

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

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



Advanced Manufacturing & Prototyping Integrated to Unlock Potentia

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Award # 1238089

### **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
  - 2 High Schools, 4 Middle Schools
  - Professional Development for over 50 teachers
- Impact: > 11,000 students over 5 years



### **AMP-IT-UP OVERVIEW VIDEO**





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## **PROGRAM COMPONENTS**

- Middle school STEM Innovation and Design (STEM-ID) exploratory courses that enable students to explore their creativity using robotics and rapid prototyping (semester long course)
- Middle school math and science modules that promote inquiry, STEM integration, and contextualize research at Georgia Tech
- Extracurricular enrichment for students and teachers
- Research on how AMP-IT-UP affects academic engagement, content understanding, knowledge transfer and student persistence in STEM





## **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
  - The focus of the module is the content of the core class that it is taught but it enhances or is enhanced by curriculum from other STEM courses.





## **STEM INTEGRATION IN AMP MODULES**



- There are three one-week modules in each middle school science area (Earth Science, Life Science, and Physical Science) and three modules per grade level in math.
- Enable teachers to implement change *incrementally*, rather than implement an entirely new, comprehensive curriculum and set of practices
- Modules do not rely on connections between science and math DCIs and focus on practices implemented in both courses
  - Pacing is flexible for implementation of modules
- Modules have strong application to science or engineering field or career
  - Every module features current research at Georgia Tech



### **STEM INTEGRATION IN THE MODULES**





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### **CRAB AQUARIUM CHALLENGE**



## **Challenge**

Your team has been asked to help an aquarium select the predators for a blue crab display so that there is an ecological balance of crabs and predators.



KEY TERMS

**Simulation:** A representation of the reallife situation can test important aspects of a phenomenon under investigation and can be used to generate predictions, explanations, and solutions. However, simulations are limited in what they can represent about the real-life situation.

## **CRAB AQUARIUM CHALLENGE**



### **Directions**

- 1. Record the Pheromone Percentage on your data sheet.
- 2. Count the blue plastic chips and record on the data sheet under Crab Mating Event.
- 3. Assign each member of your group a predator:
  - Sea Turtle: Yellow Plastic Chips
  - Red Drum: Red Plastic Chips
  - Croaker: Green Plastic Chips
- 4. Count your predator chips and record your number on your data sheet.

## **CRAB AQUARIUM CHALLENGE**



Crab Pheromone									
Concentration									
(%)	20	30	40	50	60	70	80	90	100
Number of									
Mating Events	4	6	8	10	12	14	16	18	20
Number of									
Croaker									
<b>Predatory Events</b>	2	5	8	11	14	17	20	23	26
Number of Red									
Drum Predatory									
Events	2	4	6	8	10	12	14	16	18
Number of Sea									
<b>Turtle Predatory</b>									
Events	1	3	5	6	7	8	9	10	11

## **STEM INTEGRATION**



- How does this activity address science content?
- What types of math connections can be made?
- How could this activity be an example of STEM integration?

This activity is part of a 7<sup>th</sup> Grade Math Module that covers basic GSE concepts in proportional relationships and rate of change.

How does this change your thoughts about the activity in terms of STEM Integration?

### **3-D LEARNING IN AMP-IT-UP**





### PHENOMENA AND PROBLEMS



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## AMP-IT-UP INTEGRATED THEMES

(DERIVED FROM NGSS SCIENCE AND ENGINEERING AND PRACTICES)



### 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**



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



### **Earth Science**

- Weather and Climate
- Plate Tectonics and Large Scale Systems



### Life Science

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



### **Physical Science**

- Structure and Properties of Matter
- Conservation of Energy and Energy Transfer

## **CROSSCUTTING CONCEPTS**

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

### **Example of Crosscutting Concepts in 7th Grade Data Visualization Module**

- 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







## AMP-IT-UP: SCIENCE AND MATH MODULES



AMP Crosscutting Integrated Theme		Earth Science (6 <sup>th</sup> Grade)	Life Science (7 <sup>th</sup> Grade)	Physical Science (8 <sup>th</sup> Grade)	
	Science	Molten Madness	Oil Spill Drill	Marine Snow	
Experimental Design	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	Science	Snow Day	Under the Sea	Riding the Concrete Wave: Skate Park	
IVIAKINg	Math	Sweet Machines	Perfecting Your Craft	Power Payoff	

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## **AMP-IT-UP CURRICULUM SUPPORT MATERIALS**

### **Module Curriculum Includes:**

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



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

Teecher Activities

Georgia Tech

This material list provides supplies to accommodate five class periods of thirty-five students each.

