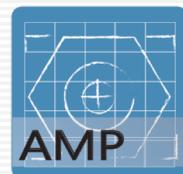


AMP UP YOUR PHYSICAL SCIENCE CURRICULUM WITH INTEGRATED PRACTICES

CENTER FOR EDUCATION INTEGRATING SCIENCE,
MATHEMATICS AND COMPUTING (CEISMIC) AND
GRIFFIN-SPALDING COUNTY SCHOOLS



Award # 1238089



Advanced Manufacturing & Prototyping Integrated to Unlock Potential



CREATING THE NEXT®

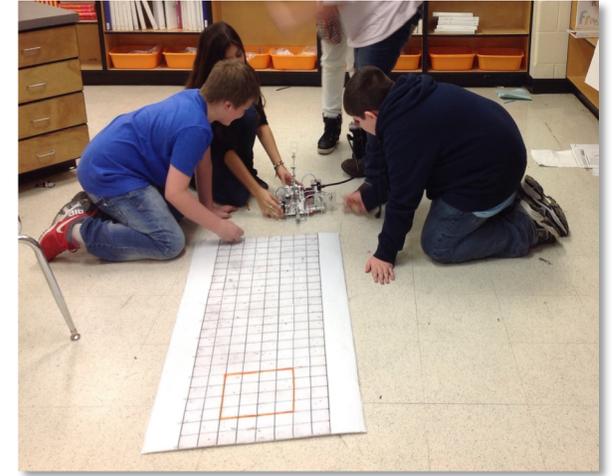


AMP-IT-UP OVERVIEW VIDEO



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 learning 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

