ADVANCED MANUFACTURING AND PROTOTYPING, INTEGRATED TO UNLOCK POTENTIAL (AMP-IT-UP)

CENTER FOR EDUCATION INTEGRATING SCIENCE, MATHEMATICS AND ENGINEERING (CEISMC) AND GRIFFIN-SPALDING COUNTY SCHOOLS

CREATING THE NEXT®

Award # 1238089

Advanced Manufacturing & Prototyping Integrated to Unlock Potential

AMP-IT-UP OVERVIEW VIDEO

AMP-IT-UP OVERVIEW

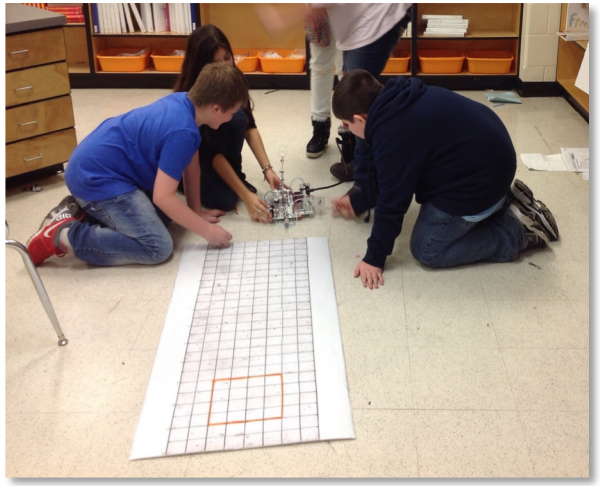
- A National Science Foundation Math and Science Partnership to *promote* workforce development and *cultivate* the next generation of creative STEM innovators.

- Partnership with the Griffin Spalding County School System

  Impact: > 11,000 students over 5 years

- Middle school STEM Innovation and Design (STEM-ID) courses that enable students to explore their creativity using robotics and rapid prototyping

- Middle school math and science modules that promote inquiry and connect with Georgia Tech



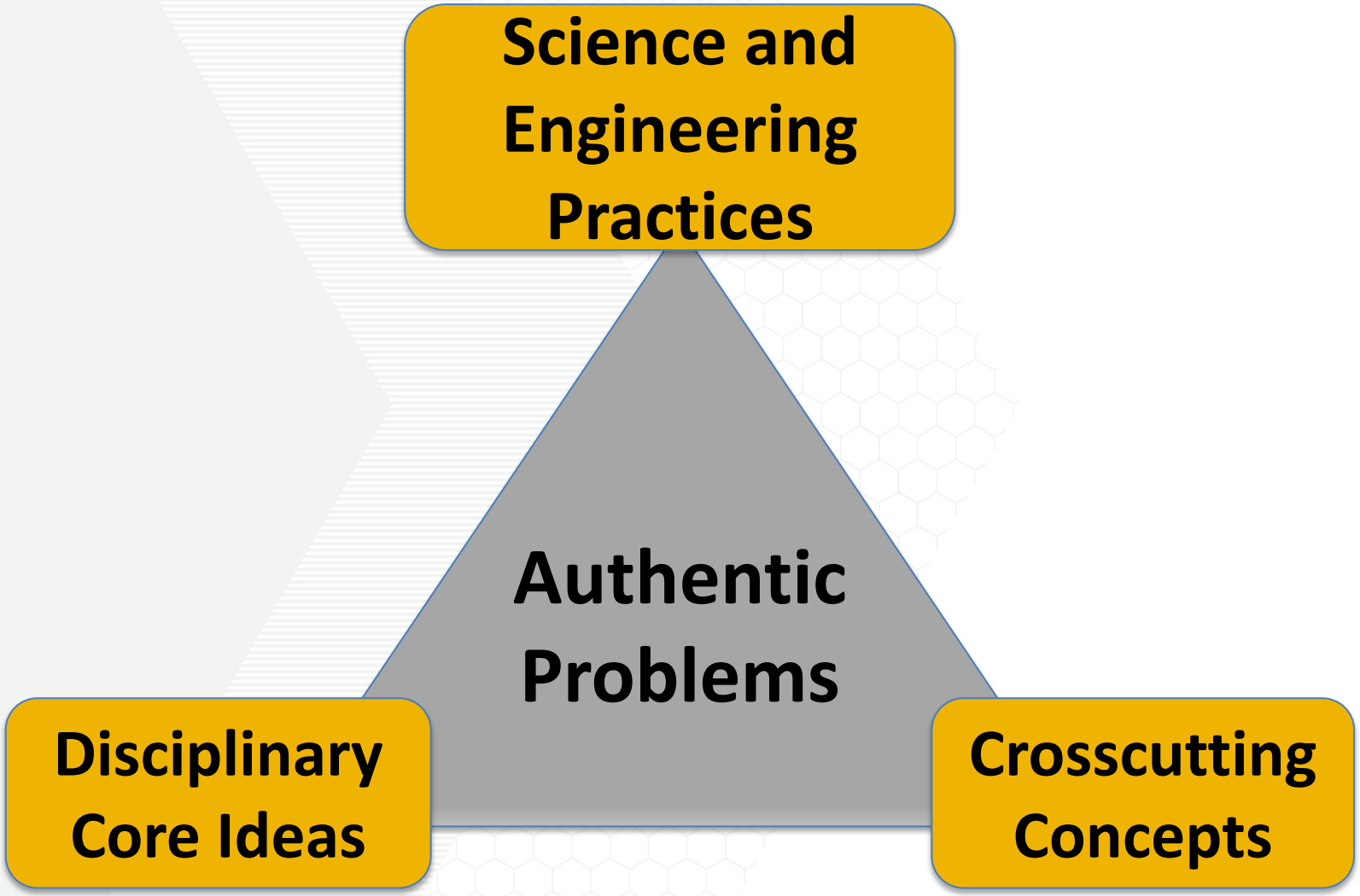
STEM INTEGRATION IN AMP MODULES

- Connect STEM-ID course themes and contexts to the science and math course learning goals and standards
- Promote inquiry and situated learned to contextualize and make relevant the science and mathematics disciplinary content
  - Science modules use data analysis to reinforce math standards
  - Math modules use science/engineering context and data to teach standards
- Modules stand separate in science and math classrooms but are connected
    - Focus on practices implemented in both courses
    - Pacing is flexible for implementation of modules

