's surface temperature and how the surface temperature changes the dynamics of the Earth's atmosphere. Studying the energy cycle is fundamental to understanding how the Earth's spheres function within its system. The surface temperature measurements contribute

JANELLE JOHNSON JUN 04, 2019 07:16AM

Who are your focal students?

Think of two or three students you work with who have been less engaged in science or STEM. Please describe them here...you will be reflecting on how effectively this content and/or approaches would engage your focal students throughout MULTI.

Often the messages students hear from families and teachers praise or criticize their innate abilities, and so they grow to believe they are one way or another, developing into a fixed mindset.

For example, if a student hears over and over that they are gifted in math, they will be inclined to think so. Then when they encounter a struggle at any level, they may judge themselves and/or give up easily believing that math is supposed to be easy for them.

Or on the converse side, the student doesn't experience much success in a subject and therefore feels that math just isn't for them.

My son was always a strong math student. In fact, school came very easily to him during his elementary years. Teachers spoke of him as gifted, and he is. But with that designation came complications I didn't expect.

Being defined by these labels, he didn't feel like he had to try hard, and if he did and wasn't successful, he blamed everyone else.

I've seen other students like this, too, who by the time they get to be seniors in high school don't even bother trying anymore because they are somehow above the possible struggle.

If we want students to develop a growth mindset, how we talk to them about their learning matters. How we demonstrate our own learning process matters, too

Developing a Growth Mindset in Our Students
Word document
PADLET DRIVE

Student L in my class is a girl who has a very fixed mindset when it comes to math and science. She believes that she will never be a "good" student so her main goal at school is socializing. Student A is an English language learner who struggles with taking feedback. If any type of feedback from other students or teachers will cause him to shut down and stop trying. He also has poor attendance and an unstable home life. — JULIE PITZ

M - he is a very capable and bright student who tends to check out when he thinks he already knows what we're learning. I'd like to teach with students like him in mind to keep him engaged and interested in the topic. D - he does not have confidence in his abilities and is one of those students who stops trying out of self preservation. I teach with him in mind to encourage effort, trial and error, and learning from our mistakes — ALYSSA MAGIER

Students who don't qualify for services and are left to struggle without support and intervention at the level required for success. — JENNIFER SUGGS-HAMMONDS

Student 1 is not engaged because they had a less-than-favorable learning experience last year. His teacher quit last October and substitute teachers finished off the year. Because of this, he is "checked out." He feels behind the other students, and he feels lost, so he spends time on his phone instead of trying. — MARIA CROUSE

My focal students aren't as successful as they could be because they can't find the relevancy to engage within the content. Other students are feeling that they are not good at subjects because it is hard, and they would rather back out than engage.
— KYLIE HINCHMAN

I have experience with a student that wants to do the work, but struggles with focusing in the classroom. He gets restless and gives up easily without asking any questions.
— ARIANNA LEBLANC

My focal students have struggled with connecting to the material or viewing the material as relevant to them. — RANDALL GIBSON

Students that miss school, can not stay focused(problems at home), physical or sexually abused.. kids that are violent and are on the spectrum. — LUEVANON052010

One word: apathy. A subset of my former high school students resisted hands-on learning because they were skilled at memorizing facts, as taught by their former science teacher. — CHRISTINA BUFFINGTON

Some my focal students include kids who want the teachers to just give them the answer rather than struggling for a bit to come up with an understanding of the concepts. These are the students that I try to work with to instill a love for science or at the very least an appreciation for science concepts. — CARLOS HERNANDEZ

BR- This is a kiddo I had a few years ago. He was from a very low income home and never saw himself as a student. In class he was a high reader and solid in math but didn't see a future for himself in academics. — JAMIE JAY SUMMERS

Students that haven't been engaged in sciences because it is "too hard" or "too complicated" they have not had teachers provide opportunities to grow their knowledge and don't feel they have access to it. — MATTHEW DAVIS

Students who are developing the ability to focus or internal motivation — KGOSS4

Students that have been unsuccessful in other classes due to dyslexia or other identified dysmorphia. Hands on work is easier for these learners to connect their writing to for analysis. — KATHLEEN JAKOBSEN

TSU GLOBEME JUN 05, 2019 10:25AM

David Padgett, Associate Professor of Geography, Tennessee State University and Director of the Geographic Information Sciences Laboratory, Nashville, TN. New to MULTI. GLOBE Partner and Trainer since 2001.

GLOBE Information & resources

JANELLE JOHNSON MAY 28, 2019 04:36PM

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 MAY 28, 2019 04:36PM

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

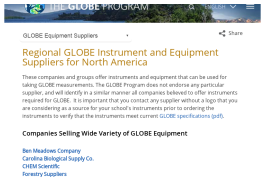
JANELLE JOHNSON MAY 28, 2019 04:33PM

GLOBE Resources

GLOBE Resources

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

PADLET



This is where the link to the Vertical Science Literacy doc is - three themes: water & watersheds, atmosphere, weather & climate, ecosystems & habitats...K-8...NGSS-aligned...GLOBE, WILD, PLT & WET activities used... — **JENNIFER BOURGEAULT**

JANELLE JOHNSON MAY 28, 2019 04:36PM

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?

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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.

GLOBE® 2014 Introduction - 1 Earth System Science

Welcome | Introduction | Protocols | Learning Activities | Appendix

Earth_as_a_System_Introduction.pdf

PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM MAY 28, 2019 04:36PM

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

JANELLE JOHNSON MAY 28, 2019 04:35PM

GLOBE Mission Mosquito campaign

Mission Mosquito - GLOBE.gov

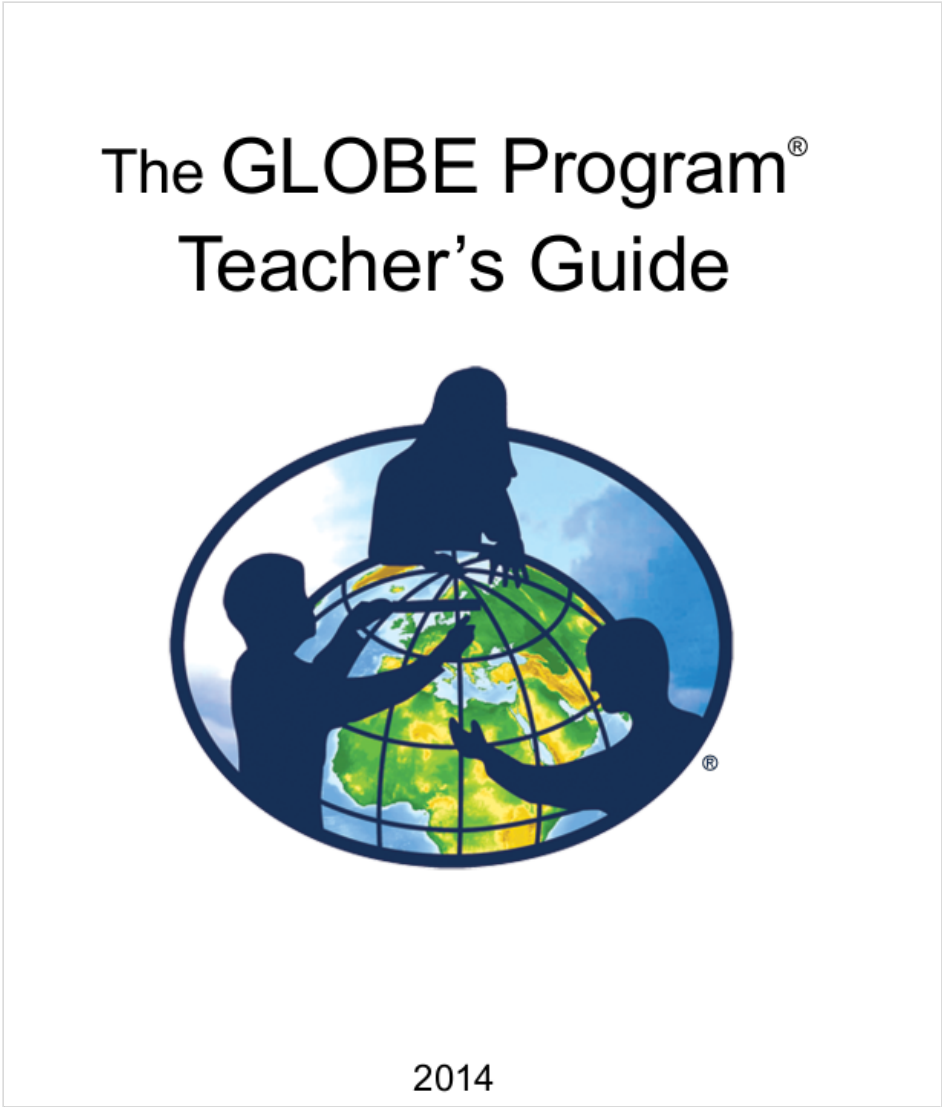
The goal of GLOBE Mission Mosquito is to create an organized citizen science community - primarily through formal education, with targeted outreach to informal education - that will conduct and report local observations using the GLOBE Observer Mosquito Habitat Mapper (GO MHM).

GLOBE

SHANNON RIVERS, THE GLOBE PROGRAM MAY 28, 2019 04:33PM

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).



GLOBE_Teachers_Guide_introduction.pdf

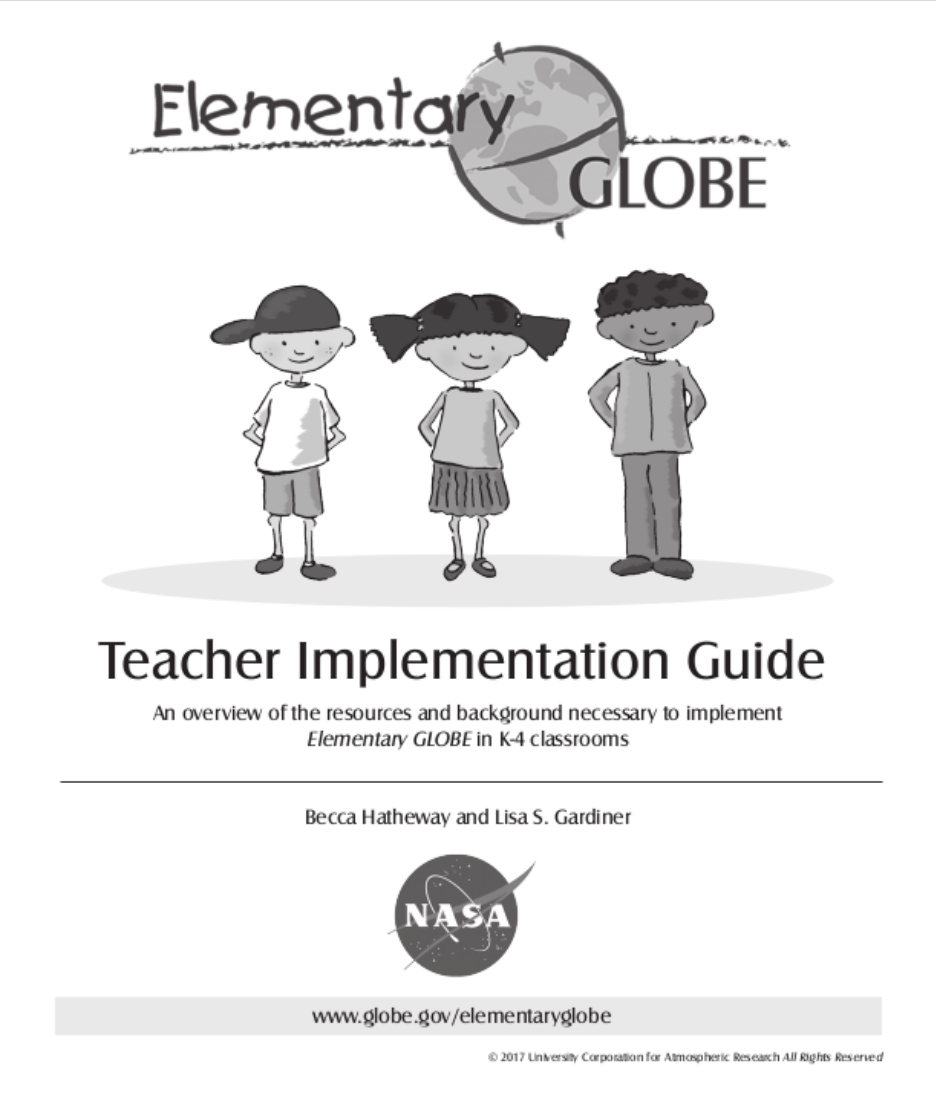
PDF document

PADLET DRIVE

SHANNON RIVERS, THE GLOBE PROGRAM MAY 28, 2019 04:33PM

Elementary GLOBE

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



Elementary_GLOBE_implementation_guide.pdf
PDF document
PADLET DRIVE

Here is a direct link to Discoveries at Willow Creek: https://www.globe.gov/web/elementary-globe/overview/water — **ANONYMOUS**

SHANNON RIVERS, THE GLOBE PROGRAM MAY 28, 2019 04:33PM

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

SHANNON RIVERS, THE GLOBE PROGRAM MAY 28, 2019 04:33PM

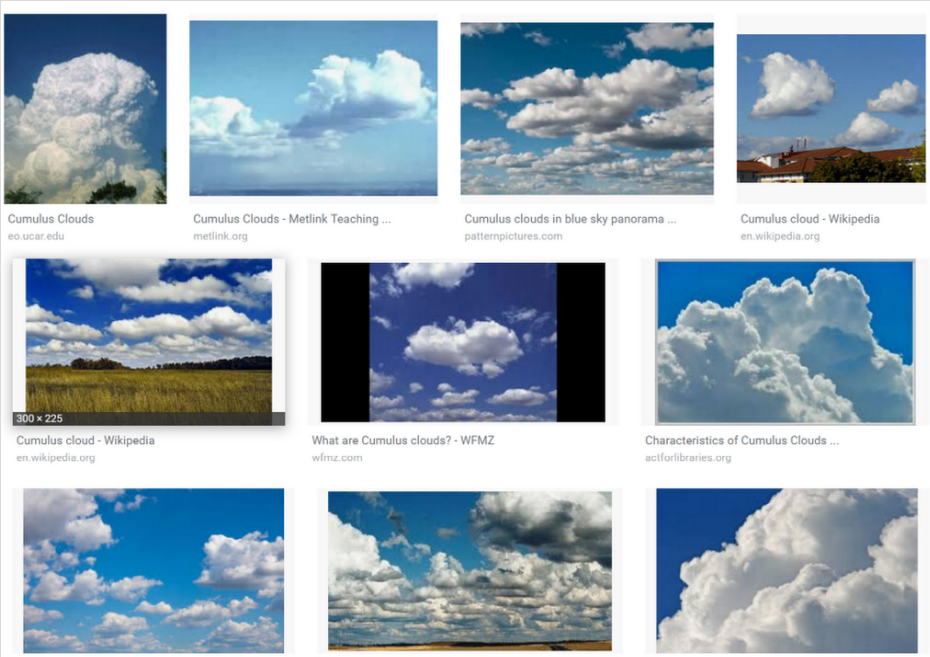
GLOBE Advanced Data Access Tool (ADAT)

The GLOBE Program's ADAT allows you to find and retrieve GLOBE data using different search parameters.
(no login required)

MARILE COLON ROBLES JUN 05, 2019 09:28AM

GLOBE Clouds - Three Main Cloud Types

Slides used during the cloud portion with multiple pictures for the three main cloud types (cumulus, stratus, cirrus) and "key words" from a 1st grade class.



cloudTypes

Powerpoint presentation

PADLET DRIVE

MARILE COLON ROBLES JUN 05, 2019 09:29AM

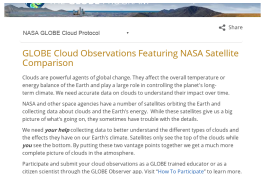
GLOBE Clouds website

Find information about clouds, satellite overpass times, how to read the satellite match table, and links to cloud charts/cloud windows.