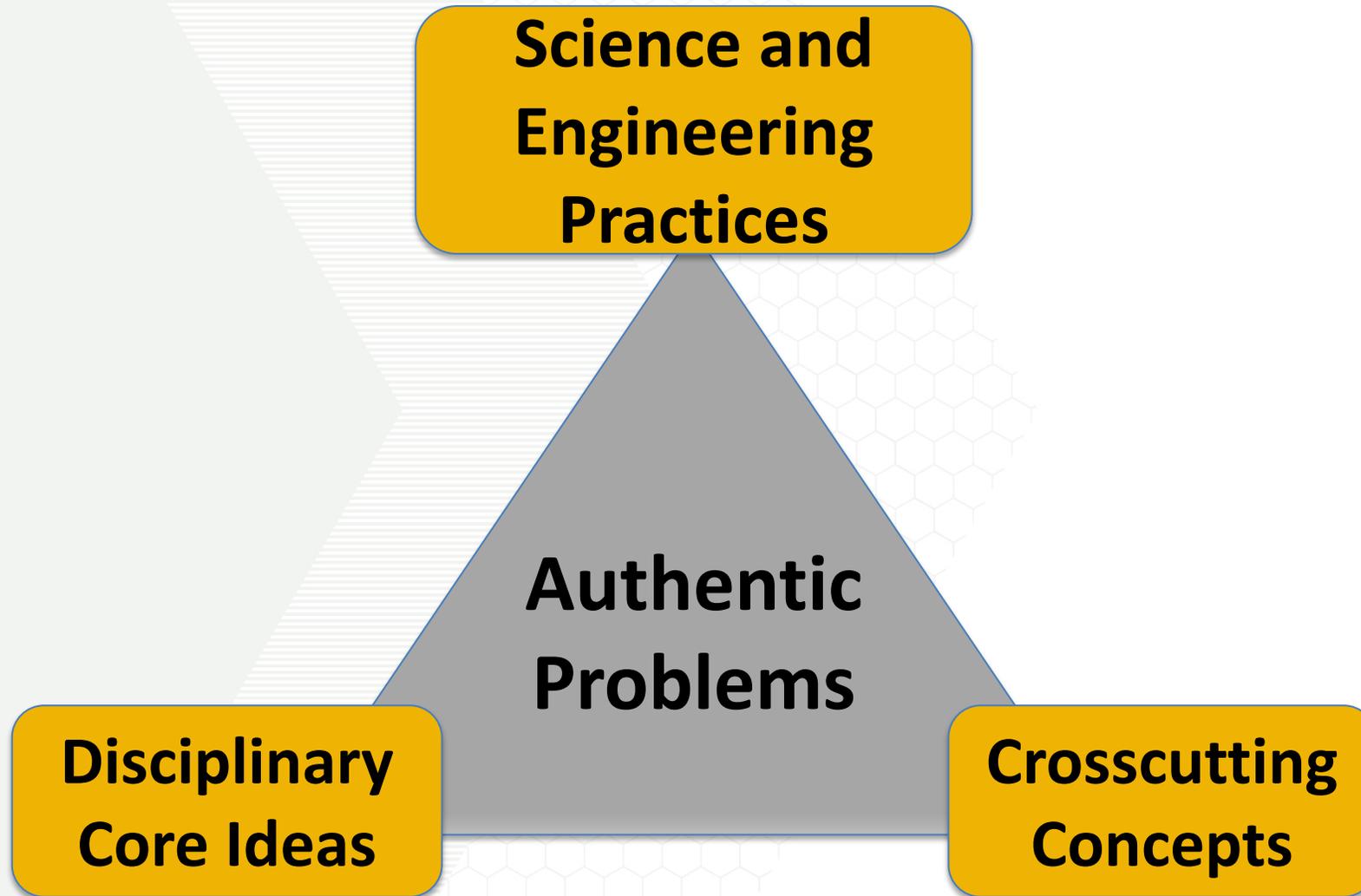


AMP-IT-UP: SCIENCE AND MATH MODULES



AMP Crosscutting Integrated Theme		Earth Science (6 th Grade)	Life Science (7 th Grade)	Physical Science (8 th 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)



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

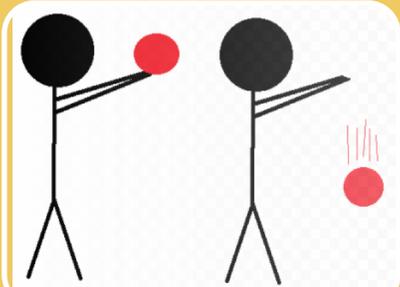
- Analyzing and Interpreting Data (NGSS Practice 4)
- Make Sense of Problems (SMP #1); Model with Mathematics (SMP #4)

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 AND CROSSING CUTTING CONCEPTS

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



Disciplinary Core Ideas

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



Crosscutting Concepts

- Energy and Matter
- Structure and Function
- Scale Proportion, and Quantity

MARINE SNOW : EXPERIMENTAL DESIGN

Challenge: Students engage as environmental engineers to develop a procedure that determines how to the oil from the Deepwater Horizon spill landed at the bottom of the ocean.

Time: This module takes 4-5 days

Essential Questions:

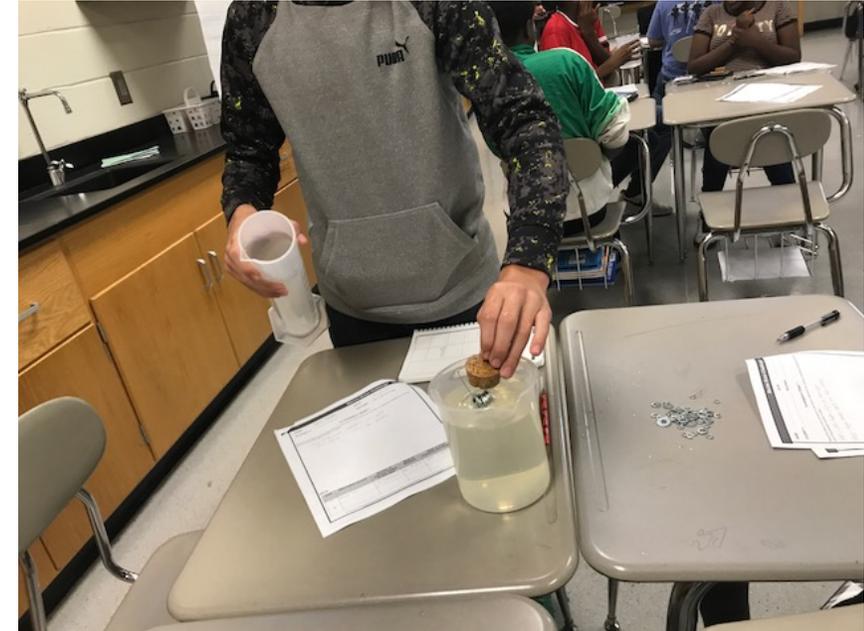
- How do scientists solve problems?
- How can physical and chemical properties be used to identify matter?

