What does STEM integration look like in the classroom?

Advanced Manufacturing and Prototyping, Integrated to Unlock Potential

An NSF Partnership to Cultivate the Next Generation of STEM Innovators

Award # 1238089
Period: 10/1/2012--9/21/2017
Advanced Manufacturing and Prototyping Integrated to Unlock Potential (AMP-IT-UP)

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

• Partnership with the Griffin Spalding County School System

• Impact: > 11,000 students over 5 years

Integrates middle school engineering, science and mathematics to promote STEM learning and entrepreneurship.
• The Program Components

• Middle school STEM Innovation and Design exploratory 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 High school engineering courses that focus on design-build challenges

• Extracurricular enrichment for students and teachers

• Research on how AMP-IT-UP affects academic engagement, content understanding, knowledge transfer, and student persistence in STEM
Middle School Math- Science Curriculum

- Integrated STEM
- Problem Based Learning
- Inquiry Driven
- Aligned with NGSS Practices
- Connections to Georgia Tech Research
So what does this look like? What is STEM Integration?

'I expect you all to be independent, innovative, critical thinkers who will do exactly as I say.'
Crab Aquarium Challenge
Crab Aquarium Challenge

Your 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.
Crab Aquarium Challenge

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

<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><strong>Number of Mating Events</strong></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><strong>Number of Croaker Predatory Events</strong></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><strong>Number of Red Drum Predatory Events</strong></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><strong>Number of Sea Turtle Predatory Events</strong></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>
Trends

• What trends do you observe about the number of the blue crab mating events as the pheromone concentration increases?

• What trends do you observe about the number of events with each Blue Crab Predator?

• Are the differences between trends of the different predators?
STEM Integration

• Think about this activity: how does this teach science content?
• What types of math connections can be made?
• How could this be an example of STEM integration?

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?
STEM Integration in AMP

• Nine Math Modules and Nine Science Modules
• Each grade level has three modules in each content area aligned to specific NGSS practices
• Each module presents a challenge that requires math/science content development to develop solutions
• Math modules use science/engineering context and data to teach specific math standards
  • Ocean Zones
  • Solar Energy
  • Manufacturing Challenge
• Science modules use data analysis to reinforce math standards
3D Learning In AMP-IT-UP
Phenomena and Problems

Examples:
• Students engage as earth scientists to help a small town that is adjacent to a volcano develop evacuation plans in the event of an eruption.
• Students play the role of school officials and have to decide whether to close school or keep it open based on weather forecasts.
• Students engage as earth scientists to help a company decide where to build its new cell phone and tablet manufacturing plant in northern California.
• Students engage as environmental engineers to develop a procedure that would remove the most amount of oil from the ocean in the shortest time possible in the event of a large scale oil spill.
Deep Dive into NGSS Practices

Each module focuses on one of these themes:

• **Experimental Design**
  - Planning and carrying out investigations (Practice 3)

• **Data Visualization**
  - Analyzing and interpreting data (Practice 4)

• **Data-Driven Decision Making**
  - Constructing explanations and designing solutions (Practice 6)

• **Engaging in Argument from Evidence** (Practice 7)

Students plan and carry out investigations to answer questions or test solutions to problems. Students are challenged to set up and run an experiment, identify variables that cause inconsistent results across groups, agree on a standard protocol, re-run the experiment and graph data to demonstrate that data converges as procedures become standardized.

Students represent data in multiple ways and realize that different types of visualizations allow people to extract different meaning from the evidence. Students analyze data and situations that are intentionally murky, and to make decisions based on data, but where there isn’t a simple solution and instead they need to address various trade-offs and then communicate and defend their decisions.
Crosscutting Concepts and Core Content

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

S6E4. Obtain, evaluate, and communicate information about how the sun, land, and water affect climate and weather. Construct an explanation of the relationship between air pressure, weather fronts, and air masses and meteorological events such as tornados and thunderstorms.

S6E4. Analyze and interpret weather data to explain the effects of moisture evaporating from the ocean on weather patterns and weather events such as hurricanes.
Science Modules

**Experimental Design**
- Molten Madness (6)
- Oil Spill Drill (7)
- Ocean Blizzard (8)

**Data Visualization**
- Shake and Brake (6)
- Under the Sea (7)
- Riding the Concrete Wave - Part 1 (8)

**Evidence Based**
- Snow Day (6)
- Don’t Wreck the Reef (7)
- Riding the Concrete Wave – Part 2 (8)
Modules in the Classroom
Griffin Spalding Community Schools and Georgia Tech: A Partnership

GRIFFIN-SPALDING COUNTY SCHOOL SYSTEM

GSCS is transforming our students into future-ready learners and contributing members of society.
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New Math & Science Curriculum is Now Available for Download

LEARN MORE AND DOWNLOAD HERE
So how can I download this curriculum?

Go to www.ampitup.gatech.edu and click on curricula. Scroll down to Science Curriculum and click on it. Modules are listed by grade level. Read through the descriptions of the modules and the supported Georgia Standards and then you can request the module through clicking on the blue link "Request this". Fill out the information on Module Request Form and then select the module(s) that you would like copies and click submit. You will then receive an email with the links for downloads of the modules requested.
GSTA AMP SESSIONS

- 6th Grade Curriculum
  Thursday at 2pm Rhododendron A
- 7th Grade Curriculum
  Thursday at 4pm Rhododendron A
- 8th Grade Curriculum
  Saturday at 8am Gardenia
Contact Information

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