AMP-IT-UP: SCIENCE AND MATH MODULES

AMP Crosscutting Integrated Theme		Earth Science (6th Grade)	Life Science (7th Grade)	Physical Science (8th Grade)
Experimental Design	Science	Molten Madness	Oil Spill Drill	Marine Snow
	Math	Some Assembly Required	It's Game Time	It's Electric!
Data Visualization	Science	Shake and Break	Don't Wreck the Reef!	Riding the Concrete Wave: Helmet
	Math	Data Saves the Whales!	Aquarium Friend or Foe?	Rescue the Hot Shots!
Data Driven Decision Making	Science	Snow Day	Under the Sea	Riding the Concrete Wave: Skate Park
	Math	Sweet Machines	Perfecting Your Craft	Power Payoff

3-D LEARNING IN AMP-IT-UP



AMP-IT-UP INTEGRATED THEMES

(DERIVED FROM NGSS SCIENCE AND ENGINEERING AND PRACTICES)

Georgia Tech

1. Experimental Design

- Planning and Carrying Out Investigations (NGSS Practice 3)
- Make Sense of Problems (SMP #1); Use Appropriate Tools Strategically (SMP #5)

2. Data Visualization

- Analyzing and Interpreting Data (NGSS Practice 4)
- Make Sense of Problems (SMP #1); Model with Mathematics (SMP #4)

3. Data Driven Decision Making

- Constructing Explanations and Designing Solutions (NGSS Practice 6)
- Engaging in Argument from Evidence (NGSS Practice 7)
- Make Sense of Problems (SMP #1); Construct Viable Arguments (SMP #3)

SUPPORTED CORE IDEAS

Georgia Standards of Excellence and NGSS Core Content Standards are supported throughout each module.

Life Science

- Interdependent Relationships in Ecosystems
- Ecosystems: Interactions, Energy, and Dynamics

OIL SPILL DRILL: EXPERIMENTAL DESIGN

Challenge: Students engage as environmental engineers to assist coastal Georgia communities to develop a procedure to develop the fastest, most efficient way to remove oil after a spill

Time: This module takes 4-5 days

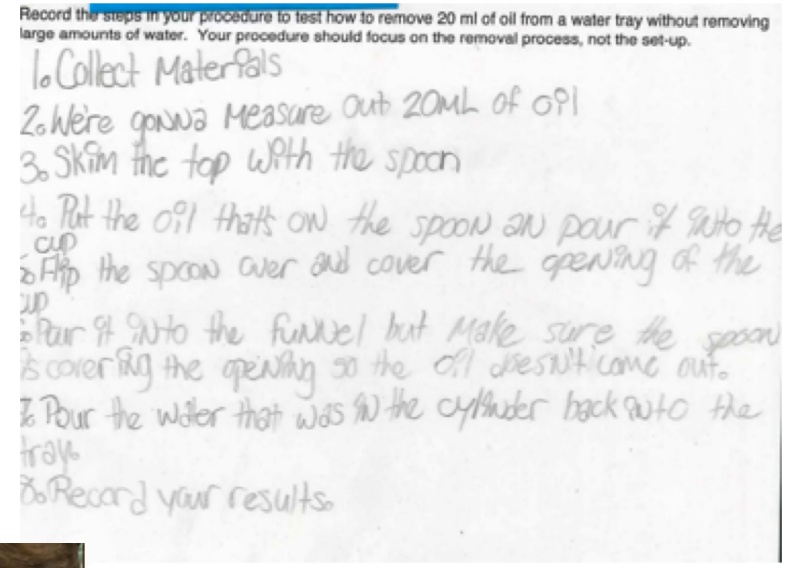
Essential Questions:

- How do scientists solve problems?
- How can consistent procedures be developed?
- What affect do changes in the environment have on organisms?

Georgia Tech Research Connection: ECOGIG (Ecosystem Impacts of Oil and Gas Inputs to the Gulf) research consortium

OIL SPILL DRILL: EXPERIMENTAL DESIGN

- Focus on modeling
- Design a procedure to remove at least 20 milliliters of oil from the water in a one minute time period.
- Analyze class results using a histogram
- Redesign a consistent class procedure and complete the investigation
- Analyze the redesign
- Communicate the results


Record the steps in your procedure to test how to remove 20 ml of oil from a water tray without removing large amounts of water. Your procedure should focus on the removal process, not the set-up.

1. Collect Materials
2. Where gonna measure out 20mL of oil
3. Skim the top with the spoon
4. Put the oil thats on the spoon an pour it into the cup
5. Flip the spoon over and cover the opening of the cup
6. Pour it into the funnel but make sure the spoon is covering the opening so the oil doesn't come out.
7. Pour the water that was in the cylinder back into the tray
8. Record your results

CORAL REEF: DATA DRIVEN DECISION MAKING

Challenge: Students assist the people of Fiji to understand what factors are degrading their reef. Students investigate a model of the food web at the coral reef to generate and then project species population data. They then take this data to help the people of Fiji decide how many fishing permits need to be allowed to keep the reef safe.