NASA GLOBE Cloud Protocol - GLOBE.gov

A team at NASA Langley Research Center will compare your observations with satellite data for comparison purposes and will send you an email with the results. This process allows participants to engage in authentic science experiences through NASA missions.

GLOBE



ANONYMOUS JUN 05, 2019 10:18AM

GLOBE Weather

A free new NGSS-Driven middle school unit:

https://globeweathercurriculum.org

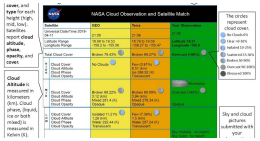
MARILE COLON ROBLES JUN 05, 2019 02:57PM

GLOBE Clouds - How to read a satellite match table!

How to Read a Terra, Aqua or GEO Satellite Match - GLOBE.gov

Partners and Country Coordinator Tutorials (restricted)

GLOBE



ANONYMOUS JUN 06, 2019 08:35AM

Colorado GLOBE Partners Collaborative

Link to a directory of Colorado GLOBE Partners and resources

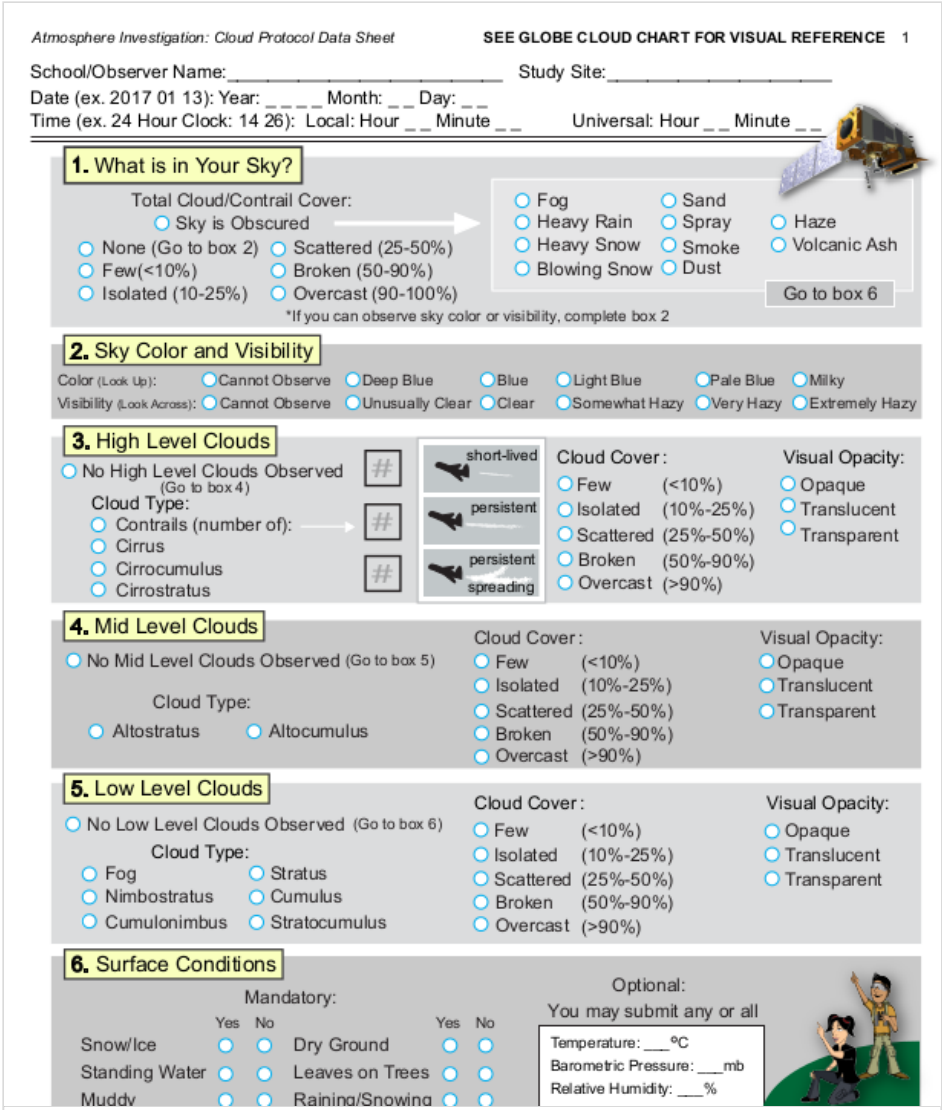
ESS-GLOBE Collaborative Directory

by Jennifer Taylor

GOOGLE DOCS

MARILE COLON ROBLES JUN 06, 2019 11:36AM

GLOBE Clouds Data Sheet



Atmosphere Investigation: Cloud Protocol Data Sheet **SEE GLOBE CLOUD CHART FOR VISUAL REFERENCE** 1

School/Observer Name:_____ Study Site:_____

Date (ex. 2017 01 13): Year: _ _ _ _ Month: _ _ Day: _ _

Time (ex. 24 Hour Clock: 14 26): Local: Hour _ _ Minute _ _ Universal: Hour _ _ Minute _ _

1. What is in Your Sky?

Total Cloud/Contrail Cover:

- Sky is Obscured
- None (Go to box 2)
- Few(<10%)
- Isolated (10-25%)
- Scattered (25-50%)
- Broken (50-90%)
- Overcast (90-100%)

- Fog
- Heavy Rain
- Heavy Snow
- Blowing Snow
- Sand
- Spray
- Smoke
- Dust
- Haze
- Volcanic Ash

Go to box 6

*If you can observe sky color or visibility, complete box 2

2. Sky Color and Visibility

Color (Look Up): Cannot Observe, Deep Blue, Blue, Light Blue, Pale Blue, Milky

Visibility (Look Across): Cannot Observe, Unusually Clear, Clear, Somewhat Hazy, Very Hazy, Extremely Hazy

3. High Level Clouds

- No High Level Clouds Observed (Go to box 4)

Cloud Type:

- Contrails (number of): #
- Cirrus
- Cirrocumulus #
- Cirrostratus

short-lived / persistent / persistent spreading

Cloud Cover:

- Few (<10%)
- Isolated (10%-25%)
- Scattered (25%-50%)
- Broken (50%-90%)
- Overcast (>90%)

Visual Opacity:

- Opaque
- Translucent
- Transparent

4. Mid Level Clouds

- No Mid Level Clouds Observed (Go to box 5)

Cloud Type:

- Altostratus
- Altocumulus

Cloud Cover:

- Few (<10%)
- Isolated (10%-25%)
- Scattered (25%-50%)
- Broken (50%-90%)
- Overcast (>90%)

Visual Opacity:

- Opaque
- Translucent
- Transparent

5. Low Level Clouds

- No Low Level Clouds Observed (Go to box 6)

Cloud Type:

- Fog
- Nimbostratus
- Cumulonimbus
- Stratus
- Cumulus
- Stratocumulus

Cloud Cover:

- Few (<10%)
- Isolated (10%-25%)
- Scattered (25%-50%)
- Broken (50%-90%)
- Overcast (>90%)

Visual Opacity:

- Opaque
- Translucent
- Transparent

6. Surface Conditions

Mandatory:

	Yes	No		Yes	No
Snow/Ice			Dry Ground		
Standing Water			Leaves on Trees		
Muddy			Raining/Snowing		

Optional:

You may submit any or all

Temperature: ___°C

Barometric Pressure: ___mb

Relative Humidity: ___%

624fab53-4159-438e-b974-4a79c402c3cb

PDF document

GLOBE

Knowledge Building

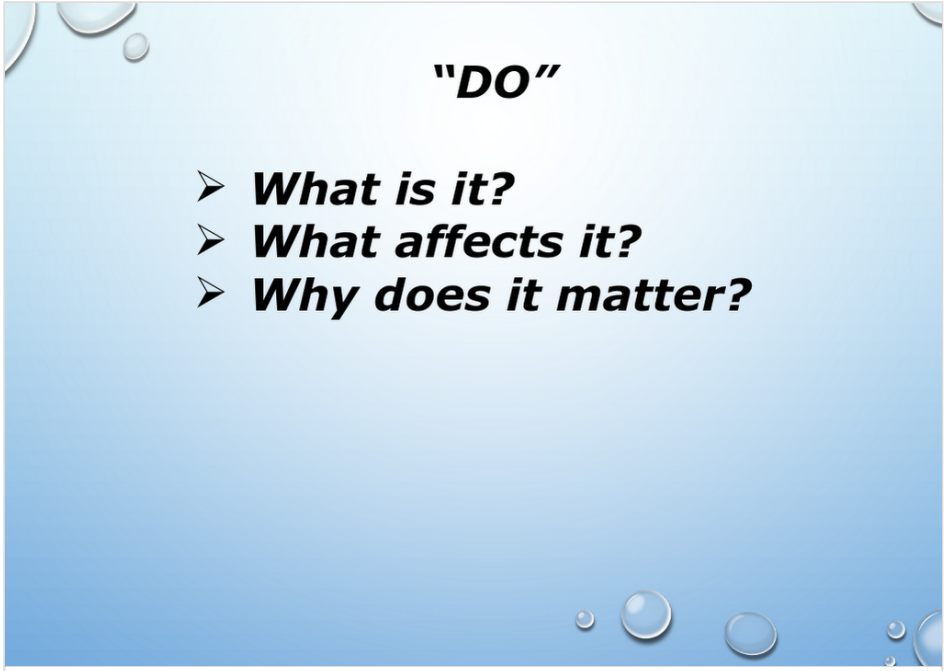
JANELLE JOHNSON JUN 04, 2019 07:24AM

AST

- Just in Time instruction

DAWN CUMMINGS JUN 04, 2019 07:02AM

Dissolved Oxygen - what is it? what affects it? why does it matter?



DO_and_water_quality.pptx
Powerpoint presentation
PADLET DRIVE

DAWN CUMMINGS MAY 31, 2019 05:39PM

DO card sort

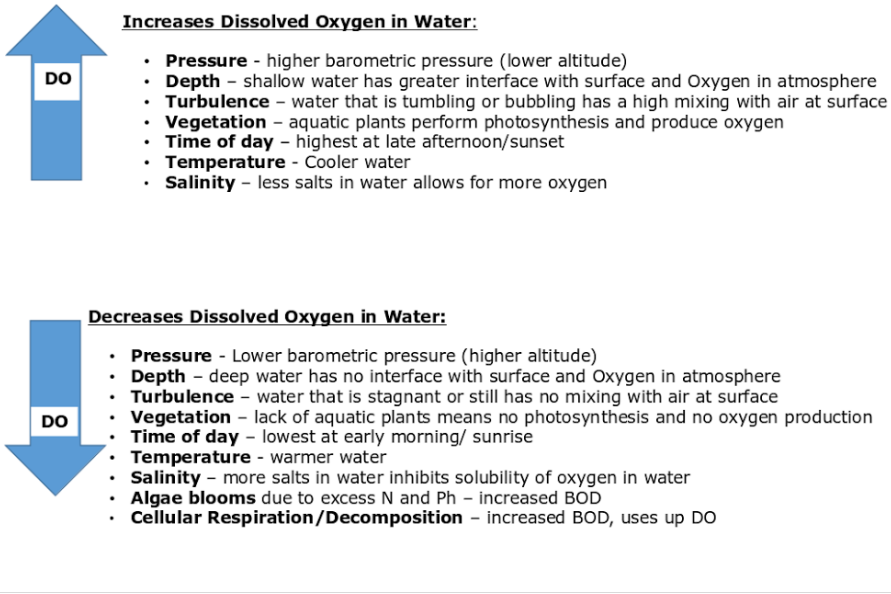
DO card sort

Increased (DO) Dissolved Oxygen	Decreased (DO) Dissolved Oxygen
high barometric pressure (lower altitude)	**Low barometric pressure** (higher altitude)
Shallow water	**Deep water**
Lots of Turbulence	**Little Turbulence**

DO_card_sort.docx
Word document
PADLET DRIVE

DAWN CUMMINGS MAY 31, 2019 05:42PM

DO "cheat Sheet"



DO_cheat_sheet.docx

Word document

PADLET DRIVE

FYI- in Montessori we call these a "Control of Error." Students check their work for accuracy with these keys; it eliminates any shame around being wrong, and gives students ownership, which results in higher and more meaningful engagement.

— KGOSS4

Generating Questions

JANELLE JOHNSON JUN 05, 2019 10:00AM

Case Study Jigsaw

Read the article in your group, and if you have time, check out one of the videos linked below. What is the problem? What kinds of data are included? What else do you need to know? Begin to generate some research questions for our own investigation of dissolved oxygen. **PLEASE RESPOND HERE**

SEPs

- Asking questions and defining problems
- Planning and carrying out investigations

AST

- Planning for engagement with important science ideas
- Group work for participation

See picture below for Dead Zone in Gulf of Mexico. What led to the dead zone of Gulf of Mexico? How do nitrates affect dissolved oxygen in a local stream?

