Addressing the Standards…What Does It Look Like in Practice?

MD Partnership for Children in Nature
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Presented by *Maryland State Department of Education:*
George Newberry, STEM Coordinator;
JoAnn Roberts, Disciplinary Literacy Specialist;
Gary Hedges, Science Specialist

Is This What It Feels Like???

MSDE's Definition of STEM Education

STEM education is an **approach** to teaching and learning that integrates the content and skills of science, technology, engineering, mathematics, and other subjects, as appropriate

The goal of STEM education is to prepare students for post-secondary study and the 21st century workforce.

STEM Standards of Practice guide STEM instruction by defining the combination of behaviors, integrated with STEM content, which is expected of a proficient STEM student.

These behaviors include

- engagement in inquiry,
- logical reasoning,
- collaboration, and
- investigation.

STEM Standards of Practice

1. **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**
2. **Integrate Science, Technology, Engineering, and Mathematics Content**
3. **Interpret and Communicate STEM Information**
4. **Engage in Inquiry**
5. **Engage in Logical Reasoning**
6. **Collaborate as a STEM Team**
7. **Apply Technology Appropriately**

NGSS and STEM

NGSS Science and Engineering Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (sci) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

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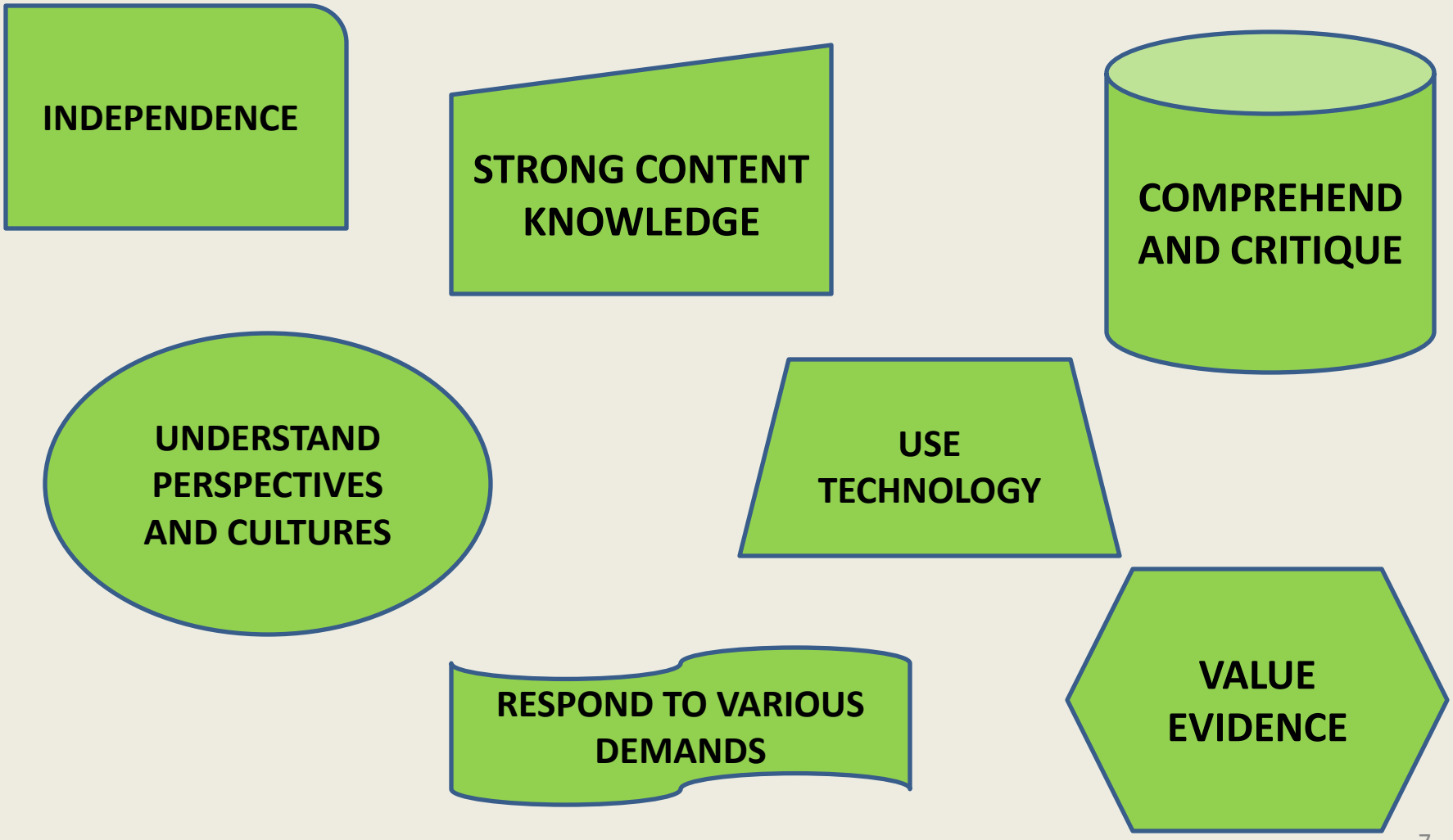
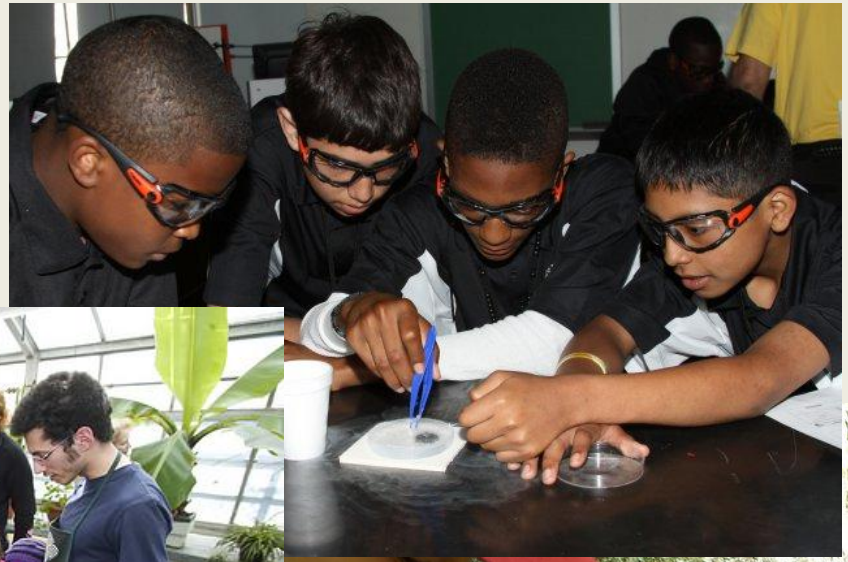
Capacities of Literate Individuals