Time: This module takes 4-5 days

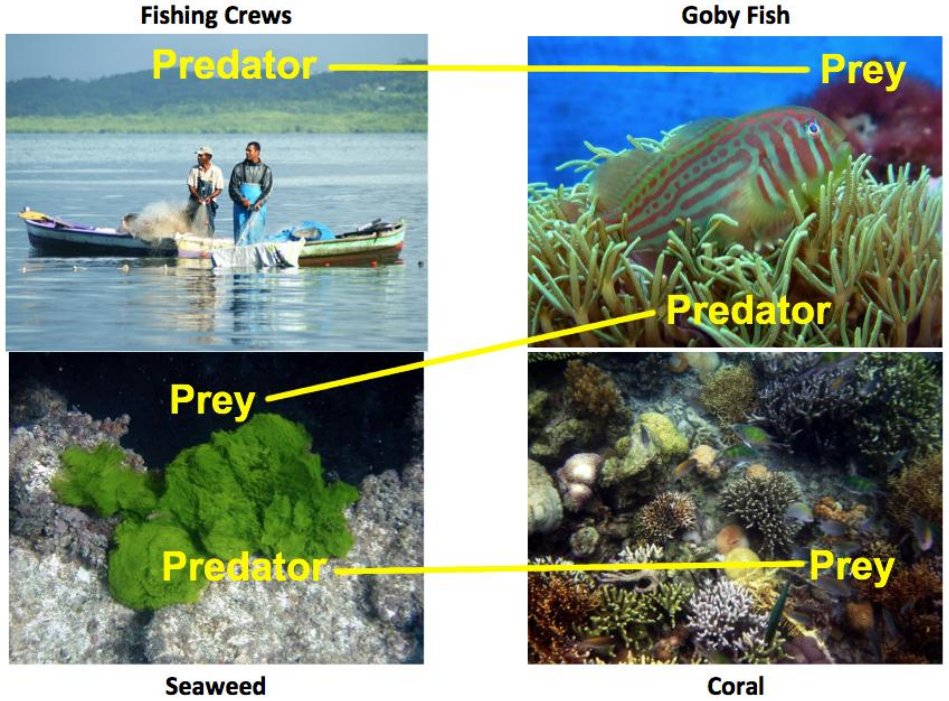
Essential Questions:

What affect do changes in the environment have on organisms?
How is matter transferred within the environment?
How do organisms depend on each other and on their environment for survival?
How can we communicate scientific data to the public?

Georgia Tech Research Connection: Dr. Mark Hay – Department of Biology

CORAL REEF: DATA DRIVEN DECISION MAKING

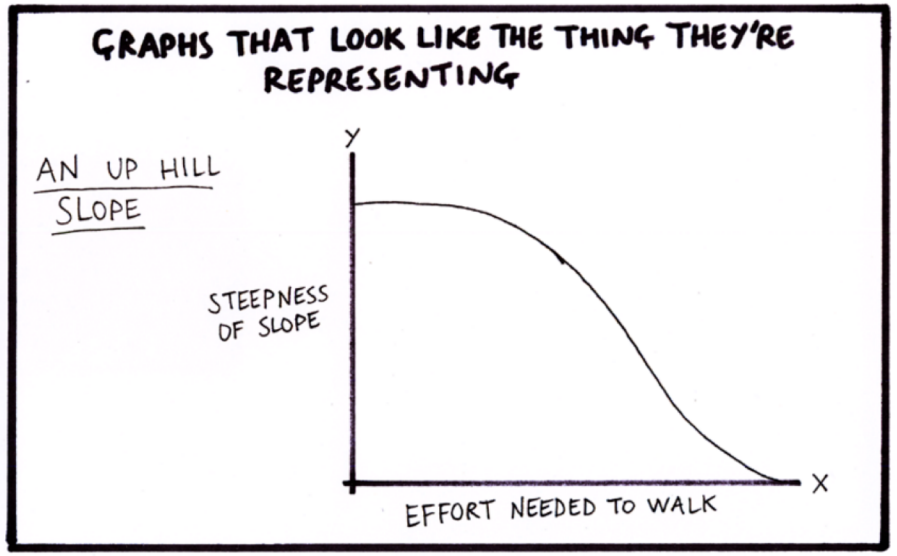
- Students are introduced to the context and content of the challenge
- Engage in a simulation modeling the food web
- Analyze their data
- Make decisions based on data and communicate those decisions to the public



Reef Location	Commercial Permits	Individual Permits	Number of Goby	Number of Seaweed	Number of Coral
Initial	1	1	20	100	100
End of year 1			19	88	18
End of year 2			18	77	1
End of year 3			17	67	1
End of year 4			16	58	1
End of year 5			15	50	1
End of year 6			8	43	1

LOOKING AT DATA VISUALIZATION

Students represent data in multiple ways and realize that different types of visualizations allow people to extract different meaning from the evidence



Data must be presented in a form that reveals any patterns and relationships- raw data has very little meaning.

A major practice for scientists is to organize, visualize, and interpret data (e.g., bar graph) to bring out the meaning and relevance of data, transforming it into evidence

Focus on NGSS: Analyzing and Interpreting Data (NGSS Practice 4)

DEEP SEA CHALLENGE: DATA VISUALIZATION

Challenge: Students analyze photos of corals to determine the effect of the Deepwater Horizon Oil Spill on Deep Sea Communities

Time: This module takes 4-5 days

Essential Questions:

What affect do changes in the environment have on organisms?
How is matter transferred within the environment?