— KATHLEEN JAKOBSEN

Climate Change Likely To Worsen U.S. and Global Dead Zones: The problem is that the number of dead zones' temperatures are increasing due to several factors. -- The data that was included was the median temperature. -- Some questions are What is the impact of local disasters (fires) on local dead zones? How do participation levels effect the amount of Dissolved Oxygen? — JAMIE JAY SUMMERS

Article: "Climate change is suffocating large parts of the ocean" Problem: The amount of low oxygen is starting to have a big impact on fish. 1.How do they know it is a low oxygen area ? 2.What size does the area have to be determined a dead zone? 3. Why do we know so LITTLE about the ocean problems? Can we find something to treat the harm on the fishes? The data they give is the world ocean has lost 2% of oxygen in the lat 50 years etc.

— LUEVANON052010

The problem is that the number of dead zones are doubling every decade since the 1960s. What contributing factors are causing this? What methods that we apply to research this further? Can we make some predictions based on what we have seen?

— MARIA CROUSE

A Killer Lake: 1. What is the problem? What lead to the death of the families/ animals? 2. What kinds of data are included? The location of where it takes place and how deep the lake is. 3. What else do you need to know? Why many of them were noticeably blue around their lips. Basics of volcanos and lake formation. Research Questions: What is the relationship between the hydrology of the lake, and the deaths of the people/ animals?

— ARIANNA LEBLANC

The problem is the increase in nitrogen runoff leading to dead zones, which will be exacerbated by climate change. Cultural practices and identity are a challenge to enacting change. — KGOSS4

JANELLE JOHNSON JUN 04, 2019 12:24PM

Career

In what kinds of careers would it be helpful to understand water quality and dissolved oxygen?

JANELLE JOHNSON JUN 04, 2019 06:19AM

Case Study Jigsaw

Lack of oxygen killing marine life in Hood Canal waters

Originally published August 28, 2015 at 7:16 pm Updated August 31, 2015 at 3:11 pm

Retrieved online at https://www.seattletimes.com/author/hal-bernton/

Lack_of_oxygen_killing_marine_life_in_Hood_Canal_waters.docx

Word document

PADLET DRIVE

JANELLE JOHNSON JUN 04, 2019 06:20AM

Case Study Jigsaw

oxygen

- By Barbara Juncosa on October 1, 2008
- Retrieved online at https://www.scientificamerican.com/article/climate-change-dead-zones/?redirect=1

"Wasteland" conjures up visions of dusty desolation where life is fleeting and harsh—if it exists at all. Oceans, too, have their inhospitable pockets. Scientists are discovering that climate change—and not just fertilizer from farm use—may be spurring the emergence of barren underwater landscapes in coastal waters. Expanding dead zones not only spell trouble for biodiversity, but they also threaten the commercial fisheries of many nations.

Dead zones are not new; they form seasonally in economically vital ecosystems worldwide, including the Gulf of Mexico and Chesapeake Bay. Agricultural runoff sparks many of these die-offs; increased use of nitrogen fertilizers has doubled the number of lifeless pockets every decade since the 1960s, resulting in 405 dead zones now dotting coastlines globally.

But lesser-known wastelands are also emerging—without nutrient input from farms. Alarms about such dead zones first sounded in Oregon during the summer of 2002. Usually "we see many schools of fish and lots of different species," says David Fox of the Oregon Department of Fish and Wildlife, but surveys revealed dead fish and invertebrates littering the seafloor. The culprit was hypoxia—low-oxygen conditions, which can occur after the decomposition of organic matter in areas where deep waters well up to the surface.

The emergence of hypoxic areas so close to shore has startled researchers, comments Jack Barth, a physical oceanographer at Oregon State University. A decade ago scientists needed to sail out 50 miles or more to find hypoxic water off Oregon, but he says, the zone was now so close that "a long baseball homer hit off of highway 101" could land in it. To scientists' surprise and dismay, "hypoxia has become a feature of the coast," with

Climate_change_may_be_sparking_new_and_bigger.docx

Word document

PADLET DRIVE

JANELLE JOHNSON JUN 04, 2019 06:20AM

Case Study Jigsaw

JANELLE JOHNSON JUN 04, 2019 06:20AM

Case Study Jigsaw

A new study says warming has reduced the oxygen levels in large swaths of the deep ocean, threatening marine life around the world.

Retrieved online at https://news.nationalgeographic.com/2018/01/climate-change-suffocating-low-oxygen-zones-ocean/

BY CRAIG WELCH
PUBLISHED JANUARY 4, 2018

ONE DAY MORE than a decade ago, Eric Prince was studying the tracks of tagged fish when he noticed something odd. Blue marlin off the southeastern United States would dive a half-mile deep chasing prey. The same species off Costa Rica and Guatemala stayed near the surface, rarely dropping more than a few hundred feet.

Prince, a billfish expert who has since retired from the National Oceanic and Atmospheric Administration, was stumped. He'd studied blue marlin off the Ivory Coast and Ghana, Jamaica and Brazil, and he'd never seen anything like it. Why wouldn't these expert divers dive?

The billfish, it turns out, were trying to avoid suffocation. The marlin near Guatemala and Costa Rica wouldn't plunge into the murky depths because they were avoiding a deep, gigantic and expanding swath of water that contained too little oxygen. The discovery was among the first examples of the many ways sea life is already shifting in response

Climate_Change_Is_Suffocating_Large_Parts_of_the_Ocean.docx

Word document

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JANELLE JOHNSON JUN 04, 2019 06:21AM

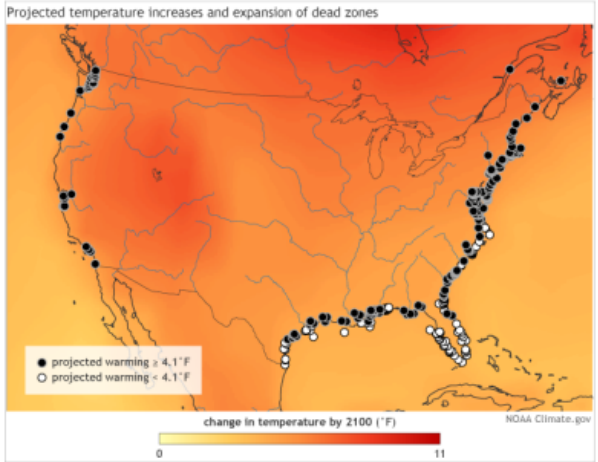
Case Study Jigsaw

Climate.gov
science & information for a climate-smart nation

Climate change likely to worsen U.S. and global dead zones

Author: Emily Greenhalgh

February 2, 2015



Reviewer:
Keryn Bromberg Gedan

Dead zones—coastal regions where bottom waters are so low in dissolved oxygen during the summer that marine life can't survive—are expected to increase in both size and number as climate change intensifies. In shallow, isolated estuaries and coastal seas where dead zones are most common, water temperature is closely linked to air temperature. Because of that connection, ocean scientists predict that global warming will have a

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Case Study Jigsaw

Published on *InsideClimate News* (https://insideclimatenews.org)

How Climate Change Will Worsen Algae and Dead Zones

More rain means more nitrogen runoff into rivers, fueling algae growth. Scientists expect a 19% increase in the U.S., and they're looking for solutions.

By Bob Berwyn, InsideClimate News

Jul 27, 2017

Water quality in the Northeast, Upper Mississippi River Basin and Great Lakes Basin are at the highest risk in the U.S. as nitrogen runoff increases with more intense rainfall, a new study shows. Credit: Robert Ashworth/CC-BY-2.0

Intensifying rainfall linked with a warmer and wetter atmosphere is increasing nitrogen pollution in rivers and oceans, exacerbating algae growth and expanding dead zones in coastal areas.

A new study [1] in the journal *Science* shows how that intensifying rainfall will affect the nitrogen cycle as the planet warms.

If countries continue to pump out greenhouse gases at a high rate, the amount of nitrogen going into American rivers could surge 19 percent by the

How_Climate_Change_Will_Worsen_Algae_and_Dead_Zones.pdf

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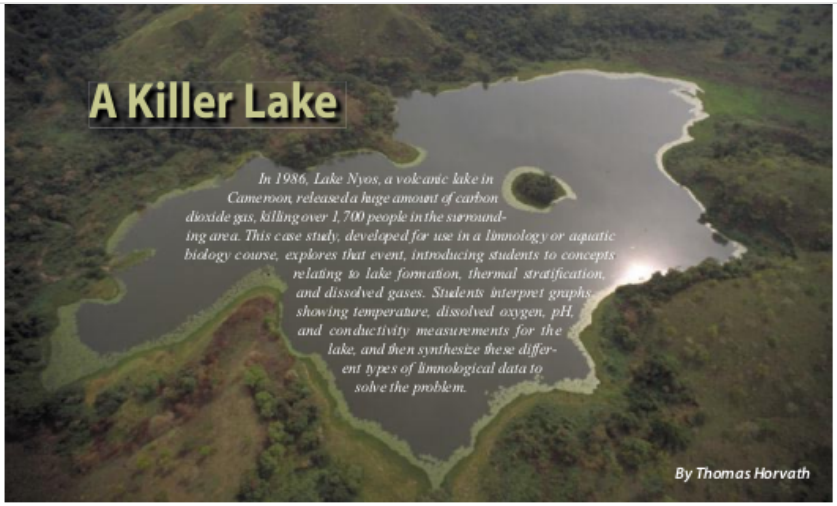

The case

On August 22, 1986, Milla was returning to his village of Lower Nyos, Cameroon. He had spent the past week with his small cattle herd in the highlands, where grazing was much better at this time of year. It was early morning and Milla was slowly approaching the village. He looked forward to hearing the voices of his fellow villagers. It was rare to see, much less talk, with another person in the highland fields.

The last few months had been warm and dry in the lowlands, but now the temperature was cooling. In fact, it had been quite cool the past few nights and the late summer rains were returning. Milla could tell that it had rained hard the night before. The ground was still wet in places. But something was different. Usually when conditions were this wet, the insects, particularly the biting flies, were very active, but Milla hadn't had to swat a single mosquito. Suddenly, Milla noticed an unusual sight just off the path. It was a lone cow lying motionless in the grass. Milla was sure it was dead, but he wanted to identify it so he could inform the owner once he arrived in Lower Nyos.

Milla's own cattle had slowed down because of the wet ground, which gave him a chance to investigate. He often encountered dead animals along the commonly traveled paths but rarely cattle, and something was very strange this time. The carcass wasn't warm, so it had been dead for some time, but there was no rotting smell, no swarming flies.

Milla began to worry. As he surveyed the area, looking for some clue that might help him understand this strange sight, it only got worse. He noticed another animal a few meters away. Same situation: a dead cow and no signs of decomposers. Ominously, he could see many more cattle lying on the ground.

Frightened, Milla began to run down the path. He knew that the Achirri family lived just outside the village. He would wake them and they would help him to understand this strange scene of death. As he approached the Achirri home, he repeatedly called out to them, "Achirri! Achirri! Please come see the cattle! They are lying dead in the fields. All of them!"

By the time he reached their door, he was short of breath. He was so upset he almost entered their home without permission. Again he spoke in breathless tones, "Please, Achirri, wake up and follow me into the upper field. They are dead. The cattle are dead and no life can be found!" But there was no response.

Looking through the doorway, Milla could see that the family was still in bed sleeping. He spoke louder, "Please wake, I have to show you the cattle lying dead in the upper field! Please wake up and come with me!" No one stirred.

Frantic, Milla went inside the house and began to shake the man in

Thomas Horvath (horvattg@oneonta.edu) is an assistant professor in the Biology Department at SUNY College at Oneonta, New York.

Killer_Lake.pdf

PDF document

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Case Study Jigsaw

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Case Study Jigsaw

Videos:
https://www.youtube.com/watch?v=5zWmdHmJMd0
Ted talk 12 min – the Dead Zone of Gulf of Mexico

https://www.youtube.com/watch?v=rK_mEHqx7rw
2:30 min video – Dead Zone 2015: focus Gulf of Mexico

https://www.youtube.com/watch?v=0JnKkit5ocI

15 min video Nat Geo - Sick fish, Eutrophication & Dead Zones (NatGeo)

https://www.youtube.com/watch?v=Y70I_kADGQY

10 min video The Weather Channel – Toxic Lake: The Untold Story of Lake Okeechobee

https://www.youtube.com/watch?v=K_sLmKkC6yk

3 min CBS news - Toxic algae bloom threatens Florida waters

https://www.youtube.com/watch?v=b6JzL4NG26k

PBS 6 min video – Saving the Great lakes from toxic algae

https://www.youtube.com/watch?v=gMwQaHtK904

Battling the Bloom (lake Erie) - 7 min video

JANELLE JOHNSON JUN 04, 2019 06:40AM

Teacher Hat

What are some possible performance assessments that would help your students meet your grade level standards? (e.g. Winogradsky columns, posters, TED talks, etc.)

Podcast PSAs on radio station — **JANELLE JOHNSON**

Environmental issues Earth Day: gallery walk with VR projects — **JANELLE JOHNSON**

JANELLE JOHNSON JUN 04, 2019 06:25AM

Links & Resources

Examples of student work, curriculum, etc.