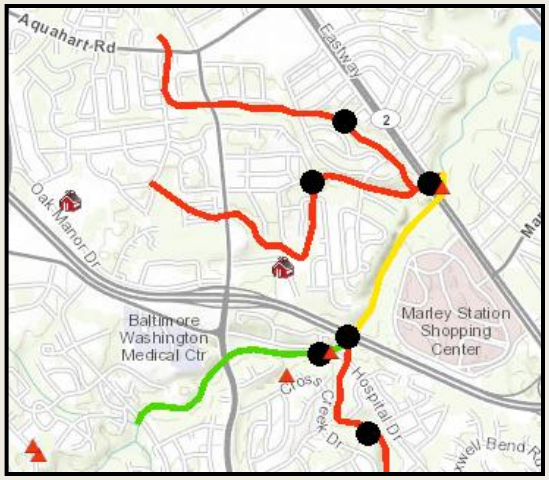


Structure of a “Lesson”



Engage Students in the Context

Engage students with the issue of importance of healthy streams



NEWS

Fly ash dump draws Md. fine

By Justin Fenton and Justin Fenton,SUN REPORTER | August 8, 2007

The state's environmental agency has ordered the operator of a coal ash dump site to pay a "significant" fine and clean contaminated water recently detected in Anne Arundel County. The Maryland Department of the Environment gave BBSS Inc. 60 days to comply or face legal action, agency spokesman Robert Ballinger said yesterday. He did not elaborate on the amount of the fine or specific actions. "Taking this corrective action is how we deem it necessary to take care" of the contamination, Ballinger said.

Engaging in the context

- activates student thinking and assesses prior knowledge
- encourages students to ask questions
- uncovers student misconceptions