How do I express a pattern to show a relationship

Georgia Tech Research Connection: ECOGIG (Ecosystem Impacts of Oil and Gas Inputs to the Gulf) research consortium

DEEP SEA CHALLENGE: ENGAGE

- Students are introduced to the Deepwater Horizon oil spill, the ecology of the Gulf of Mexico, and ECOGIG's research into how the oil spill affected the ecosystem
- Students are introduced to the challenge(assisting ECOGIG with analyzing images of coral to determine the amount of damage)

DEEP SEA CHALLENGE: EXPLORE

Georgia Tech

Creating a Rubric: Student Sheet #1

Categories	0 *(would not touch this burger)*	1 *(okay burger)*	2 *(amazing burger)*
Bun	Soggy and flat	Fresh but not fluffy	Toasted and fluffy
Meat	Flat, gray, and looks old	Sufficient, fresh, cooked appropriately.	*
Toppings	*	Toppings look fresh and include normal toppings: lettuce, tomato, and cheese	Topping are fresh and include extra toppings such as avocado or bacon
	One-three ounce patty	Quarter pounder	*

DEEP SEA CHALLENGE: EXPLORE

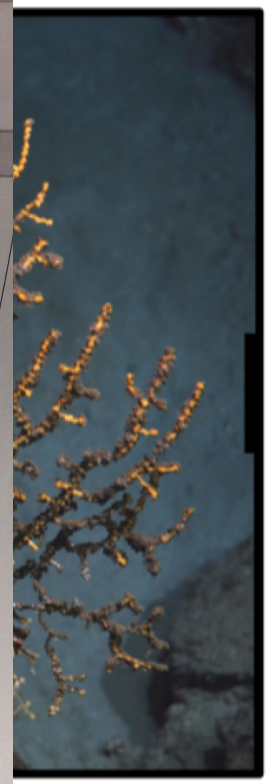
Image of Healt

ME: _____ DATE: _____

UDENT #: _____ TEACHER: _____

Coral Characteristics: Student Sheet #4

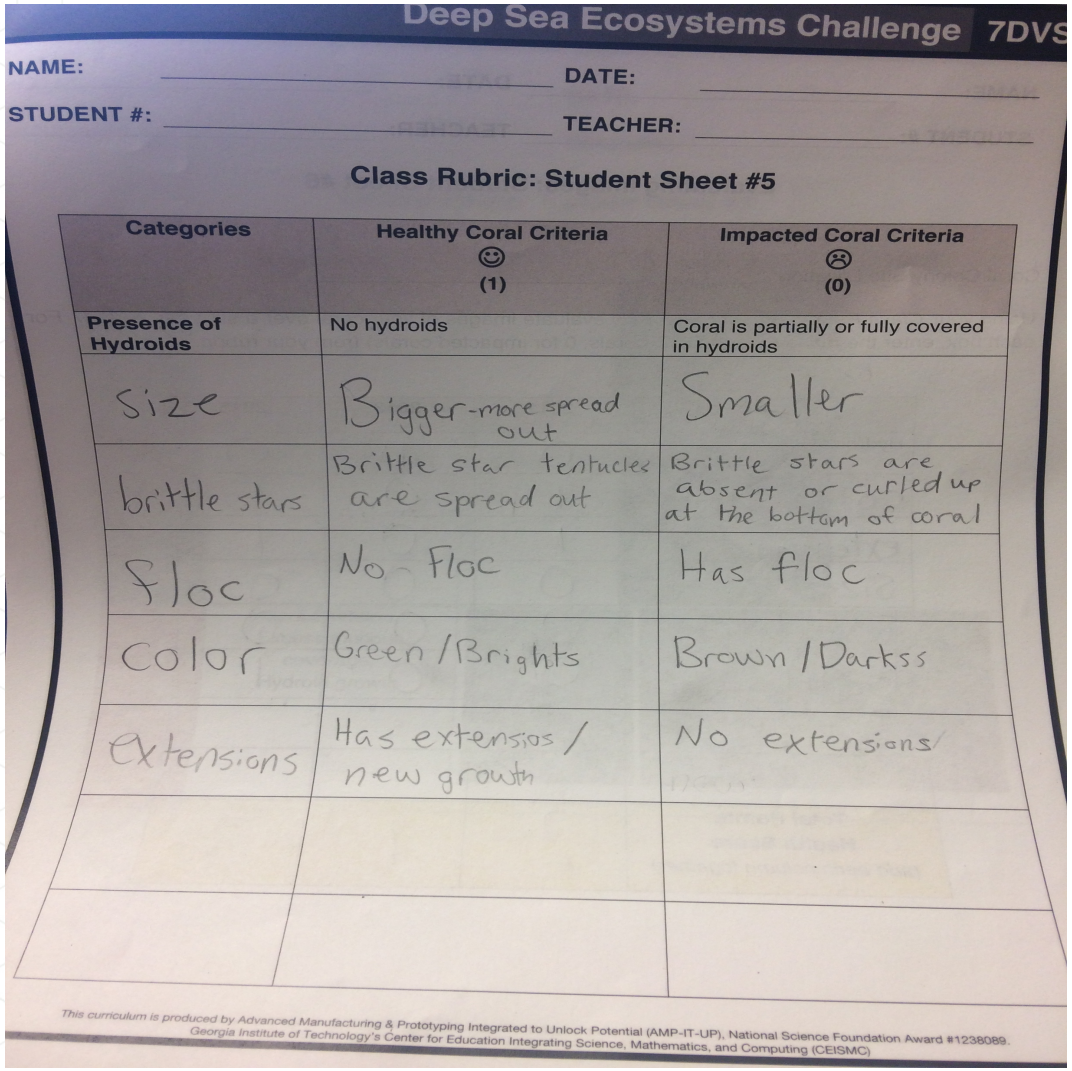
Characteristics of a Healthy Coral	Characteristics of an Impacted Coral
• More color and life • Starfish are all over • The water and seafloor look clean • No Floc • The brittle star is spread out • more full	• Has floc all over the coral • The brittle star are at the bottom • The water and seafloor look polluted • Brittle star is packed in a small space



cted Coral

DEEP SEA CHALLENGE: EXPLAIN

Students will review spatial and temporal data and standardize their rubrics to evaluate photos of corals from there different site at three different timestamps (2011, 2013, 2015)



