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

CENTER FOR EDUCATION INTEGRATING SCIENCE, MATHEMATICS AND ENGINEERING (CEISMC) & GRIFFIN-SPALDING COUNTY SCHOOLS
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
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
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.
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
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 real-life 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.
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.
<table>
<thead>
<tr>
<th>Crab Pheromone Concentration (%)</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Mating Events</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Number of Croaker Predatory Events</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td>14</td>
<td>17</td>
<td>20</td>
<td>23</td>
<td>26</td>
</tr>
<tr>
<td>Number of Red Drum Predatory Events</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Number of Sea Turtle Predatory Events</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>
This activity is part of a 7th 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

- Science and Engineering Practices
- Authentic Problems
- Disciplinary Core Ideas
- Crosscutting Concepts
PHENOMENA AND PROBLEMS

• How do scientists solve problems?

• Students are introduced to problems or phenomena related to Georgia Tech research.

• The challenge frames the investigation throughout the module.
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)
Georgia Standards of Excellence and NGSS Core Content Standards are supported throughout each module.

**SUPPORTED CORE IDEAS**

**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
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

<table>
<thead>
<tr>
<th>AMP Crosscutting Integrated Theme</th>
<th>Earth Science (6th Grade)</th>
<th>Life Science (7th Grade)</th>
<th>Physical Science (8th Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Design</strong></td>
<td>Science</td>
<td>Molten Madness</td>
<td>Oil Spill Drill</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Some Assembly Required</td>
<td>It’s Game Time</td>
</tr>
<tr>
<td><strong>Data Visualization</strong></td>
<td>Science</td>
<td>Shake and Break</td>
<td>Don’t Wreck the Reef!</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Data Saves the Whales!</td>
<td>Aquarium Friend or Foe?</td>
</tr>
<tr>
<td><strong>Data Driven Decision Making</strong></td>
<td>Science</td>
<td>Snow Day</td>
<td>Under the Sea</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Sweet Machines</td>
<td>Perfecting Your Craft</td>
</tr>
</tbody>
</table>
AMP-IT-UP CURRICULUM SUPPORT MATERIALS

Module Curriculum Includes:

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

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

Curriculum contact information: ampitup@ceismc.gatech.edu