Establish the Essential Question

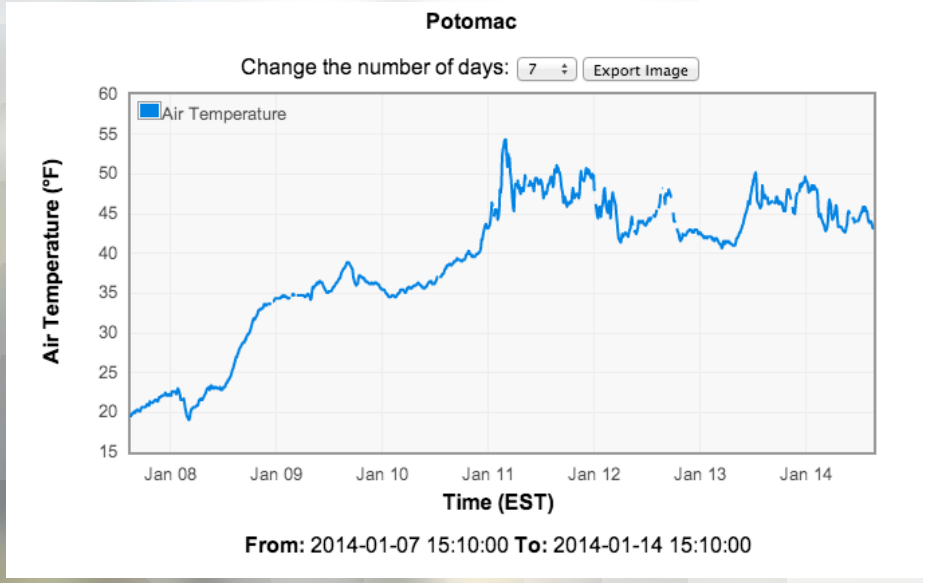
How can we reduce the impact of human activities on the water quality of streams in Maryland?

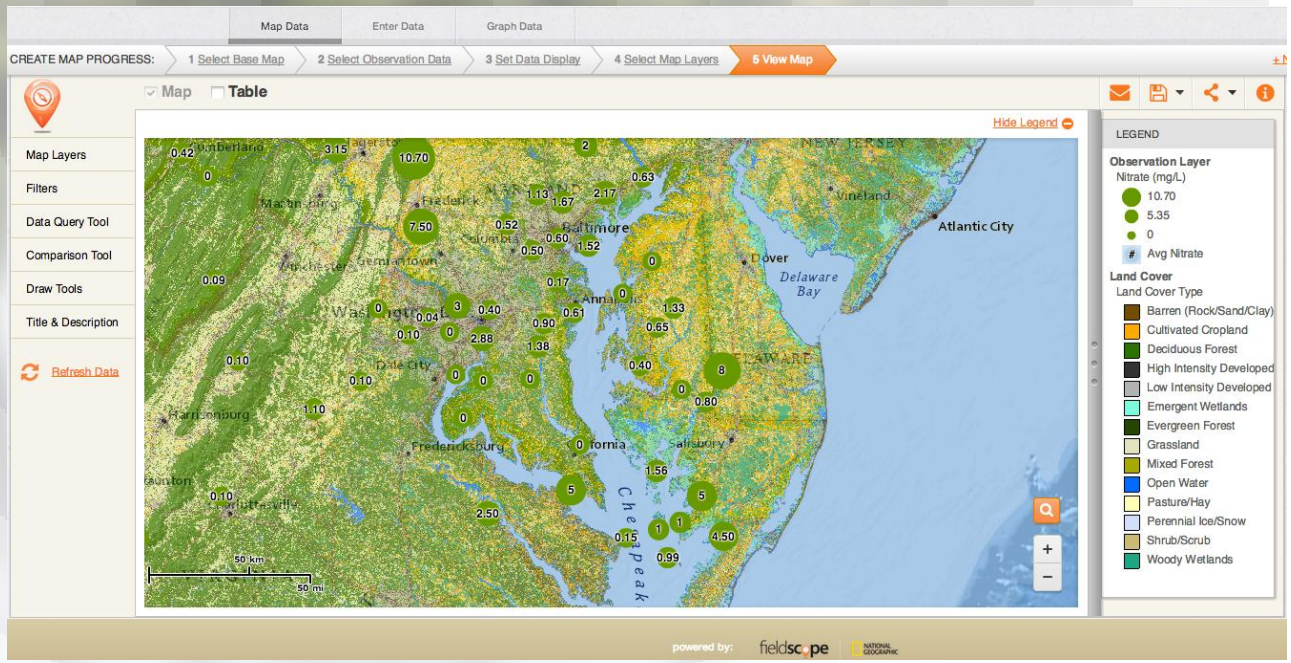
The Essential Question

- How can we reduce the impact of human activities on the water quality of streams in Maryland?
  - Establishes the purpose for learning
  - Guides the inquiry
  - Is aligned with appropriate standards
  - Provides opportunities for student investigation
  - Makes connections between past and present learning experiences