Deep Sea Ecosystems Challenge 7DVS

NAME: _____ DATE: _____

STUDENT #: _____ TEACHER: _____

Class Rubric: Student Sheet #5

Categories	Healthy Coral Criteria ☺ (1)	Impacted Coral Criteria ☹ (0)
Presence of Hydroids	No hydroids	Coral is partially or fully covered in hydroids
Size	Bigger-more spread out	Smaller
brittle stars	Brittle star tentucles are spread out	Brittle stars are absent or curled up at the bottom of coral
floc	No Floc	Has floc
color	Green / Brights	Brown / Darkss
extensions	Has extensios / new growth	No extensions

This curriculum is produced by Advanced Manufacturing & Prototyping Integrated to Unlock Potential (AMP-IT-UP), National Science Foundation Award #1238089. Georgia Institute of Technology's Center for Education Integrating Science, Mathematics, and Computing (CEISMC)

DEEP SEA CHALLENGE: EXPLORE

Georgia Tech

Coral Colony Site

Using your *Class*
each box, enter th

six-year period. For
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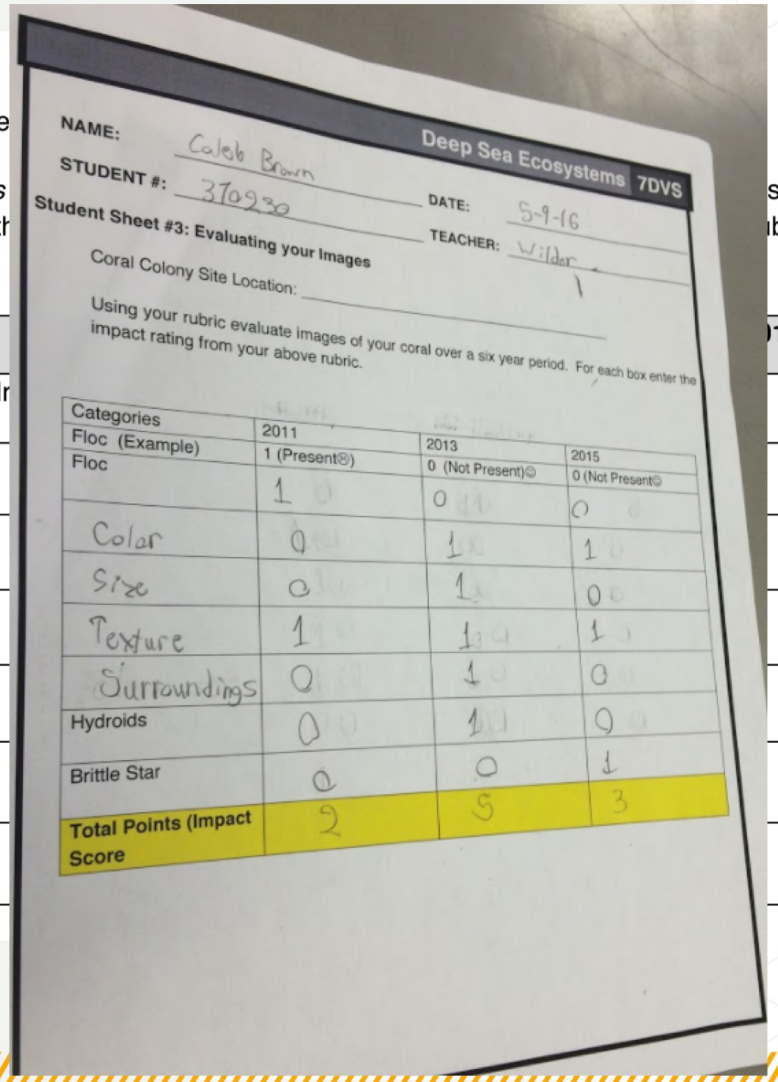


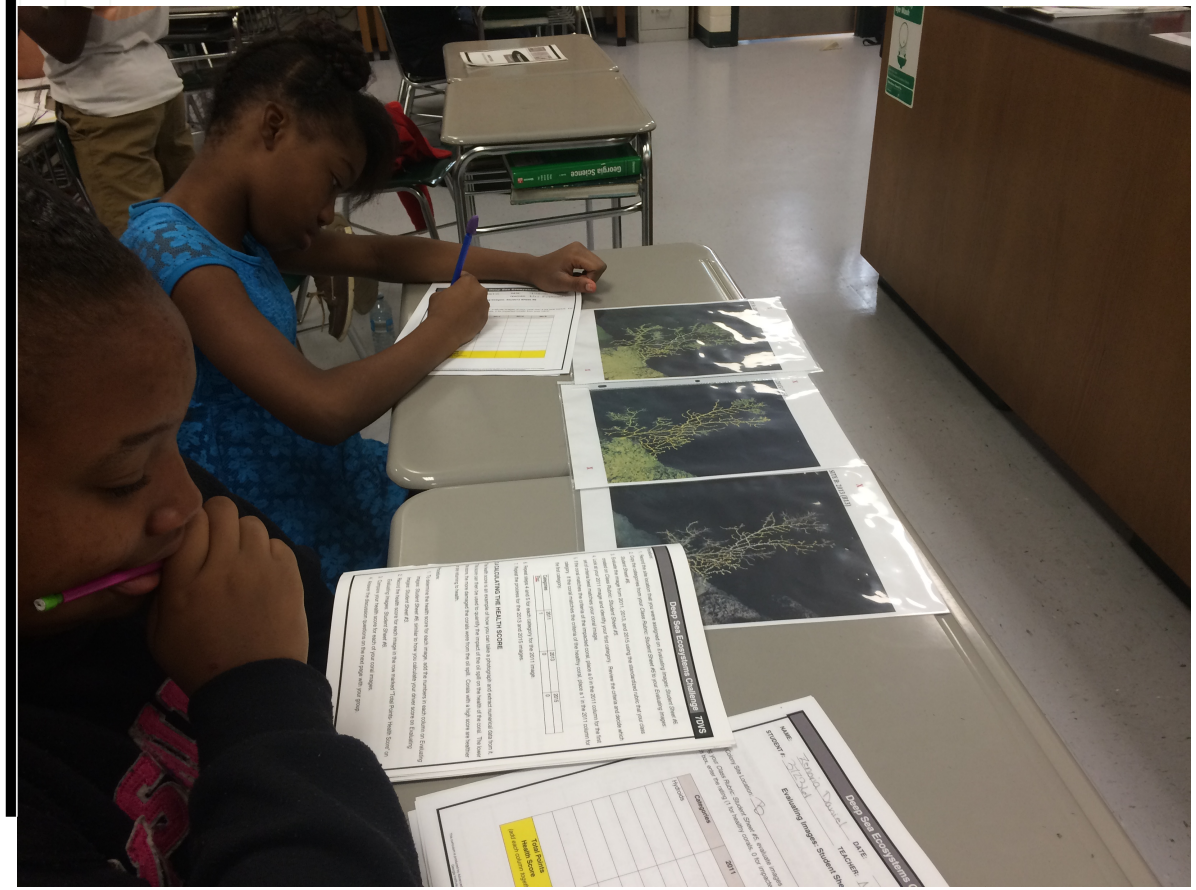
NAME: Caleb Brown
STUDENT #: 370230
Deep Sea Ecosystems 7DVS
DATE: 5-9-16
TEACHER: Wilder 1