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				detailed ma	tenta desempt	ions.
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	18	\$0.54	\$9.72
			https://www.uline.com/Product/Detail/S-13340/Specialty-Boxes/Corrugated-Trays-Kraft-15-x-12-x-			
			2?FromOrderHistory=Y			
Wide Mouth Jar Canisters (class set)	Uline	S-14509	White Round Wide-Mouth Jars – 12 oz. White Cap	32	\$0.84	\$30.24
			https://www.uline.com/Product/Detail/S-14509/Jars/White-Round-Wide-Mouth-Jars-12-oz-White-Cap			
Orange Counters (Refer to the Material	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips	1	\$9.99	\$9.99
Preparation Guide for the			https://www.amazon.com/1000-Bingo-Chips-Storage-			
quantity per canister)			Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1			
Purple Counters (Refer to the Material	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips	1	\$9.99	\$9.99
Preparation Guide for the			https://www.amazon.com/1000-Bingo-Chips-Storage-			
quantity per canister)			Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3?_encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1			
Green Counters	Amazon	N/A	Royal Bingo Supplies 1000 Pack of 3/4-inch Bingo Chips	2	\$9.99	\$19.98
(Hefer to the Material Propagation Quide for the			https://www.emegan.com/4000.Bings.Ching.Storage			
quantity por canistor)			Integs://www.amazon.com/integratingo-comps-storage- Oranagido/BODEHKZ727/Jaf-nd_cat.m.1.32_anording-LITER&rafPID-CHK\/SDM52PB0\/MY076CK&th-1			
Dink Counters	Amazon	N/A	Printeen and a second s	2	CO 02	\$10.08
(Refer to the Material	Amazon	N/A	Noyai bingo Supplies Tobo Pack of Sreinch bingo Chips	2	45.55	<b>\$13.30</b>
Preparation Guide for the			https://www.amazon.com/1000-Bingo-Chips-Storage-			
quantity per canister)			Orange/dp/B00EHKZ7Z2/ref=pd_cart_rp_1_3? encoding=UTF8&refRID=GHKV5PM52PB0VMX0Z6GK&th=1			
Colored Pencils	Staples	433097	Binney & Smith Cravola® Classpack Colored Pencils, 462 Pencils/Set, 14 Assorted Colors	1	\$98.99	\$98.99
(1 per teacher)						
			http://www.staples.com/Crayola-Classpack-Colored-Pencils-462-Box/product 433097			
Labels for Canisters	Document is inside of the Material List folder		2	\$0	\$0	
			Recommended to be printed on Avery Label Number 5160 (address labels)			
Material Preparation			Document is inside of the Material List folder	1	\$0	\$0
Instruction Guide						
Procedure Sheets			Document is inside of the Supplemental Materials folder	18	\$0	\$0
(1 per pair of students)			Recommended to be printed on card stock			
Coral Reef Sorting Sheet	Document is inside of the Supplemental Materials folder			18	\$0	\$0
(1 per pair of students)	Recommended to be printed on card stock					
Coral Reef Digital Decision	Document is inside of the Supplemental Materials folder			1	\$0	\$0
Matrix			Share document electronically with students for the activity			
			Estimated Challongo Tota	Coat n	ar Toacho	r. ¢100 0

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

Estimated Challenge Total Cost per Teacher: \$198.89

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## AMP-IT-UP PROFESSIONAL DEVELOPMENT



- Annual Summer Institute
- Professional Learning Days
- PBIL Course
- In classroom Support
- Google Hangouts
- Google Collaborative
  Forums



## **AMP-IT-UP IN THE CLASSROOM**





### PARTNERSHIPS







### **AMP-IT-UP NSTA PRESENTATIONS**



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- 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



@ Georgia Tech

### Friday 12:30-1:30

Georgia World Congress Center, B402

### **QUESTIONS?**



### Download the Curriculum: http://ampitup.gatech.edu

Curriculum contact information:

ampitup@ceismc.gatech.edu



#### New Math & Science Curriculum is Now Available for Download

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LEARN MORE AND DOWNLOAD HERE >





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