Student Exploration

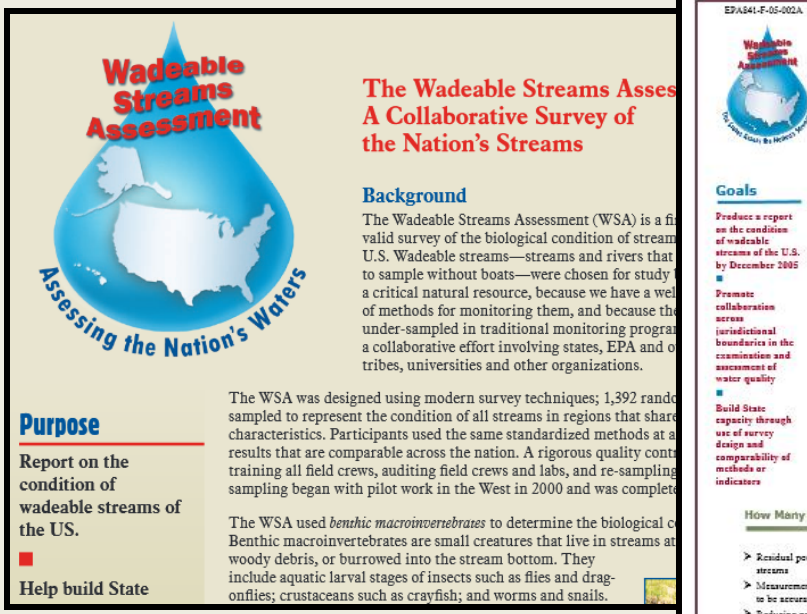
STUDENT EXPLORATION

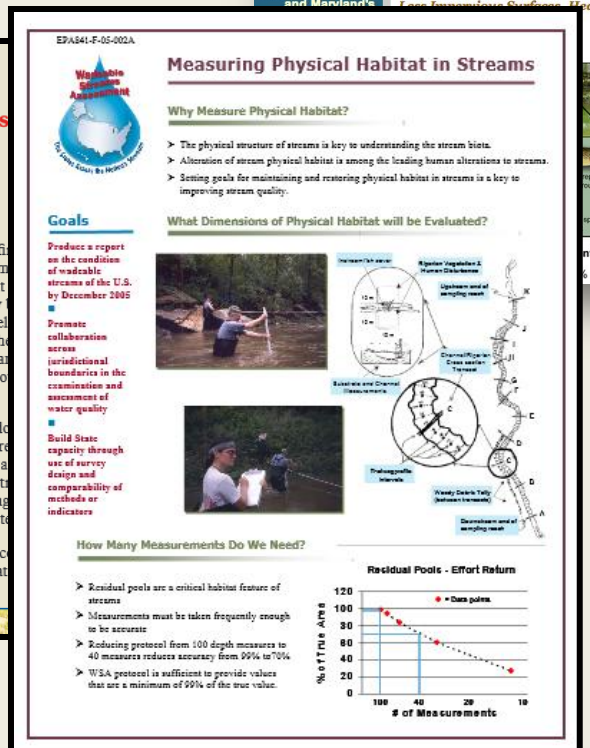




Student Preparation

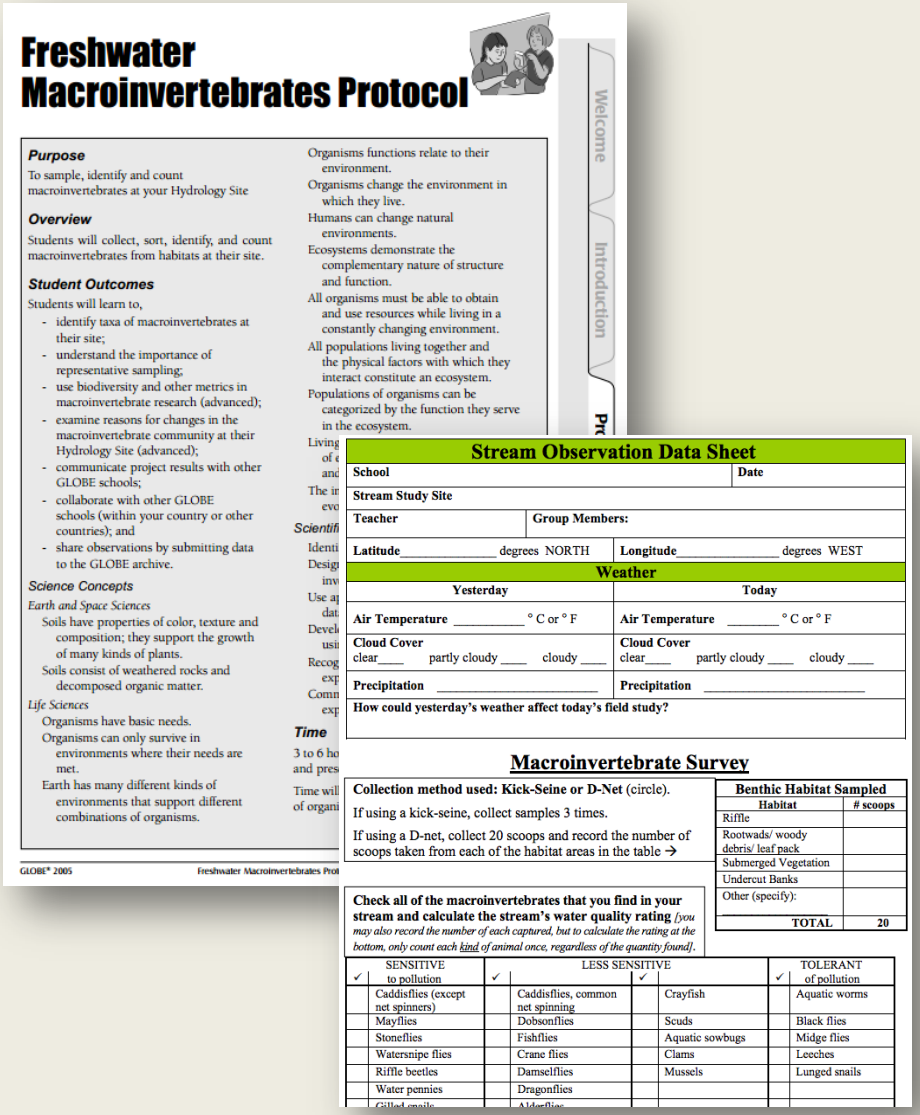
- Review literature for relevant background information