- Tabuk well water and its impact on soil
- Type of running water in the Wadi Uday
- STUDY ON IMPACTS OF SAND AND DUST STORMS ON ENVIRONMENT IN NAWAN AREA
- Using The lake Water Of King Fahd Dam at WadiBisha in Fish Farming with the most Updated Techniques.
- Study of water quality from water sources supporting agricultural areas and use some floating plants to improve water quality.
- Characterization of physico-chemical parameters of water with the metabolism of cultivable bacteria in the Rochester School's artificial reservoir
- Comparing Water Quality Data Before And After Improvements To The Combined Sewer Overflow

From Christi:

- **GREAT Dissolved Oxygen VIDEO FROM MIT K-12:** **https://www.youtube.com/watch?reload=9&v=oVW5LAzd7Ec**
  - The references of the video has catfish case study
- Citizen Science for Dissolved Oxygen Monitoring: Case Studies from Georgia and Rhode Island. https://www.liebertpub.com/doi/abs/10.1089/ees.2017.0218
- Dissolved oxygen and temperature fact sheet (Rhode Island): http://cels.uri.edu/docslink/ww/water-quality-factsheets/DO-Temp.pdf
- Dissolved oxygen declining in one of the cleanest lakes in the world, Flathead Lake: https://flatheadlakers.org/explore/water-quality/

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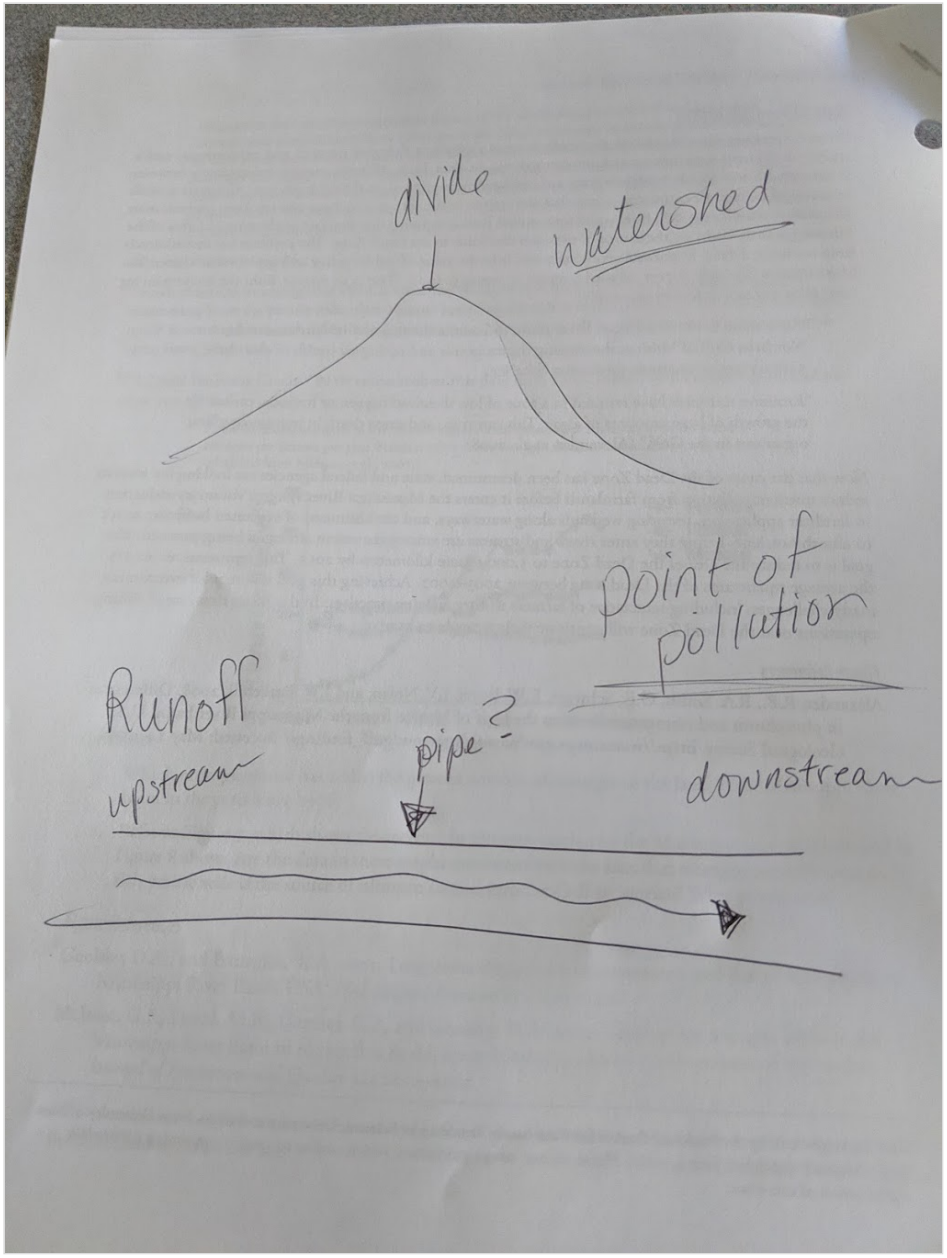
JANELLE JOHNSON JUN 04, 2019 06:36AM

Career Pathways

ANONYMOUS JUN 05, 2019 10:52AM



DESA DEBANE JUN 06, 2019 02:31PM

Oiled Birds Socratic Lab APES

This is the Socratic Lab I did with the APES classes. This word doc includes my teacher notes and the list of questions I had on hand to progress the Socratic Lab.

Effects of Oil Spills

Background: The impacts of environmental pollution are often difficult to see. A major oil spill, however, provides dramatic evidence of potential impact to wild life. Many people are involved in efforts to prevent oil spills and their consequences as well as help clean-up efforts should an accident occur. Such actions are not always successful and sometimes have unfortunate consequences as well. The purpose of this activity is to examine some of the possible consequences of oil spills on birds.

Effect of oil spills on feathers

1.Examine a feather with a magnifying glass. Weigh the feather using the scale provided.
Weight: _____

2.Now simulate an oil spill by dipping the feathers in oil. Remove the feather and record your observations below (What does it look like?).

3.Clean the feather in the soapy water. Once cleaned of the oil, rinse the feather in the water bath to remove any suds.

4.Using low heat and low speed *gently* dry the feather with the blow-dryer. Weight the feather once its dry.
Weight: _____

Note any observations before, during and after the cleaning:

The Effects of Oil Spills Lab and Socratic Seminar
Word document

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CHRISTINA BUFFINGTON JUN 06, 2019 02:56PM

How-to Guide Socratic Seminar

4 types... by Dr. Estee Aiken

Socratic Discussions: Seminars to Circles to Fishbowls and Beyond

AGATE Spring Conference 2015

Presented by Estee Aiken, Ed. D.

Department of Education, The University of Montana Western

estee.aiken@umwestern.edu

Socrates, a Greek philosopher who lived from 469-399 BC, taught in the streets of Athens. His teaching was grounded i questioning. Through the questions he asked, his students could come to deeper understandings of themselves and th knowledge. Socratic Discussions are founded on this basic idea—the teacher's role is to ask questions, not give answe Ultimately, the students become the teachers as they not only work to answer questions, but ask them, as well. This is v the true power of a Socratic Discussion lies. Traditionally, teachers ask questions to which they already know the answe and then judge students' understandings by whether or not "correct" answers can be given. In a Socratic Discussion, questions are authentic to the learners. There are no "right" answers. Through open dialogue, new understanding is constructed.

In order to scaffold the skills necessary to participate in meaningful Socratic Discussions, teachers must model question that supports higher-order thinking skills and teach students how to do the same. Further, as students develop skills to g their own discussions, teachers are able to become observers and use their observations for formative assessment and guidance for future learning experiences.

There are a variety of ways in which to foster Socratic Discussions in a classroom. Different methods are better suited t different communities of learners, time frames, and/or content.

Type of Socratic Discussion	Description	Time Ne
Socratic Seminars	Socratic Seminars are the most traditional form of Socratic Discussion. Students guide the conversation as they explore their own questions about a topic. In order to facilitate this type of discussion, students usually sit in a circle so they can see all group members. Students do not need to raise their hands in order to indicate that they would like a turn to speak. Rather, as in real discussions, they observe others' cues and interact with the flow of the conversation.	**Preparat** 15-60 mi **Discussi** 20-60 mi **Processi** 0-15 min
Fishbowl Discussions	In a Fishbowl Discussion, not all students are invited to the discussion at one time; instead, some students (4-6) are in the "fishbowl" participating while others listen from the periphery. The students outside of the "fishbowl" can "tap in" when they want to participate in the discussion and a participant in the "fishbowl" exchanges places with the student who would like to participate. The teacher can require that all students participate in the "fishbowl" or participation can be optional.	**Prepara** 0-15 min **Discussi** 10-20 m **Process** 0-15 min

Socratic seminar how-to

PDF document

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UNIT TWELVE: SOCRATIC SEMINAR

Introduction

Socrates believed that enabling students to think for themselves was more important than filling their heads with "right answers." In a Socratic Seminar, participants seek deeper understanding of complex ideas through rigorously thoughtful dialogue. A Socratic Seminar fosters active learning as participants explore and evaluate the ideas, issues, and values in a particular text. The skills that students develop through participation in Socratic Seminars are crucial for college success.

This unit includes step-by-step guidelines for implementing Socratic Seminars in your AVID classroom including several pages of information to help you prepare yourself and your students to engage in meaningful and productive Socratic Seminars. Successful Socratic Seminars are dependent upon ***groups*** of students developing skills together over time. Your first attempts may not be entirely satisfactory to you or your students, and it is important that you leave time at the end of each seminar to debrief and reflect on the process itself and the skills that the group is developing. The group may set goals for the next seminar. Activity sheets to support this process are included.

It is imperative that students understand several concepts before you attempt a Socratic Seminar. These include:

- the difference between dialogue and debate
- the four elements of Socratic Seminar
- the role of the seminar leader
- the role and responsibilities of the participants
- the guidelines for seminar behavior

Be sure that you use the information in this unit to adequately prepare your students for the Socratic Seminar before you begin. Many AVID teachers use Philosophical Chairs as a skill-building activity in preparation for Socratic Seminar. This is an excellent strategy, but it is also important to distinguish for students the differences between the two activities.

Socratic Seminar is a necessary element in every AVID program, and successful seminars have been implemented in AVID classrooms at every grade level. Your team of AVID elective teachers should decide when the implementation of this strategy fits best into your articulated curriculum. The following are suggestions for grade level expectations and differentiation.

6th/7th/8th Grade

- Use Philosophical Chairs to develop students' skills before beginning Socratic Seminar.
- Select a text that is short, no more than one to two pages.

Appendix B_ AVID Socratic Seminar_ Buffington Lesson 16

PDF document

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CHRISTINA BUFFINGTON JUN 06, 2019 02:55PM

Socratic Seminar guide by AVID

This was/is my Socratic discussion go-to guide

CHRISTINA BUFFINGTON JUN 06, 2019 02:55PM

Socratic Seminar - Law of Conservation of Matter Lesson Plan

Understanding by Design-format for 8th grade physical science

	valid reasoning and relevant and sufficient evidence.
TITLE (if applicable): **Socratic Discussion: "What is fire" and/or "What happens to matter when it burns?"**	

Information from UbD Stage 1: Desired Results

Competency (Key knowledge, skill and/or misconceptions will be addressed):	K1: Ancient Greek theory proposed that matter consisted of four elements: earth, air, wind and fire; K2: Background information of science at the time of Antoine Lavoisier. K3: Lavoisier's writings and experiments led to the Law of Conservation of Matter and the first chemical revolution. K4: The Law of Conservation of Matter is often misunderstood today, causing misuse of resources.
Enduring Understanding(s):	U1: Matter is not created or destroyed in transformations; it is conserved. U2: Revolutions in science long ago affect our lives today. U3: Conceptual models are used to demonstrate and explain ideas in science. U4: Conceptual models change as revolutions in science continue to unfold.
Essential Question(s) – could be used as an Academic Prompt):	Q1: What happens to the mass of a metal when it rusts or burns? Q2: Where did matter go? Where did matter come from? Q3: What are examples in our lives of the Law of Conservation of Matter? Q4: How do misconceptions of scientific laws and theories lead to problems in human societies and the environment?

Differentiated Instruction needed to ensure all learners have access to this learning (including SPED and Gifted)

Modifications:	Accommodations:
Students with IEPs and 504 plans will be placed as a "co-pilots" to a "pilot," or as a "pilot" if willing (Figure 1, AVID, nd). Co-pilots observe the discussion using a checklist adapted to specific learning needs. I will post "sentence starters" on the board (Appendix A), Gifted students, who thrive on added complexity (Byrd, 2015)	All students prepare for the Discussion by selecting one behavior to work on (Appendix C). After the first 3-5 minutes of the discussion, pilots and co-pilots discuss the readings and refine questions and have an opportunity to trade places

UbD Learning Plan Format_Buffington Lesson 16

Word document

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GLOBE Hydrosphere

JANELLE JOHNSON JUN 04, 2019 07:27AM

SEPs

Observing the Site

- Developing and using models

Outdoor Data Collection

- Planning and carrying out investigations

Comparing the Data

- Developing and using models
- Using mathematical and computational thinking

AST

- Group work for participation

JANELLE JOHNSON JUN 04, 2019 07:05AM

Vernier Probeware

INSTRUCTOR INFORMATION **Experiment 19**

Dissolved Oxygen in Water

1. In the Electronic Resources you will find multiple versions of each student experiment—one for each supported data-collection software or app (Logger *Pro*, Graphical Analysis 4, Spectral Analysis, LabQuest App, and EasyData). Deliver to your students the version that supports the software and hardware they will use. Sign in to your account at **vernier.com/account** to access the Electronic Resources. See Appendix A for more information. **Note**: The printed version of the book and the PDF of the entire book (found in the Electronic Resources) include only the Logger *Pro* versions of the experiments.
2. Different styles of dissolved oxygen probes can be used for this experiment: Dissolved Oxygen Probes and Optical DO Probes. All versions of the experiment can be found in the Electronic Resources. **Note**: The printed version of the book and the PDF of the entire book contain the Optical DO Probe version of the experiment.
3. Temperatures of 5, 10, 15, 20, 25, and 30°C are typical.
4. When students are adding ice into their milk container, warn them to not add more than will melt while they are shaking the container.
5. If you are using Go Direct sensors, see **www.vernier.com/start/go-direct** for information about how to connect your sensor.
6. For additional information about the Vernier probeware used in this experiment, including tips and product specifications, visit **www.vernier.com/manuals** and download the appropriate user manual.

Dissolved Oxygen Probe Users Only

7. While the instructions for calibrating the Dissolved Oxygen Probe are included in the student instructions, it is not necessary to calibrate the Dissolved Oxygen Probe for this experiment. These instructions can be deleted from the student procedure.
8. If you calibrate a Dissolved Oxygen Probe using Logger *Pro* or LabQuest App, you can store the calibration directly on the probe (this cannot be done using EasyData). Once the calibration has been stored on the probe, it will be used automatically each time the probe is connected to an interface. Directions about how to store the calibration are included in the student version of this experiment. **Note**: Due to various factors, such as changes in the characteristics of the membrane over time, the stored calibration should be updated every few weeks.
9. In order for the Dissolved Oxygen Probe to warm up and stay polarized, power to the sensor must be continuous. LabPro, LabQuest, and CBL 2 deliver continuous power once the data-collection software is started even if the screen goes to sleep. However, EasyLink used with a TI-84 graphing calculator and the EasyData App stops powering the sensor when the calculator goes to sleep. The calculator goes to sleep to conserve battery power if no user

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Vernier Probeware

Graphical Analysis **19**

Dissolved Oxygen in Water

(Optical Dissolved Oxygen Probe)

Aquatic life depends upon oxygen dissolved in water, just as organisms on land rely upon oxygen in the atmosphere. Molecular oxygen is used by organisms in aerobic respiration where energy is released during the combustion of sugar in the mitochondria. Without sufficient oxygen, they suffocate. Some organisms, such as salmon, mayflies, and trout, require high concentrations of oxygen in the water. Other organisms, such as catfish, midge fly larvae, and carp can survive with much less oxygen.