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



MARINE SNOW: EXPERIMENTAL DESIGN

- Modeling
- Predict/Observe/Explain Activity on density
- Design a procedure to determine the minimum number and the minimum mass of washers (plankton) it will take to sink your cork (oil).
- Analyze class results using a histogram
- Redesign a consistent class procedure and complete the investigation
- Analyze the redesign
- Communicate the results
- Discuss principles of density



HELMET CHALLENGE: DATA VISUALIZATION

Challenge: Students engage as crash-test scientists for the SkateTech company to test helmets for skateboarders. The students use a computer simulation to collect the data on helmet safety that will inform their recommendation on skateboarding safety.

Time: This module takes 3-4 days

Essential Questions:

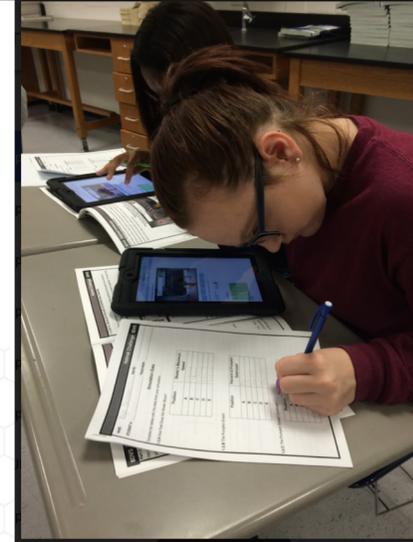
- What is the key differences between linear and non-linear relationships when graphed?
- How do the changes in speed affect changes in kinetic energy ?
- How do data visualizations help communicate data more effectively than charts and tables?

Georgia Tech Research Connection: Dr. Michelle LaPlaca, Biomedical Engineering



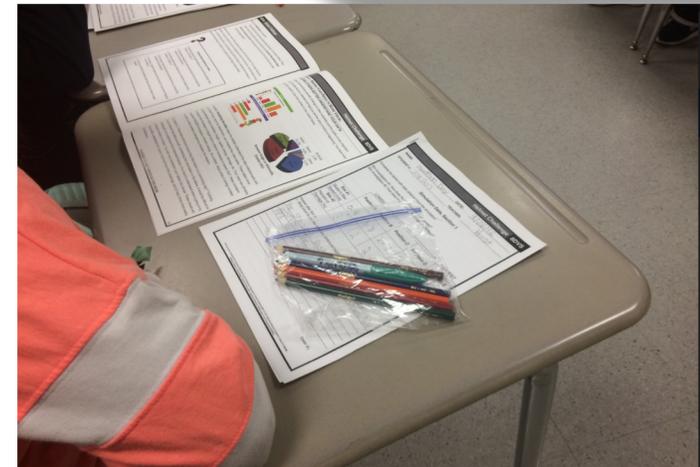
HELMET CHALLENGE: DATA VISUALIZATION

- Students use a simulation to collect data about:
 - How does speed change as a skater rides through the skate park?
 - How will that speed affect the potential damage caused during a fall?
- Review a basic content tutorial on energy.
- Analyze data to calculate speed and kinetic energy
- Graph data to answer the helmet challenge
- Math Connections: Linear-Non-Linear Relationships



Simulation: A representation of a real-life phenomenon or event that can test important aspects of that real-life phenomenon or event. Data or results from simulations can be used to generate predictions, explanations, and solutions.

KEY
TERMS



DATA DRIVEN DECISION MAKING

- 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.
- Progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s)



SKATE PARK: DATA DRIVEN DECISION MAKING



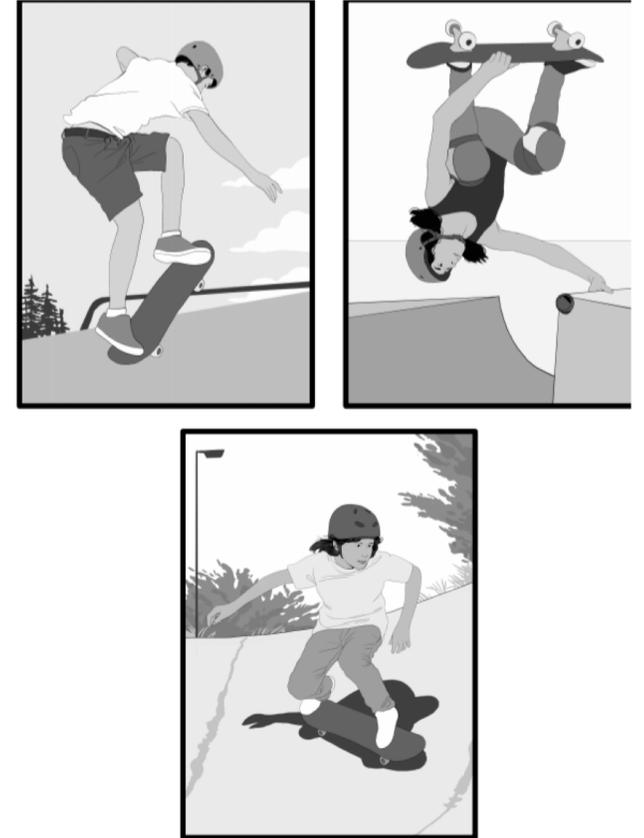
Challenge: Students engage as product reviewers for the SkateTech company's website to craft a product review of various helmets for various abilities of skateboarders. The students use computer simulations, data visualization, and computational skills to match a profiled skater to their best-fit helmet.