Student Preparation

- Identify resources appropriate to the essential question
  - Protocols
  - Equipment
  - Methods to collect data



Freshwater Macroinvertebrates Protocol

Welcome | Introduction

Purpose

To sample, identify and count macroinvertebrates at your Hydrology Site

Overview

Students will collect, sort, identify, and count macroinvertebrates from habitats at their site.

Student Outcomes

Students will learn to,

- identify taxa of macroinvertebrates at their site;
- understand the importance of representative sampling;
- use biodiversity and other metrics in macroinvertebrate research (advanced);
- examine reasons for changes in the macroinvertebrate community at their Hydrology Site (advanced);
- 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 archive.

Science Concepts

Earth and Space Sciences

Soils have properties of color, texture and composition; they support the growth of many kinds of plants.

Soils consist of weathered rocks and decomposed organic matter.

Life Sciences

Organisms have basic needs.

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

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

Organisms functions relate to their environment.

Organisms change the environment in which they live.

Humans can change natural environments.

Ecosystems demonstrate the complementary nature of structure and function.

All organisms must be able to obtain and use resources while living in a constantly changing environment.

All populations living together and the physical factors with which they interact constitute an ecosystem.

Populations of organisms can be categorized by the function they serve in the ecosystem.

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GLOBE® 2005 Freshwater Macroinvertebrates Prot

Stream Observation Data Sheet

School	Date
Stream Study Site	
Teacher	Group Members:
Latitude _____ degrees NORTH	Longitude _____ degrees WEST

Weather

Yesterday	Today
Air Temperature _____ ° C or ° F	Air Temperature _____ ° C or ° F
Cloud Cover clear____ partly cloudy ____ cloudy ____	Cloud Cover clear____ partly cloudy ____ cloudy ____
Precipitation _____	Precipitation _____

How could yesterday's weather affect today's field study?

Macroinvertebrate Survey

Collection method used: Kick-Seine or D-Net (circle).

If using a kick-seine, collect samples 3 times.

If using a D-net, collect 20 scoops and record the number of scoops taken from each of the habitat areas in the table →

Benthic Habitat Sampled	
Habitat	# scoops
Riffle	
Rootwads/ woody debris/ leaf pack	
Submerged Vegetation	
Undercut Banks	
Other (specify): _____	
TOTAL	20

Check all of the macroinvertebrates that you find in your stream and calculate the stream's water quality rating *[you may also record the number of each captured, but to calculate the rating at the bottom, only count each kind of animal once, regardless of the quantity found].*

✓	SENSITIVE to pollution	✓	LESS SENSITIVE	✓		✓	TOLERANT of pollution
	Caddisflies (except net spinners)		Caddisflies, common net spinning		Crayfish		Aquatic worms
	Mayflies		Dobsonflies		Scuds		Black flies
	Stoneflies		Fishflies		Aquatic sowbugs		Midge flies
	Watersnipe flies		Crane flies		Clams		Leeches
	Riffle beetles		Damselflies		Mussels		Lunged snails
	Water pennies		Dragonflies				
	Gilled snails		Alderflies				