Oxygen dissolves at the interface between the water and the air or when aquatic autotrophs release oxygen as a byproduct of photosynthesis. Abiotic factors including temperature and pressure influence the maximum amount of oxygen that can be dissolved in pure water. Biotic life also influences the amount of oxygen that is dissolved.

The following table indicates the oxygen and temperature tolerance level of selected animals. The quality of the water can be assessed with fair accuracy by observing the aquatic animal populations in a stream. These assessments are based on known dissolved oxygen tolerance. If a stream has only species that can survive at low oxygen levels, it is expected to have low oxygen levels.

Table 1

Animal	Temperature range (°C)	Minimum dissolved oxygen (mg/L)
Trout	5–20	6.5
Smallmouth bass	5–28	6.5
Caddisfly larvae	10–25	4.0
Mayfly larvae	10–25	4.0
Stonefly larvae	10–25	4.0
Catfish	20–25	2.5
Carp	10–25	2.0
Water boatmen	10–25	2.0
Mosquito	10–25	1.0

BWV_19_Dissolved_Oxygen__ODO_Probe_.pdf

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RICH WAGNER JUN 03, 2019 03:26PM

GLOBE Hydrosphere Investigation Data Sheet

Hydrosphere Investigation

Data Sheet

School name: _____ Class or group name: _____

Name(s) of Student(s) collecting data: _____

Measurement Time: *

Year: _____ Month: ____ Day: ____ Time: __:__ (UT) Time: __:__ (Local)

Name of Site : _____

Water State: (check one) *

❒ Normal ❒ Flooded ❒ Dry ❒ Frozen ❒ Unreachable

Note: If Normal is selected, continue below; all other selections stop here

Sky Conditions (Check one):

- ❑ Clear (no Clouds Visible)
- ❑ Clouds Visible (1% to 100% Covered by Clouds or Contrails)
- ❑ Obscured (More than 25% of the Sky is not Visible)

Note: selecting ***Obscured*** will prevent data entry on clouds and contrails; therefore skip the cloud type and cover and the contrail type and cover sections and proceed to the Obscured section. If clouds and contrails are visible in non-obscured areas of the sky, these data can be entered in the Metadata field.

If Clouds are Visible select all Cloud Types Seen

High (in the sky):
(Check all types seen)


❑ Cirrus


❑ Cirrocumulus


❑ Cirrostratus

Middle (of the sky):
(Check all types seen)


❑ Altostratus


❑ Altocumulus

Low (in the sky):
(Check all types seen)


❑ Stratus


❑ Stratocumulus


❑ Cumulus

Rain or Snow Producing Clouds:

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PDF document

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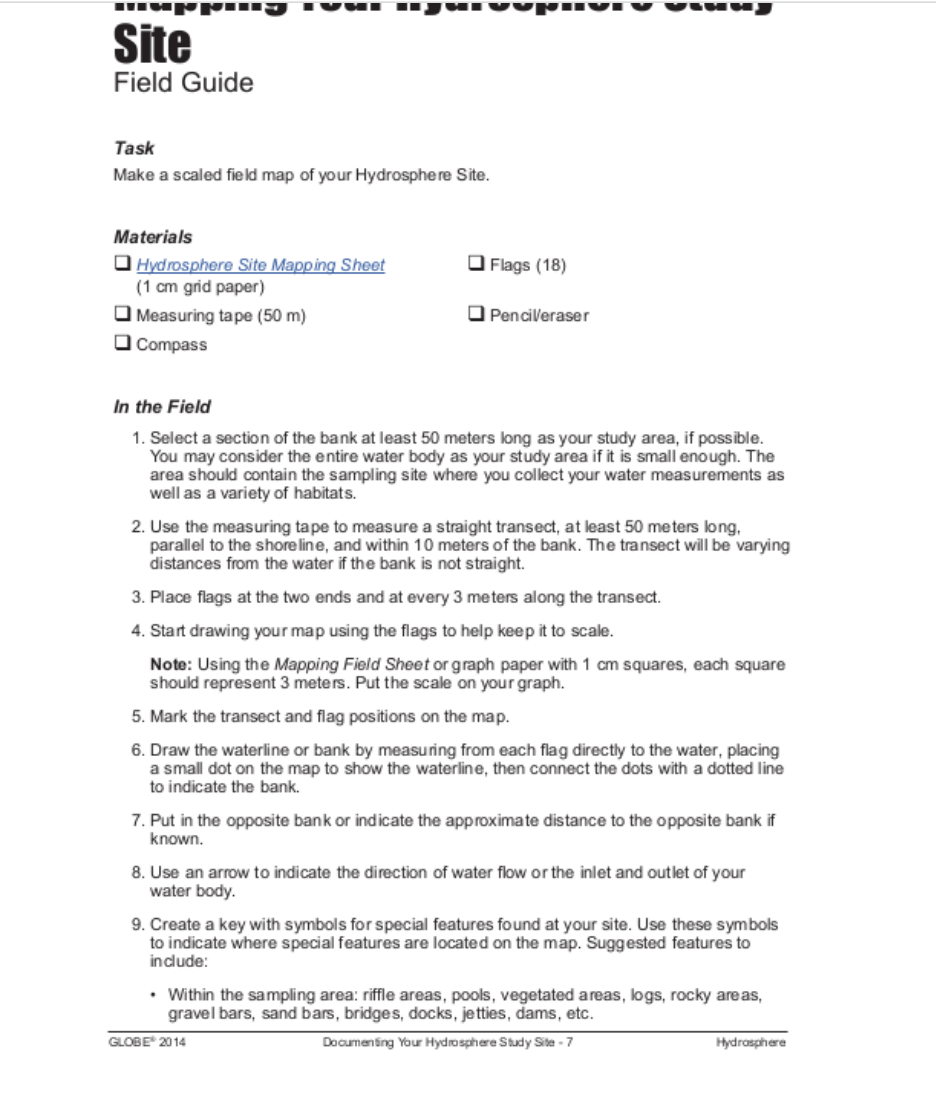
RICH WAGNER JUN 03, 2019 03:39PM

GLOBE Mapping Hydrosphere Site



Mapping Your Hydrosphere Study Site

Field Guide

Task

Make a scaled field map of your Hydrosphere Site.

Materials

- ❑ *Hydrosphere Site Mapping Sheet* (1 cm grid paper)
- ❑ Measuring tape (50 m)
- ❑ Compass
- ❑ Flags (18)
- ❑ Pencil/eraser

In the Field

1. Select a section of the bank at least 50 meters long as your study area, if possible. You may consider the entire water body as your study area if it is small enough. The area should contain the sampling site where you collect your water measurements as well as a variety of habitats.
2. Use the measuring tape to measure a straight transect, at least 50 meters long, parallel to the shoreline, and within 10 meters of the bank. The transect will be varying distances from the water if the bank is not straight.
3. Place flags at the two ends and at every 3 meters along the transect.
4. Start drawing your map using the flags to help keep it to scale.

   Note: Using the *Mapping Field Sheet* or graph paper with 1 cm squares, each square should represent 3 meters. Put the scale on your graph.
5. Mark the transect and flag positions on the map.
6. Draw the waterline or bank by measuring from each flag directly to the water, placing a small dot on the map to show the waterline, then connect the dots with a dotted line to indicate the bank.
7. Put in the opposite bank or indicate the approximate distance to the opposite bank if known.
8. Use an arrow to indicate the direction of water flow or the inlet and outlet of your water body.
9. Create a key with symbols for special features found at your site. Use these symbols to indicate where special features are located on the map. Suggested features to include:
   - Within the sampling area: riffle areas, pools, vegetated areas, logs, rocky areas, gravel bars, sand bars, bridges, docks, jetties, dams, etc.

GLOBE© 2014 Documenting Your Hydrosphere Study Site - 7 Hydrosphere

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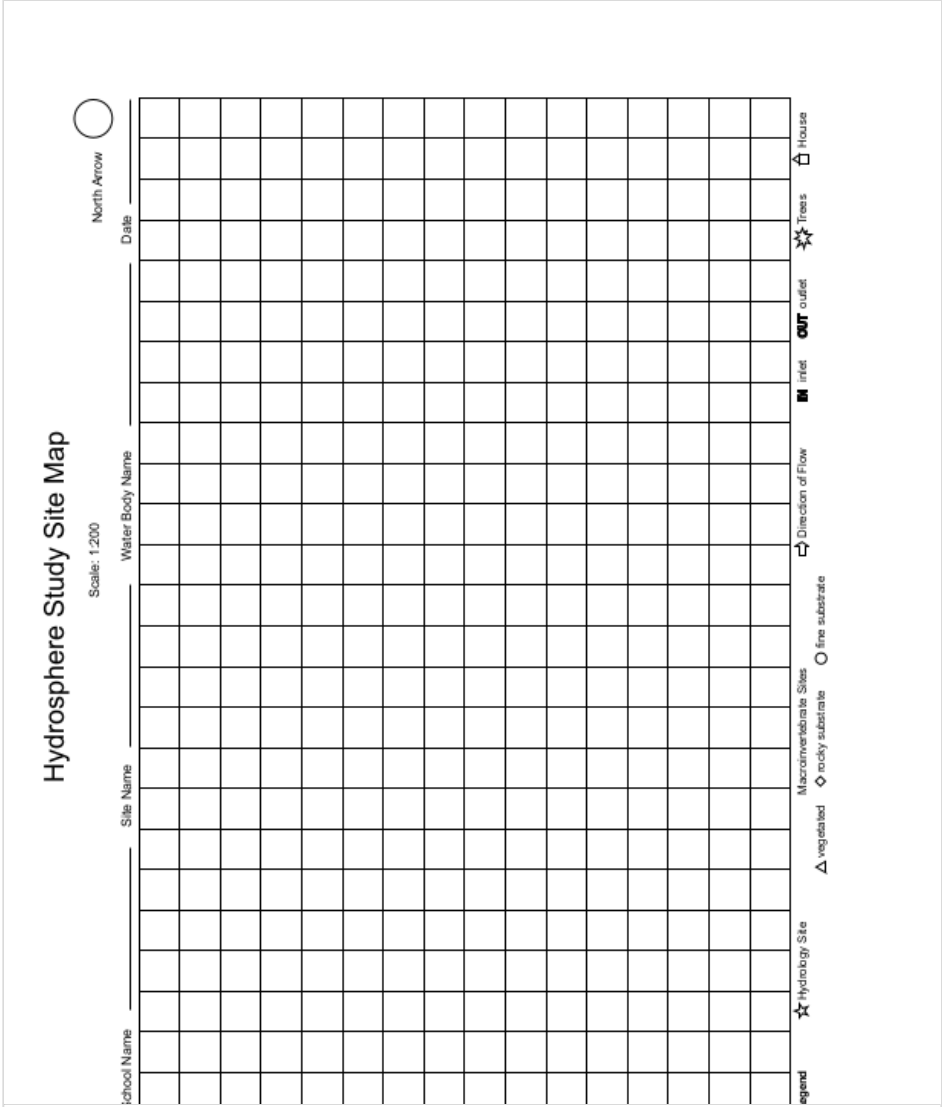
PDF document

GLOBE



Hydrosphere Study Site Map

Scale: 1:200

North Arrow

Date

Water Body Name

Site Name

School Name

Legend

Hydrology Site

vegetated

Macroinvertebrate Sites

rocky substrate

fine substrate

Direction of Flow

IN inlet

OUT outlet

Trees

House

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PDF document

GLOBE

RICH WAGNER JUN 03, 2019 03:41PM

GLOBE Hydrosphere Site Map

RICH WAGNER JUN 03, 2019 03:56PM

GLOBE Dissolved Oxygen Protocol

Dissolved Oxygen Protocol

Welcome | Introduction | Protocols | Learning Activities | Appendix

Purpose

To measure the amount of oxygen dissolved in water

Overview

Students will use a dissolved oxygen kit or probe to measure the dissolved oxygen in the water at their hydrosphere study site. The exact procedure depends on the instructions in the dissolved oxygen kit or probe used.

Student Outcomes

Students will learn to:

- use a dissolved oxygen kit or probe;
- use technology in the classroom (DO probe);
- examine reasons for changes in the dissolved oxygen of a water body;
- communicate project results with other GLOBE schools;
- collaborate with other GLOBE schools (within your country or other countries); and
- share observations by submitting data to the GLOBE science database.

Science Concepts

Earth and Space Science

Earth materials are solid rocks, soils, water and the atmosphere.

Water is a solvent.

Each element moves among different reservoirs (biosphere, lithosphere, atmosphere, hydrosphere).

Physical Sciences

Objects have observable properties.

Life Sciences

Organisms can only survive in environments where their needs are met.

Earth has many different environments that support different combinations of organisms.

Organisms change the environment in which they live.

Humans can change natural environments.

All organisms must be able to obtain and use resources while living in a

Scientific Inquiry Abilities

Use a chemical test kit or probe to measure dissolved oxygen.

Identify answerable questions.

Design and conduct scientific investigations.

Use appropriate mathematics to analyze data.

Develop descriptions and explanations using evidence.

Recognize and analyze alternative explanations.

Communicate procedures and explanations.

Time

Kit: 20 minutes

Kit Quality Control Procedure: 20 minutes

Probe Setup: 20-30 minutes

Probe measurements: 10 minutes

Level

Middle and Secondary

Frequency

Weekly

Quality Control Procedure every 6 months

Probe calibration every time probe is used

Materials and Tools

Hydrosphere Investigation Data Sheet

Dissolved Oxygen Protocol (Test Kit) Field Guide

Dissolved Oxygen Protocol (Probe) Field Guide

Dissolved oxygen kit or probe

Latex gloves

Safety goggles

Waste bottle with cap

Distilled water

For dissolved oxygen kit Quality Control Procedure:

- 100-mL graduated cylinder
- 250-mL polyethylene bottle with lid
- Clock or watch
- Thermometer
- *Solubility of Oxygen Table*
- *Correction for Elevation Table*
- *Hydrosphere Investigation Quality Control Procedure For Dissolved Oxygen Kits Data Sheet*

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PDF document

GLOBE

RICHARD WAGNER JUN 04, 2019 09:26AM

GLOBE Water Temperature Protocol

Water Temperature Protocol for Thermometer Probes

Field Guide

Task

Measure the temperature of your water using a calibrated meter and thermometer probe.