Student Sheet #3: Evaluating your Images

Coral Colony Site Location:

Using your rubric evaluate images of your coral over a six year period. For each box enter the impact rating from your above rubric.

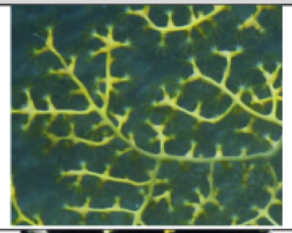
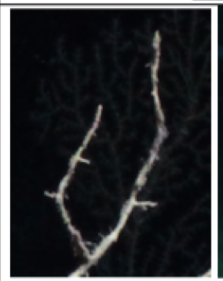
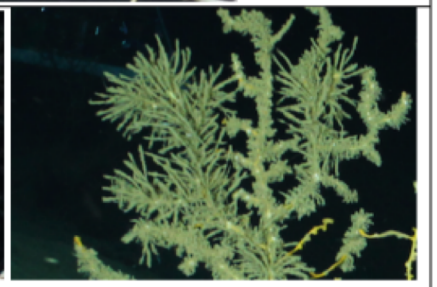
Categories	2011	2013	2015
Floc (Example)	1 (Present®)	0 (Not Present)©	0 (Not Present©
Floc	1	0	0
Color	0	1	1
Size	0	1	0
Texture	1	1	1
Surroundings	0	1	0
Hydroids	0	1	0
Brittle Star	0	0	1
Total Points (Impact Score	2	5	3



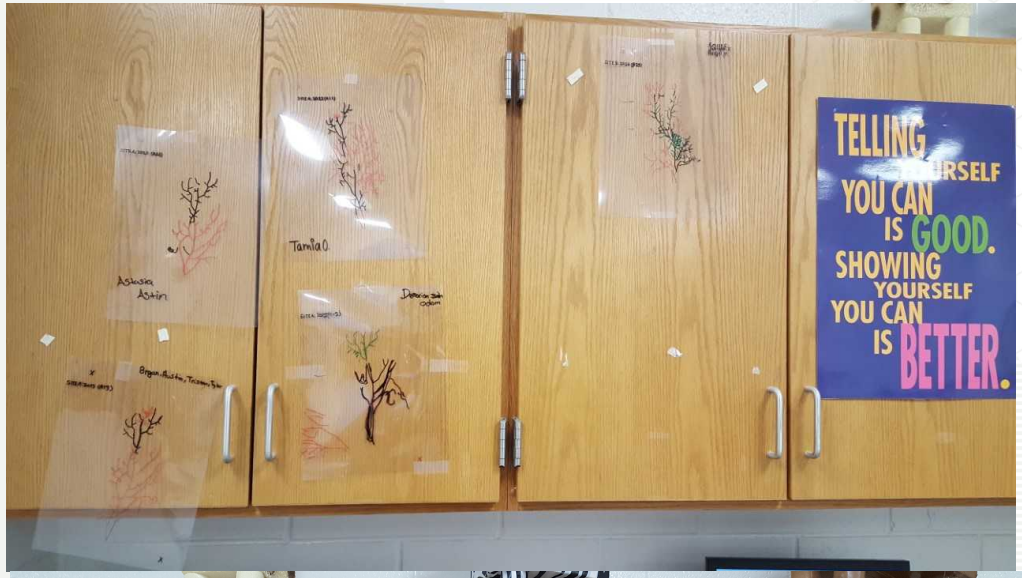
DEEP SEA CHALLENGE: ELABORATE

Georgia Tech

Coding Corals: Student Sheet #6

Color	Description	Example
	Healthy coral, Yellow color, Extended polyps	
	Schlerite enlargement, No extended polyps, Some color in tissue	
	Bare Skeleton, Excess mucous coverage, Hydroid growth	 

DEEP SEA CHALLENGE: EVALUATE



Data Visualization Questions: Student Sheet #7

1. What information does the impact score tell you about the health of your P.Biscaya coral colony?

2. What information does color-coding tell you about the health of your P.Biscaya coral colony?

3. How are these two methods different in quantifying data from an image?

4. Which method would you recommend to the ECOGIG team to use when determining if a P. Biscaya coral colony ecosystem is in recovery? Why?

CROSSCUTTING CONCEPTS

The modules include crosscutting concepts through students engaging in the practices.