What students do during the field experience

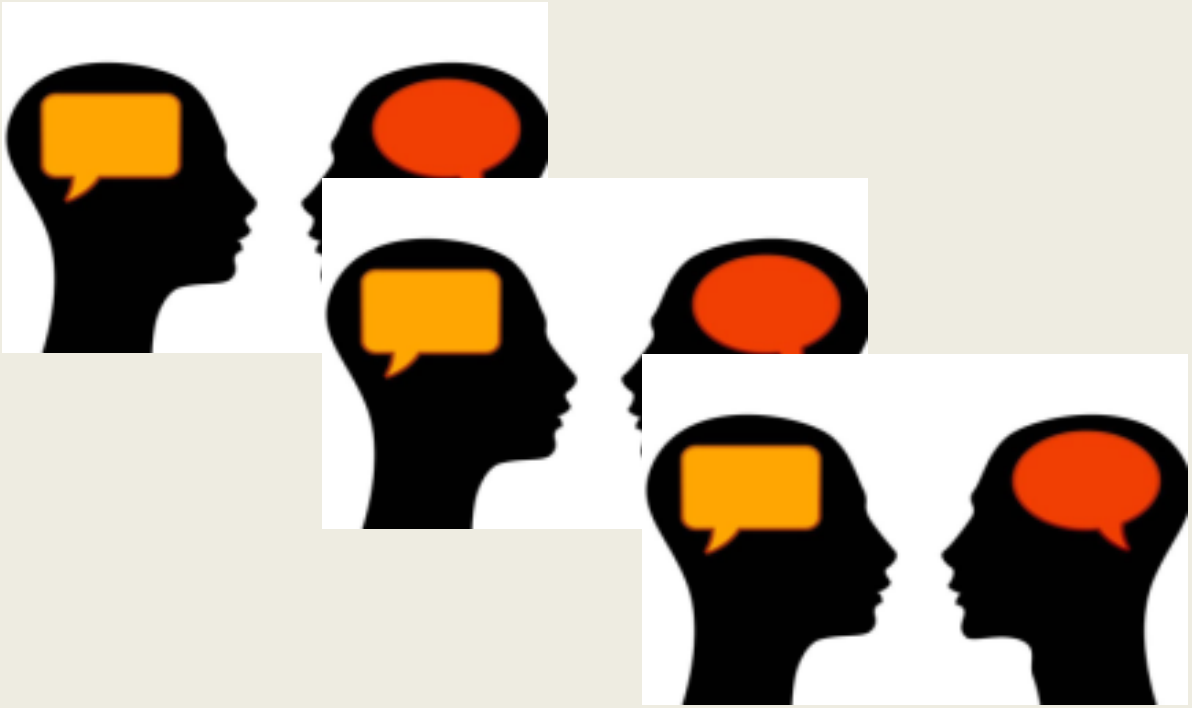
- Design and/or participate in investigations to collect data in the field and/or classroom
- Review data and compare to expected results
- Repeat protocol or modify as needed

What students do after the field experience

- Discuss to evaluate validity of investigative results.
  - Compare data collected by classmates
  - Compare data collected by community groups
- Collect additional data as needed
- Analyze data to identify trends

Explaining Results

- Making connections between stream health and human activities



Explaining Results

- Analyze data to make inferences related to the essential question
  - Student data (own and others)
  - Agency data
- Share the data
  - Student-student discourse/Student-teacher discourse
  - Upload to FieldScope
  - Write an essay to explain the results

Making Connections

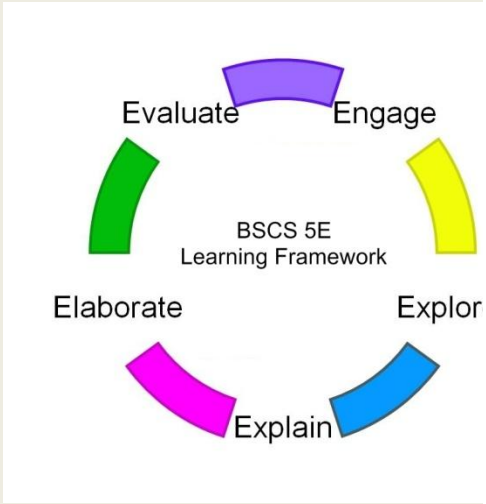
- Make inferences on the health of the stream
- Conduct additional research as needed
- Construct an argument about the best way to reduce the impact on the stream (“claim – evidence – reasoning”)