What You Need

- ☐ *Hydrosphere Investigation Data Sheet*
- ☐ Clock or watch
- ☐ Calibrated meter and probe
- ☐ Latex gloves
- ☐ Pen or pencil

In the Field

1. Make sure that your temperature probe and meter have been calibrated within the last 24 hours (see *Calibrating an Alcohol-filled Thermometer Lab Guide*)
2. Fill out the top portion of your *Hydrosphere Investigation Data Sheet*.
3. Put the probe or the into the sample water to a depth of 10 cm.
4. Leave the probe in the water for three minutes.
5. Read the temperature on the meter without removing the probe from the water.
6. Let the thermometer probe stay in the water sample for one more minute.
7. Read the temperature again. If the temperature has not changed, go to Step 8. If the temperature has changed since the last reading, repeat Step 6 until the temperature stays the same.
8. Record the temperature on the *Hydrosphere Investigation Data Sheet*.
9. Have two other students repeat the measurement with new water samples.
10. Calculate the average of the three measurements.
11. All temperatures should be within 1.0˚ C of the average. If they are not, repeat the measurement.

GLOBE© 2014 Water Temperature Protocol - 6 Hydrosphere

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PDF document

GLOBE

TSU GLOBEME JUN 06, 2019 01:23PM

Cherry Creek Hydrosphere Sample Sites Map 6/6/19 - ArcGIS Online http://arcg.is/zXDLn

ID	Group	Site Name
1	A	Cherry Creek at Lawrence Bridge
2	B	Cherry Creek at Speer Street Bridge
3	C	Cherry Creek at Larimer Street Bridge
4	D	Cherry Creek near Speer and Larimer
5	E	Cherry Creek at Market Street

MULTI_STEM_Hydrology_Attribute_Table.xlsx

Excel spreadsheet

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The GLOBE Visualization (“Viz”) System

Viz ppt for MULTI

Powerpoint presentation

PADLET DRIVE

Data Visualizations

JANELLE JOHNSON JUN 04, 2019 07:23AM

SEPs

- Analyzing and interpreting data

AST

- Models and modeling

JANELLE JOHNSON JUN 04, 2019 07:08AM

GLOBE Viz System

JANELLE JOHNSON JUN 04, 2019 07:10AM

GLOBE Viz System Tutorial

For reference

Using the GLOBE Visualization System

(Reference Only) Viz tutorial (2)
Powerpoint presentation
PADLET DRIVE

KRISTIN WEGNER JUN 06, 2019 06:41AM

Data Viz Challenge!

Find this dataset:
•**Organization**: St. Francis Xavier Catholic School
•**Site**: 8th Grade Pond Monitoring Site
•**DateRange**: October 1, 2018 – March 20, 2019
•Filter Measurement (not datacounts)

- Student report: https://www.globe.gov/documents/10157/99058315-c9e9-4294-b949-c76e78a6dcec

- Student video: https://www.youtube.com/watch?v=Nx4Msabe7s8&feature=youtu.be

Claims, Evidence, Reasoning

JANELLE JOHNSON JUN 04, 2019 07:27AM

Socratic Lab

SEPs
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

AST
- Helping students talk about evidence
- Group work for participation

Socratic Lab ppt
Powerpoint presentation
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JANELLE JOHNSON JUN 04, 2019 07:13AM

Socratic Lab handout

Name: _____ Period: ____

Socratic Seminar Preparation & Brainstorming

TOPIC: Dissolved Oxygen and Water Temperature

Step 1: List what could possibly affect dissolved oxygen or water temp. in freshwater?

-
-
-
-
-

IV: Independent Variable; DV: Dependent Variable.

Step 2: Explore some of the factors you picked in Step 1 and put them in the blanks below. Then write what you think might happen and how you would know it happened.

Question #1: How does _____(IV) affect _____ (DV)?
What might happen? How would you know?

Handout for Socratic Lab

Word document

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MIKE JABOT JUN 05, 2019 06:18PM

Question Formulation Technique Resources

Teaching + Learning Archives - Right Question Institute

From Education Week's Special Report: 10 Big Ideas in Education: For educators seeking to nurture rather than stifle students' natural...

RIGHT QUESTION INSTITUTE

Teacher Hat: How can you incorporate this content and/or approaches with your grade level standards?

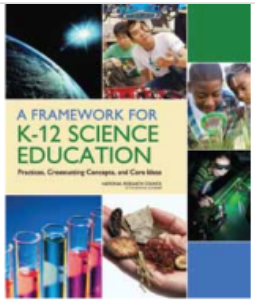
Please jot down your ideas here. (Article about the Scientific and Engineering Practices/SEPs attached.)

Reflection: Application in your Classroom

JANELLE JOHNSON JUN 06, 2019 09:28AM

Scientific and Engineering Practices in K–12 Classrooms

Understanding *A Framework for K–12 Science Education*



by Rodger W. Bybee

This morning I watched *Sesame Street*. During the show, characters "acted like engineers" and designed a boat so a rock could float. In another segment, children asked questions and made predictions about the best design for a simple car. They then built a model car and completed an investigation to determine which design worked best when the cars went down inclined planes. Children also learned that a wider base provided stability for a tower. And, among other segments, the children counted from 1 to 12 and explored the different combinations of numbers that equaled 12. Bert and Ernie had to move a rock and ended up "inventing" a wheel. These segments exemplify the science, technology, engineering, and mathematics (STEM) theme that *Sesame Street* is introducing in the show's 42nd season.

What, you ask, does this have to do with science and engineering practices in K–12 classrooms? The producers of *Sesame Street* decided that STEM practices were important enough that they are using them as substantive themes for the season, if not longer. Children watching *Sesame Street* will have been introduced to practices such as asking questions and defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data; using mathematics; constructing explanations and designing solutions; engaging in arguments using evidence; and obtaining, evaluating, and communicating information. True, these are sophisticated statements of practices, but many students will be introduced to them when they enter elementary classrooms.

In this article, I present the science and engineering practices from the recently released *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC 2011). I recognize the changes implied by the new framework, and eventually a new generation of science education standards will present new perspectives for the science education community. I am especially sensitive to the challenges for those students in teacher preparation programs and classroom teachers of science at all levels. Questions such as "Why practices and why not inquiry?" and "Why science *and* engineering?" are reasonable, and I will discuss them later. But to provide background and context, I first discuss the practices.

Understanding and applying the science and engineering practices

This section further elaborates on the practices and briefly describes what students are to know and be able to do, and how they might be taught. Figures 1 through 8 are adapted from the National Research Council (NRC) framework, with changes for clarity and balance. I have maintained the substantive content.

Even before elementary school, children ask questions of each other and of adults about things around them, including the natural and designed world. If students develop the practices of science and engineering, they can ask better questions and improve how they define problems. Students should, for example, learn how to ask questions of each other, to recognize the difference between questions and problems, and to evaluate scientific questions and engineering problems from other types of questions. In upper grades, the practices of asking scientific questions and defining engineering problems advance in subtle ways such as the form and function of data used in answering questions and the criteria and constraints applied to solving problems.

In the lower grades, the idea of scientific and engineering models can be introduced using pictures, diagrams, drawings, and simple physical models such as airplanes or cars. In upper grades, simulations and more sophisticated

Understanding the Framework Scientific and Engineering Practices in K–12 Classrooms

PDF document

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I am struggling to see a direct connection with the new content that I am going to be teaching this next year. There isn't a lot of water that is in the 3rd grade standards. I think I will be using more of the scientific mindsets, like the QFT, rather than specific GLOBE tests that we covered. — JAMIE JAY SUMMERS

I can't wait to use the QFT process with my students. I am always looking for ways to empower my students and give them the chance to be involved with the planning. I am looking forward to seeing how this will enhance engagement. Thank you! — MARIA CROUSE

Gathering data, and the importance collaborative analysis is so important for young learners. These last two days I have seen some great techniques of using tech to gather data, and the importance of organization and collaboration. I believe that these skills can help focal students engage and build their confidence. I love the ideas around questioning generated from students, and helping them understand the lab process. I have tried to the socratic seminar, but these ideas and strategies around this makes me want to go back and try this with new eyes. — TONY BULLOCK

I will be implementing the importance of giving roles to my students in data collection or any group activity. With being assigned a role, students are less likely to be off task. — ARIANNA LEBLANC

I will be using Socratic science labs for reflection on the process or experiment they engaged in. — KAY BOLERJACK

I really like the cloud materials, I feel like those would be easy for even the first graders to use! As well as using the DO prob. those are easy to use and you get a lot out of them! — LUEVANON052010

I am looking forward to creating an environmental science class at my school. The GLOBE program will fit perfectly with my vision for the class. — CARLOS HERNANDEZ

Using the socratic lab as a replacement to lab write ups. I would also use the information about DO, and have students go into the field and collect data. I could then have them compare data that is provided by GLOBE — MORGAN GURSS

We plan on integrating GLOBE/ citizen science across the board in the Upper elementary- from finding and defining a site to use over multiple years, learning and using a wide range of protocols, continuing to approach science from a spheres and systems approach, engaging in citizen science protocols each Friday to build skills, and incorporate the mathematics/ graphing as a significant part of our practical math curriculum. — KGOSS4

I really like the concept of older students mentoring younger students. David Padgett already does this and the community college students here at Metro will do this in the future. Alaska GLOBE teachers have high school students mentoring elementary students as well. — CHRISTINA BUFFINGTON

I plan to incorporate the use of the water and watershed theme shared by Jennifer B. This will be used to address standards for ecology, water cycle, chemistry, weathering, erosion & deposition, and environmental issues. — KATHLEEN JAKOBSEN

I will be incorporating the Dissolved oxygen protocol into a data and measurement PBL with my 4th and 5th graders. I will also do some further research into the Question Formulating Technique we learned about so I can have buy students formulate questions as a group. — JULIE PITZ

I can use this content to show my students that math and science are more intertwined than they think! — ALYSSA MAGIER

The Socratic discussion as an understanding of the laboratory activities we do as a means to analyze and synthesize applied scientific theories. — MATTHEW DAVIS

There are many different ways that this approach can be implemented into my classroom. I feel the most beneficial for my focal students, would be visuals. I could take each step and make a flowchart on a wall/bulletin board. This way the students would be able to see where they are within the process; and know how far they still have to go. The hardest struggle I have with my students is keeping the momentum. If they are able to see what is next, then they will also be able to see how far they have gone within the process aswell. This can translate smoothly into my PBL and inquiry teaching. — TARA KIMMEY

JANELLE JOHNSON JUN 06, 2019 09:29AM

Focal Student Hat: How can you apply this content and/or approaches with your focal students in mind?

What would you need to modify for this to work with your focal students? How do you think they would respond? (And check out Curriculum as Window and Mirror, Differentiated vs. Traditional Classrooms, the 5E modeland great resources from Ambitious Science Teaching below.)

I think the biggest thing my local student would take away is that they actually have a place in science. They have the ability to have their voice and ideas projected. — JAMIE JAY SUMMERS

I think the biggest thing my local student would take away is that they actually have a place in science. They have the ability to have their voice and ideas projected. — JAMIE JAY SUMMERS

My focal students will benefit from the movement, visuals, and atypical approaches to typical school work — ALYSSA MAGIER

QFT and Socratic discussions really helped my focal students in the past, though it often frustrated the students who were strong test-takers (who had aced science). I will look at additional QFT tools from Right Question Institute to figure out what is graded and what is not. — CHRISTINA BUFFINGTON

I can use all of this with my focal students because a lot of it is hands on and that is what works best with them! — LUEVANON052010

Gathering data from the field and seeing how that data is applied in the real world. — MORGAN GURSS

Any tool that I can use to provide support to accesses and use academic science language expands the learning of all my students. I feel this directly addresses the 5 E model. — KATHLEEN JAKOBSEN

Student J-This student struggles with math so I will be incorporating some data analysis into her math intervention group so that she is better prepared to access the information in the science activities. Student A- I will be using some leadership opportunities with his so that he has a chance to positively interact with his classmates. — JULIE PITZ

The opportunities for small group real world experiences out in nature will be deeply engaging for several of my focal students. — KGOSS4

QFT corroboration of questions will greatly help improve access to sciences — MATTHEW DAVIS

Visuals are key for my focal students. As I stated in my previous statement with the 'Teacher Hat', when planning my lessons, the focal student is always on my mind. I want to be able to reach all students. Although I am planning for the focal students, this will definitely benefit all. Along with visuals, repetition is key. The more they are able to see and hear, the more chance we have for them to lead to memorization. — TARA KIMMEY

JANELLE JOHNSON JUN 06, 2019 09:28AM

The 5E model

The 5 E's is an instructional model based on the constructivist approach to learning, which says that learners build or construct new ideas on top of their old ideas. The 5 E's can be used with students of all ages, including adults.
Each of the 5 E's describes a phase of learning, and each phase begins with the letter "E": Engage, Explore, Explain, Elaborate, and Evaluate. The 5 E's allows students and teachers to experience common activities, to use and build on prior knowledge and experience, to construct meaning, and to continually assess their understanding of a concept.

Enhancing Education: The 5 E's

Each of the 5 E's describes a phase of learning, and each phase begins with the letter "E": Engage, Explore, Explain, Elaborate, and Evaluate. The 5 E's allows students and teachers to experience common activities, to use and build on prior knowledge and experience, to construct meaning, and to continually assess their understanding of a concept.

WGBH

The 5 E model is fantastic. As a mixed age classroom where we have students for 3 successive years, supporting students building up on their understanding has been essential to real success. — **KGOSS4**

JANELLE JOHNSON JUN 06, 2019 09:28AM

Differentiated vs. traditional instruction

TABLE 4.1: Comparison of Differentiated and Traditional Classrooms

TRADITIONAL CLASSROOM	DIFFERENTIATED CLASSROOM
■ Student differences are masked or acted upon when problematic.	■ Student differences are studied as a basis for planning.
■ Assessment is most common at the end of learning to see "who got it."	■ Assessment is ongoing and diagnostic to understand how to make instruction more responsive to the learners' needs.
■ A relatively narrow sense of intelligence prevails.	■ Focus on multiple forms of intelligence is evident.
■ A single definition of excellence exists.	■ Excellence is defined in large measure by individual growth from a starting point.
■ Student interest is infrequently tapped.	■ Students are frequently guided in making interest-based learning choices.
■ Relatively few learning profile options are taken into account.	■ Many learning profile options are provided for during instruction.
■ Whole-class instruction dominates.	■ Many instructional arrangements are used in the classroom, including whole-class, small group, and individual learning.
■ Coverage of texts and curriculum guides drive instruction.	■ Student readiness, interest, and learning profile shape instruction.
■ Mastery of facts and skills out-of-context are the focus of learning.	■ Use of essential skills to make sense of and understand key concepts and principles is the focus of learning.
■ Single option assignments are the norm.	■ Multi-option assignments are frequently used.
■ A single text prevails.	■ Multiple materials are provided to students.
■ Single interpretations of ideas and events may be sought.	■ Multiple perspectives on ideas and events are routinely sought.
■ The teacher solves problems.	■ Students help other students and the teacher solve problems.
■ The teacher provides whole-class standards for grading.	■ Students work with the teacher to establish both whole-class and individual learning goals.
■ A single form of assessment is often used.	■ Students are assessed in multiple ways.