Example of Crosscutting Concepts in the Deep Sea Challenge

- Patterns
  - *Use of rubrics and coding schema to classify changes in corals over time and space due to the 2010 Deepwater Horizon Oil Spill*
- Cause and Effect
  - *Using visual images to determine the differences in corals before and after the 2010 Deepwater Horizon Oil Spill. Investigating the effects of oil/floc on deep sea corals*
- Stability and Change
  - *Exploring changes in the deep sea Gulf ecosystems over a period of 5 years after the 2010 Deepwater Horizon Oil Spill*

ECOGIG CONNECTION

ECOGIG
Deep Ecosystem Research

www.ecogig.org

AMP-IT-UP CURRICULUM SUPPORT MATERIALS

Georgia Tech

Module Curriculum Includes:

- Student texts
- Student pages
- Annotated Teachers Edition
- Teacher Prep Guide
- Videos
- Material List
- Supplemental Materials

5E Stage	Student Activities	Teacher Activities

AMP IT UP

Advanced Manufacturing & Prototyping Integrated to Unlock Potential

Life Science
Data-Driven Decision Making
"Don't Wreck the Reef:" Coral Reef Challenge
Materials List

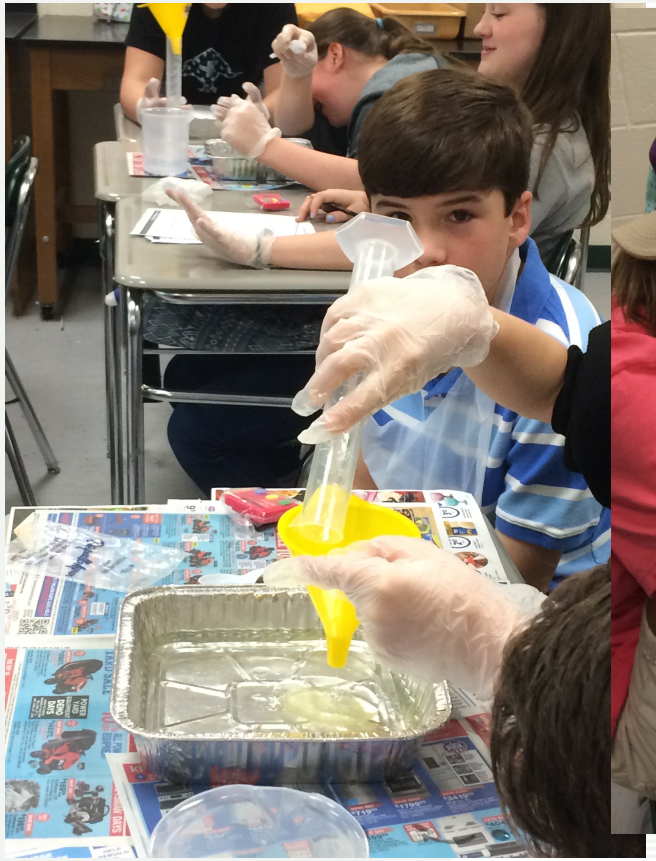
This material list provides supplies to accommodate five class periods of thirty-five students each. Please be sure to review the teacher's edition for more detailed material descriptions.

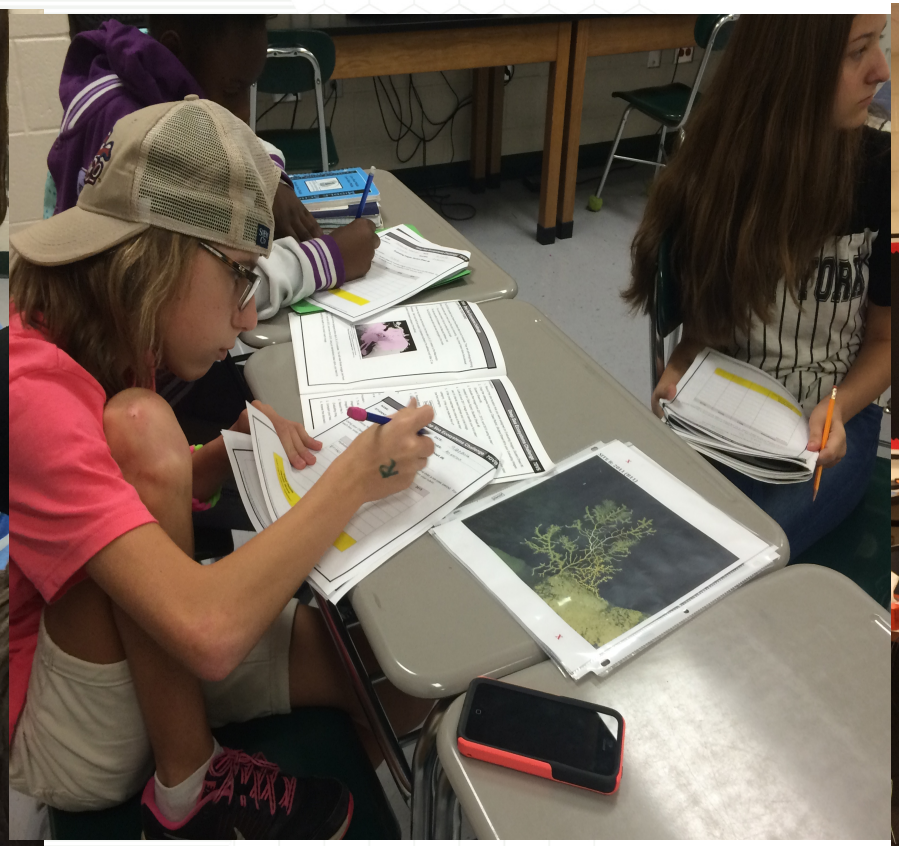
Item	Source of Purchase	Item #	Item Description	Qty	Price per item	Total per item
Cardboard Trays *(1 per pair of students)*	Uline	S-13340	Corrugated Trays https://www.uline.com/Product/Detail/S-13340/Specialty-Boxes/Corrugated-Trays-Kraft-15-x-12-x-2?FromOrderHistory=Y	18	$0.54	$9.72
Wide Mouth Jar Canisters *(class set)*	Uline	S-14509	White Round Wide-Mouth Jars – 12 oz. White Cap https://www.uline.com/Product/Detail/S-14509/Jars/White-Round-Wide-Mouth-Jars-12-oz-White-Cap	32	$0.84	$30.24
Orange Counters *(Refer to the Material Preparation Guide for the quantity per canister)*	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips https://www.amazon.com/1000-Bingo-Chips-Storage-Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1	1	$9.99	$9.99
Purple Counters *(Refer to the Material Preparation Guide for the quantity per canister)*	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips https://www.amazon.com/1000-Bingo-Chips-Storage-Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1	1	$9.99	$9.99
Green Counters *(Refer to the Material Preparation Guide for the quantity per canister)*	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips https://www.amazon.com/1000-Bingo-Chips-Storage-Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1	2	$9.99	$19.98
Pink Counters *(Refer to the Material Preparation Guide for the quantity per canister)*	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips https://www.amazon.com/1000-Bingo-Chips-Storage-Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1	2	$9.99	$19.98
Colored Pencils *(1 per teacher)*	Staples	433097	Binney & Smith Crayola® Classpack Colored Pencils, 462 Pencils/Set, 14 Assorted Colors http://www.staples.com/Crayola-Classpack-Colored-Pencils-462-Box/product_433097	1	$98.99	$98.99
Labels for Canisters	Document is inside of the Material List folder *Recommended to be printed on Avery Label Number 5160 (address labels)*			2	$0	$0
Material Preparation Instruction Guide	Document is inside of the Material List folder			1	$0	$0
Procedure Sheets *(1 per pair of students)*	Document is inside of the Supplemental Materials folder *Recommended to be printed on card stock*			18	$0	$0
Coral Reef Sorting Sheet *(1 per pair of students)*	Document is inside of the Supplemental Materials folder *Recommended to be printed on card stock*			18	$0	$0
Coral Reef Digital Decision Matrix	Document is inside of the Supplemental Materials folder *Share document electronically with students for the activity*			1	$0	$0