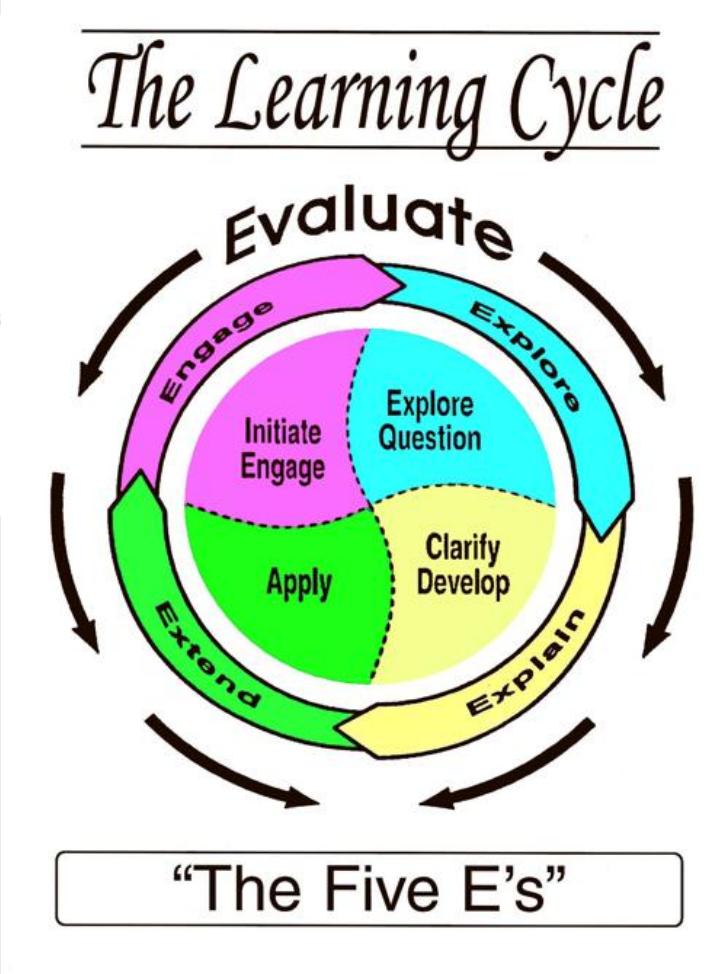
Extending Learning to Civic Action

Engaging in Civic Action

- Student(s) identify appropriate strategy for action
- Work collaboratively to address the issue
  - Identify resources
  - Establish partnerships
  - Anticipate obstacles
- Implement strategy
- Reflect on the effectiveness of the strategy

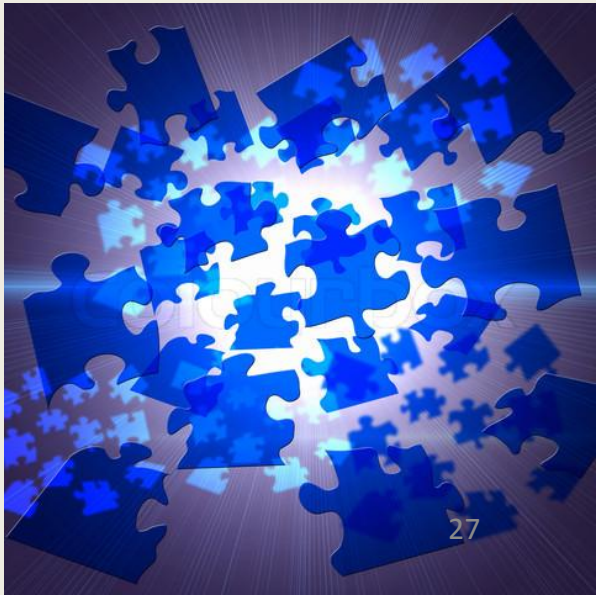
What Instructional Format was Used?