Differentiated & Traditional Classrooms copy

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Curriculum as Window and Mirror

Emily Style

Curriculum As Window and Mirror

Emily Style

Social Science Record, Fall, 1996. First published in *Listening for All Voices*, Oak Knoll School monograph, Summit, NJ, 1988.

Consider how the curriculum functions, insisting with its disciplined structure that there are ways (plural) of seeing. Basic to a liberal arts education is the understanding that there is more than one way to see the world; hence, a balanced program insists that the student enter into the patterning of various disciplines, looking at reality through various "window" frames.

Years ago a Peanuts cartoon illustrated this vividly for me. Schultz's dog Snoopy was pictured sitting at his typewriter, writing the cultural truth "Beauty is only skin deep." When the dog looked in the mirror however, it made more sense (to the dog) to write "Beauty is only fur-deep."

In the following day's comic strip, the bird Woodstock had apparently made a protest; Snoopy responded by shifting the definition to "feather-deep." Woodstock, too, had looked in the mirror and insisted on naming truth in a way that made the most sense to him.

Perhaps the only truth that remains, after such an exchange, is that "Beauty is," still no small truth to expound upon.

For me, the beauty of the classroom gathering lies in its possibilities for seeing new varieties of Beauty. This multiplicity, in turn, enables both students and teachers to be engaged in conversation about an evolving definition of the beautiful. Such dialogue requires the practice of *both/and* thinking as participants acknowledge the varied experiences of reality which frame individual human perspective.

In considering how the curriculum functions, it is essential to note the connection between eyesight and insight. As the Peanuts cartoon illustrates, no student acquires knowledge in the abstract; learning is always personal. Furthermore, learning never takes place in a vacuum; it is always contextual.

This brief paper will explore the need for curriculum to function both as window and as mirror, in order to reflect and reveal most accurately both a multicultural world and the student herself or himself. If the student is understood as occupying a dwelling of self, education needs to enable the student to look through window frames in order to see the realities of others and into mirrors in order to see her/his own reality reflected. Knowledge of both types of framing is basic to a balanced education which is committed to affirming the essential dialectic between the self and the world. In other words, education engages us in "the great conversation" between various frames of reference.

Theologian Nelle Morton, who taught for years at Drew University in Madison, New Jersey, has made a significant contribution to balancing the Western educational emphasis on the importance of the Word, the logos of communication. She suggests that the opening lines to the gospel of John, "In the beginning was the Word," are often understood as the whole truth — when, in fact, they probably more accurately render only half the picture. She illustrates the other half of the dialectic when she insists, "In the beginning is the Hearing."

At this point, I would link hearing and seeing to emphasize a further aspect of shared framing. The delightful truth is that sometimes when we hear another out, glancing through the window of their humanity, we can see our own image reflected in the glass of their window. The window becomes a

The National SEED Project – www.nationalseedproject.org

Curriculum_As_Window_and_Mirror

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Planning for engagement with important science ideas

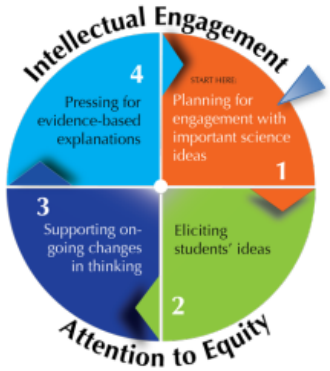
Overview

Consider three very common problems for students trying to learn science:

1) They often experience instruction as a series of unrelated and isolated lessons, one after another. They don't understand how readings or new concepts fit in with bigger science ideas.
2) They don't know *why* they are doing particular science activities—when asked they will say "Because the teacher wants me to."
3) They don't see how science relates to their everyday experiences or how their lived experiences can be used as resources to help them and others learn important science ideas.

The root of all three of these problems is that there is *nothing on the horizon* for students to focus on. There is no genuine puzzlement, interest, or larger learning goal that they are aware of. Consequently the motivation for learning dissipates and they disengage from learning activities.

In our Framework for Ambitious Science Teaching, the first phase in any unit of instruction is the teacher planning to engage students in big science ideas. Only when teachers understand where they are going in the unit can they begin to design instruction, and then take the journey with students through the other three essential practices of the Framework.



All four of the teaching practices in the Framework focus on helping students to participate in modeling and the construction of evidence-based explanations. Modeling and causal explanation are at the heart of what scientists do and also at the core of ambitious teaching.

Here's an example. Our scenario involves a 3rd grade teacher whose students were about to investigate sound as energy. She considered a phenomenon (event or process) that could anchor her unit (when we say units, we refer to two to four weeks of instruction focusing on a related set of important science ideas).

Primer-Plannning-for-Engagement

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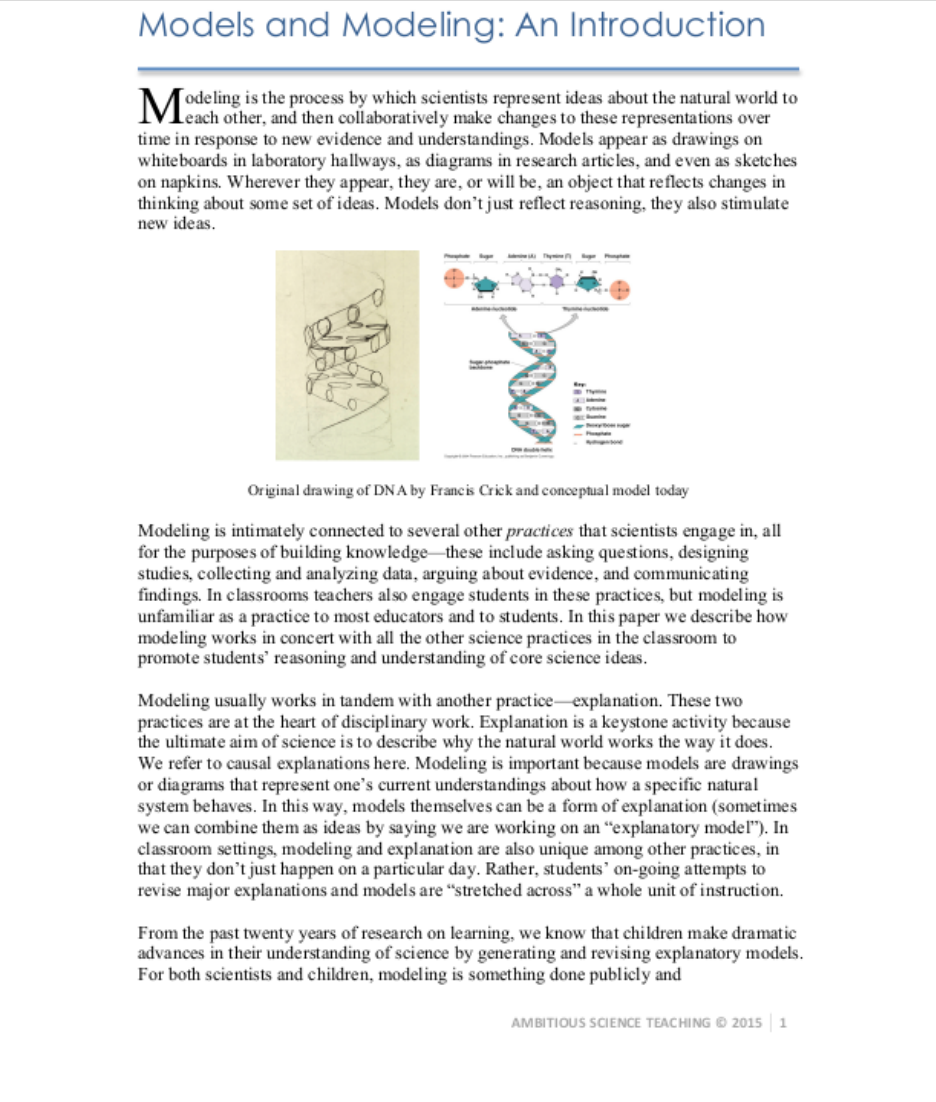
JANELLE JOHNSON JUN 04, 2019 07:18AM

AST: Planning for Engagement

JANELLE JOHNSON JUN 04, 2019 07:18AM

AST: Models & Modeling



Models and Modeling: An Introduction

Modeling is the process by which scientists represent ideas about the natural world to each other, and then collaboratively make changes to these representations over time in response to new evidence and understandings. Models appear as drawings on whiteboards in laboratory hallways, as diagrams in research articles, and even as sketches on napkins. Wherever they appear, they are, or will be, an object that reflects changes in thinking about some set of ideas. Models don't just reflect reasoning, they also stimulate new ideas.

Original drawing of DNA by Francis Crick and conceptual model today

Modeling is intimately connected to several other *practices* that scientists engage in, all for the purposes of building knowledge—these include asking questions, designing studies, collecting and analyzing data, arguing about evidence, and communicating findings. In classrooms teachers also engage students in these practices, but modeling is unfamiliar as a practice to most educators and to students. In this paper we describe how modeling works in concert with all the other science practices in the classroom to promote students' reasoning and understanding of core science ideas.

Modeling usually works in tandem with another practice—explanation. These two practices are at the heart of disciplinary work. Explanation is a keystone activity because the ultimate aim of science is to describe why the natural world works the way it does. We refer to causal explanations here. Modeling is important because models are drawings or diagrams that represent one's current understandings about how a specific natural system behaves. In this way, models themselves can be a form of explanation (sometimes we can combine them as ideas by saying we are working on an "explanatory model"). In classroom settings, modeling and explanation are also unique among other practices, in that they don't just happen on a particular day. Rather, students' on-going attempts to revise major explanations and models are "stretched across" a whole unit of instruction.

From the past twenty years of research on learning, we know that children make dramatic advances in their understanding of science by generating and revising explanatory models. For both scientists and children, modeling is something done publicly and

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Models-and-Modeling-An-Introduction1

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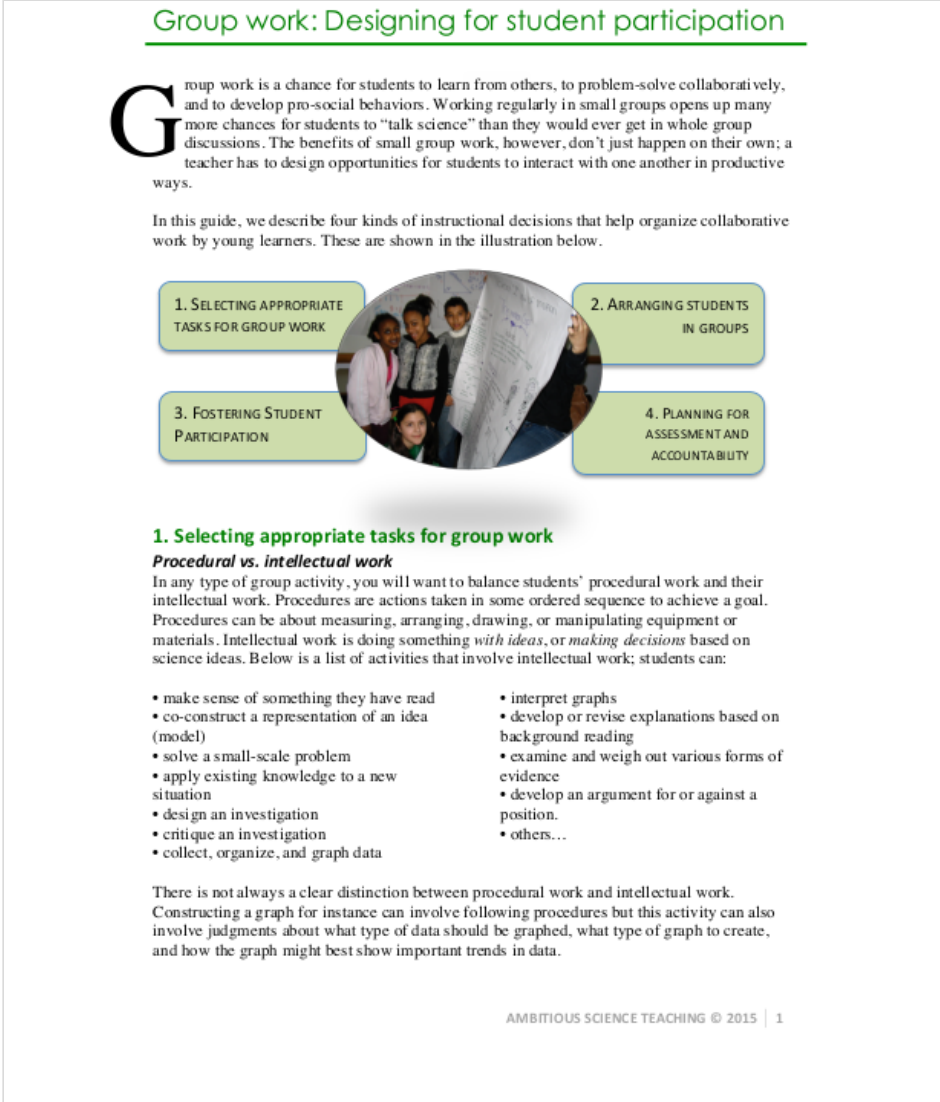

Group work: Designing for student participation

Group work is a chance for students to learn from others, to problem-solve collaboratively, and to develop pro-social behaviors. Working regularly in small groups opens up many more chances for students to "talk science" than they would ever get in whole group discussions. The benefits of small group work, however, don't just happen on their own; a teacher has to design opportunities for students to interact with one another in productive ways.

In this guide, we describe four kinds of instructional decisions that help organize collaborative work by young learners. These are shown in the illustration below.

1. Selecting appropriate tasks for group work
2. Arranging students in groups
3. Fostering Student Participation
4. Planning for assessment and accountability

1. Selecting appropriate tasks for group work

Procedural vs. intellectual work

In any type of group activity, you will want to balance students' procedural work and their intellectual work. Procedures are actions taken in some ordered sequence to achieve a goal. Procedures can be about measuring, arranging, drawing, or manipulating equipment or materials. Intellectual work is doing something *with ideas*, or *making decisions* based on science ideas. Below is a list of activities that involve intellectual work; students can:

- make sense of something they have read
- co-construct a representation of an idea (model)
- solve a small-scale problem
- apply existing knowledge to a new situation
- design an investigation
- critique an investigation
- collect, organize, and graph data
- interpret graphs
- develop or revise explanations based on background reading
- examine and weigh out various forms of evidence
- develop an argument for or against a position.
- others…

There is not always a clear distinction between procedural work and intellectual work. Constructing a graph for instance can involve following procedures but this activity can also involve judgments about what type of data should be graphed, what type of graph to create, and how the graph might best show important trends in data.