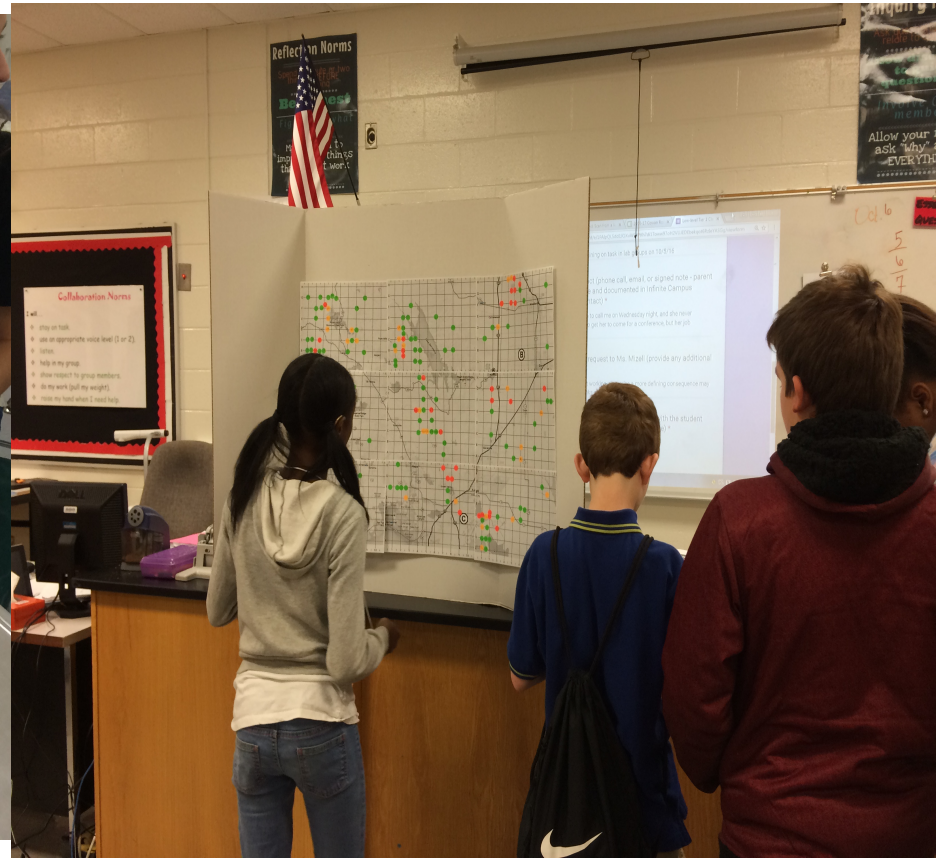
Estimated Challenge Total Cost per Teacher: $198.89

practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions?	

AMP-IT-UP IN THE CLASSROOM







AMP IT UP PARTNERSHIP

Griffin-Spalding County School System

AMP-IT-UP NSTA PRESENTATIONS

- **Earth Science Modules**:
  - Today 2:00pm-3:00pm
    Georgia World Congress Center, A305
- **Life Science Modules**:
  - Saturday 12:30-1:30
    Georgia World Congress Center, C207
- **Physical Science Modules**:
  - Saturday 11:00am-12:00pm
    Georgia World Congress Center, C302
- **STEM-ID Course**:
  - Saturday 11:00am-12:00pm
    Georgia World Congress Center, C213

K-12 INVENTURE® PRIZE

@ Georgia Tech

Friday 12:30-1:30

Georgia World Congress Center, B402

Georgia Tech Center for Education Integrating Science, Mathematics & Computing

THANK YOU!

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