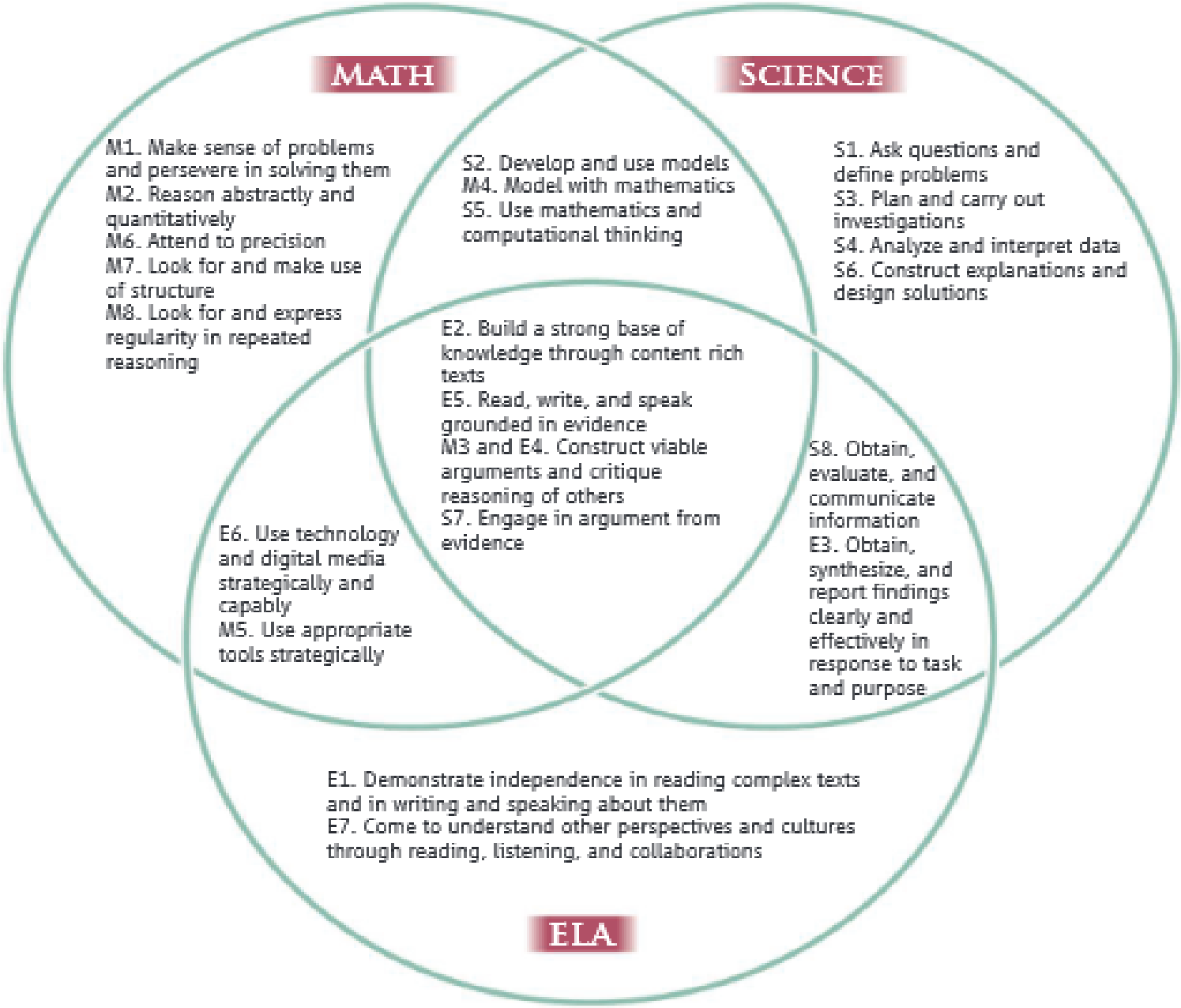


Jigsaw

- Share your individual observations
- Discuss as a group
- Summarize the Ahas
- Identify the Take Aways
- Discuss the implications for your and/or for instruction
- Report to all



STEM STANDARDS of PRACTICE



STEM STANDARDS of PRACTICE

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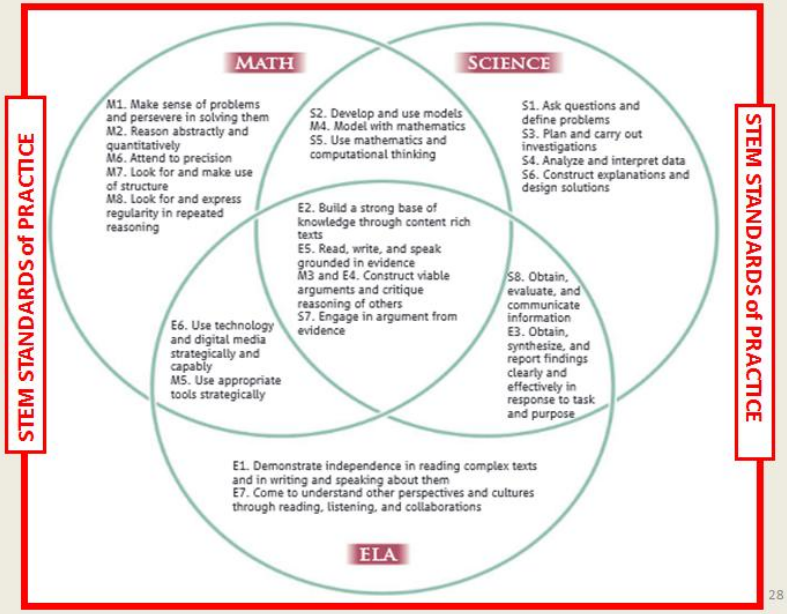

[additional info]

For the above Venn diagram (previous slide) showing the relationship of ELA, Math, NGSS, and STEM, here are the links that were mentioned:

http://nstahosted.org/pdfs/ngss/PracticesVennDiagramColor.pdf (COLOR)
http://nstahosted.org/pdfs/ngss/PracticesVennDiagramBW.pdf (BLACK & WHITE)

These links do not include STEM–the rectangle around the outside edge was added to indicate that STEM really touches everything.