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Designing-Group-Work

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AST: Designing Group Work

JANELLE JOHNSON JUN 04, 2019 07:19AM

AST: Just in Time Instruction

How to use direct (or "just-in-time") instruction in your science classroom

Some teachers believe that lecturing is to be avoided in the classroom. Other teachers depend too much on the "stand-and-deliver" method of instruction. Neither of these extremes is appropriate. There are *times for telling* by the teacher—in specific situations and about ideas that are carefully chosen. We'll describe when to use this kind of strategy and how to use it effectively.

The process of telling by the teacher is often referred to as direct instruction. In research on learning however, scholars call productive versions of this *just-in-time instruction*, because the choices of which ideas to expand on are often driven by students. They feel a need to know more in order to make progress, rather than having the teacher delivering information to them that they don't know what to do with.

How do you use just-in-time instruction strategically? It usually precedes an activity that students will do, in which you want them to reason with new ideas. The ideas that you will share are usually at the conceptual level and they cannot be "discovered" by students through any form of work with data or observation. Examples here are *equilibrium* in chemistry, *unbalanced forces* in physics, how the sun gives off different forms of radiant energy that can be found in the *electromagnetic spectrum* in the earth sciences, and the concept of ecological *niches* in biology. Students can do lab activities that involve these concepts, they can collect data, and describe patterns in the data. But these activities will not help them spontaneously generate the concepts mentioned above. It took scientists hundreds of years to develop these ideas, your students won't do it in a class period. Rather, these conceptual ideas need to be introduced through just-in-time instruction by the teacher.

> There are *times for telling* by the teacher—in specific situations and about ideas that are carefully chosen.

Here is another way to say this. The explanatory story that underlies your anchoring event for the unit will include unobservable processes, structures, and events. These will explain what *is* observable. Just-in-time instruction is about these unobservables. The unobservables might include features that are inaccessible (i.e. the layers of the earth or how the brain senses carbon dioxide levels in the blood), structures or processes that are too small to see (i.e. atomic structures, chemical bonding), or that are conceptual (i.e. selective pressure, the compression feature of sound waves, unbalanced forces).

Right away a caution is in order. You do *not* want to use direct instruction to create explanations for your students. Rather, you want students to know enough about a conceptual idea to then use it themselves to create explanations of phenomena you are studying. If we take the example of niches in biology for example, a teacher can describe what they are, why they are important, and how they work generally in ecosystems. But a

Just-in-Time-Instruction

PDF document

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Helping students talk about evidence: A guide for science teachers

One of the central aims of science is to create explanations for events and processes that happen in the natural world. To be accepted in the scientific community, explanations have to be supported by evidence. Explanations and arguing from evidence are also important science practices for students to engage in—in fact they are featured in the *Next Generation Science Standards*.

As teachers, we often find it challenging to engage students in conversations about claims, evidence, and explanations. This is because we are unfamiliar with such talk ourselves. We may be unsure about "what counts" as a claim, as an explanation, or as evidence in a particular situation. This guide will help you understand the basics behind claims, evidence, explanations, and the reasoning that links these together. It will also help you envision how conversations about evidence and explanations can play out in your classroom, and provides tools you can use to support these conversations.

To anchor our descriptions about using evidence, we'll use some common scenarios that are part of science learning at the high school, middle school and elementary levels. We've chosen scenarios in which students use different types of data and information as evidence, and therefore construct different types of arguments.

1. *Sound energy example*: This is a case from a 3rd grade unit on the physics of sound. In this scenario young learners were trying to figure out how a singer could break a glass with just the sound energy from his voice. They had just watched a video of this event and discussed how sound travels in waves. After this initial lesson, students became aware of sound in their everyday world. A day after the unit began, several of them came in from recess to share with the teacher that they could hear a soccer ball being bounced on the pavement no matter where they were standing. One student suggested that sound travels like waves on the surface of a lake, out from the source in all directions. Another student added that she thinks the waves travel equally quickly in all directions. These hypotheses became the basis for a round of experiments by the students on the playground. In upcoming sections of this guide we will refer to this round of experiments and how these 3rd graders used them to generate evidence-based explanations.

2. *Cellular respiration example*: During a 7th grade unit on cellular respiration, a teacher had her students mix dried yeast and sugar into a flask of warm water. They then affixed a balloon on the top of the flask. As students watched the balloon inflate, they hypothesized about what they were

helping students talk about evidence

PDF document

PADLET DRIVE

JANELLE JOHNSON JUN 04, 2019 07:20AM

AST: Helping Students Talk about Evidence

Feedback & Evaluation

JANELLE JOHNSON JUN 04, 2019 07:00AM

Follow up

How can we best support you in this work moving forward?

HS Math: 39.746786, -105.004001 — **MARIA CROUSE**

If each group can provide me with the latitude/longitude coordinates of their Hydrosphere Study Sites, I can do a demonstration on how to may the data using ArcGIS Online. — **TSU GLOBEME**

JANELLE JOHNSON JUN 04, 2019 06:51AM

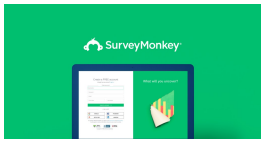
Evaluation

Thanks so much for your thoughtful answers! This is important data for us to report to our funding agency, and also to include in a new proposal.

GLOBE MULTI STEM Summer 2019 Institute - June 6, 2019

Web survey powered by SurveyMonkey.com. Create your own online survey now with SurveyMonkey's expert certified FREE templates.

SURVEYMONKEY



Additional Resources

ANONYMOUS JUN 06, 2019 09:11AM

Drone Activities

Here are the UAV activities that Janelle mentioned for our NSF ITEST Project. Including 'Disasterville" https://scied.ucar.edu/engineering-activities

In place of GPS receivers - the Where Am I At? app https://itunes.apple.com/us/app/where-am-i-at/id389894248?mt=8 — **TSU GLOBEME**

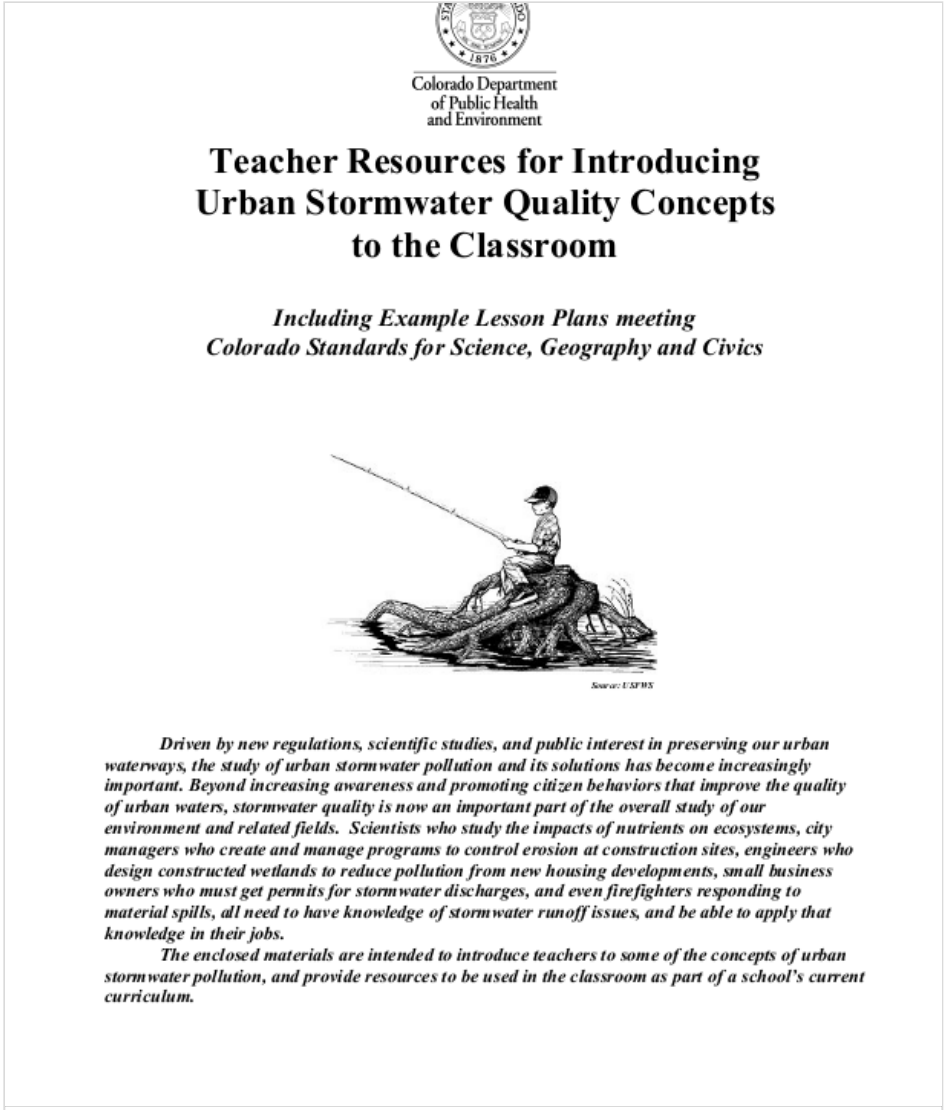
TSU GLOBEME JUN 06, 2019 09:11AM

Large Cities May Create Clouds - https://www.sciencemag.org/news/2019/05/large-cities-may-create-their-own-clouds

CHRISTINA BUFFINGTON JUN 05, 2019 11:04AM

Stormwater (DO) Teacher Resources

Borrow an Enviroscape Model!



Colorado Department of Public Health and Environment

Teacher Resources for Introducing Urban Stormwater Quality Concepts to the Classroom

Including Example Lesson Plans meeting Colorado Standards for Science, Geography and Civics

Source: USFWS

Driven by new regulations, scientific studies, and public interest in preserving our urban waterways, the study of urban stormwater pollution and its solutions has become increasingly important. Beyond increasing awareness and promoting citizen behaviors that improve the quality of urban waters, stormwater quality is now an important part of the overall study of our environment and related fields. Scientists who study the impacts of nutrients on ecosystems, city managers who create and manage programs to control erosion at construction sites, engineers who design constructed wetlands to reduce pollution from new housing developments, small business owners who must get permits for stormwater discharges, and even firefighters responding to material spills, all need to have knowledge of stormwater runoff issues, and be able to apply that knowledge in their jobs.

The enclosed materials are intended to introduce teachers to some of the concepts of urban stormwater pollution, and provide resources to be used in the classroom as part of a school's current curriculum.

WQ_Teacher-Resources.pdf
PDF document
WWW.COLORADO.GOV

KATHLEEN JAKOBSEN JUN 05, 2019 11:15AM

Earth Force resource in Colorado

Process to do outdoor inventory to connect area around a waterway

Engaging Youth as Environmental Citizens
After 20 years our amazing partnership with GM has come to an end. The programs will continue and the investment made by GM will continue to pay off in communities across the country. Thank you to everyone at GM that made this partnership possible. Previous Next

EARTH FORCE

RICH WAGNER JUN 05, 2019 02:44PM

Waterflow data on our section of Cherry Creek

(US Geologic Survey)

USGS Current Conditions for USGS 06713500 CHERRY CREEK AT DENVER, CO.
Warning: Javascript must be enabled to use all the features on this page!

USGS

JENNIFER SUGGS-HAMMONDS JUN 05, 2019 03:10PM

Eco-Schools USA

Watersheds, Oceans and Wetlands

WOW Pathways | National Wildlife Federation
The National Wildlife Federation's Eco-schools USA Watersheds Oceans Wetlands (WOW) pathways

NATIONAL WILDLIFE FEDERATION

TSU GLOBEME JUN 05, 2019 03:03PM

Presentation - Extending GLOBE with Environmental Justice and Service Learning

https://drive.google.com/file/d/1CafyLVrlLUfA59YifuSPrCbYhWSO9W35/view?usp=sharing — **TSU GLOBEME**

COLLEEN MCDANIEL JUN 05, 2019 04:35PM

How to connect the Go Direct Optical DO probe to your device

Getting Started with Your Vernier Sensor

Getting Started with Your Vernier Sensor

VERNIER

MIKE JABOT JUN 05, 2019 06:17PM

Expect More: Children Can Do Remarkable Things book

Expect More: Children Can Do Remarkable Things

This book encourages teachers, parents, grandparents, and volunteers who work with children to expect more. It focuses on the skills children will need to compete in a highly competitive global economy. From systems thinking, to interpreting complex visual images, to integrative thinking our chil...

AMAZON

JENNIFER BOURGEAULT JUN 06, 2019 01:26PM

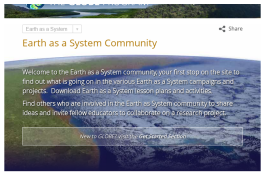
GLOBE Protocol Bundles

These were created by the Science Working group and include "bundles" of GLOBE protocols that can be used together to study certain locations (i.e. urban environments) or concepts (water cycle, water quality). There is often the list of protocols and some background information, along with example research questions.

Earth as a System Community - GLOBE.gov

This bundle includes atmosphere, hydrosphere, and pedosphere protocols that are used for the GLOBE ENSO (El Niño Southern Oscillation) Campaign which has been formulated to engage students in determining where and how much El Niño affects local places and to put students in contact with the resulting patterns in their local environment.

GLOBE



MARILE COLON ROBLES JUN 06, 2019 02:27PM

NASA Internships for Teachers

Teachers, go into the system as a student and you will find a "teacher" option. You might have to put you are working on a degree to overpass the system, but you can get a paid internship during the summer at any NASA center or institute.

NASA Internships and Fellowships

NASA Internships are competitive awards to support educational opportunities that provide unique NASA-related research and operational experiences for high school, undergraduate, and graduate students, as well as educators. These opportunities serve students by integrating interns with career professionals emphasizing mentor-directed, degree-related tasks, while contributing to the operation of a NASA facility or the advancement of NASA's missions.

NASA

Math Connections

RICH WAGNER JUN 05, 2019 02:47PM

Statistical Data on Cherry Creek Streamflow

See "**Daily discharge, cubic feet per second -- statistics for Jun 5 based on 64 years of record" table.**

USGS Current Conditions for USGS 06713500 CHERRY CREEK AT DENVER, CO.

Warning: Javascript must be enabled to use all the features on this page!

USGS

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