Time: This module takes 3-4 days

Essential Questions:

- How do data visualizations help communicate data more effectively than charts and tables?
- How can we use data as evidence to support claims?

Georgia Tech Research Connection: Dr. Michelle LaPlaca,
Biomedical Engineering



SKATE PARK: ENGAGE



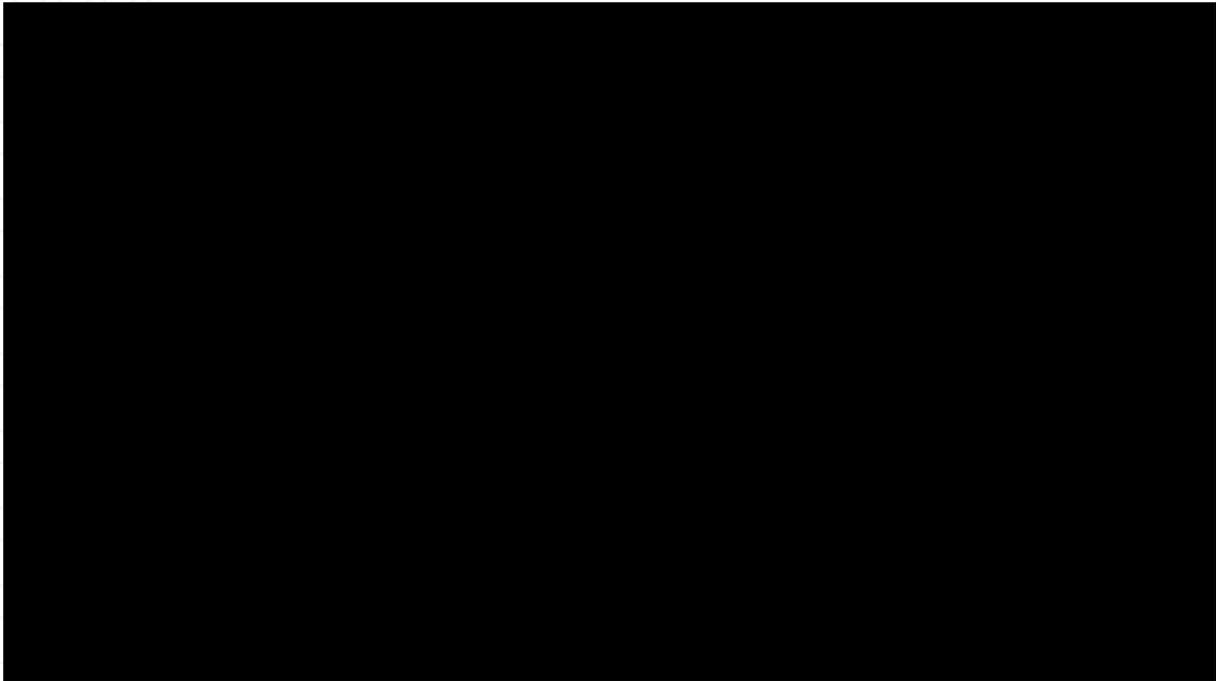
Kaylee, 15
Experience Skating: 8 years
Current Savings: \$70
Notes: She skates all the time and likes to skate tough challenging bowls, parks, and half pipes, but she will skate anything. She rarely falls, but she knows her limits and tries not to test them too much. She makes most of her money working in her parent's restaurant. It is a steady source of money, though it doesn't always pay a lot.



Grant, 13
Experience Skating: Less than a year
Current Savings: \$200
Notes: Grant really likes skateboarding. He is definitely a beginner, and he has had his share of falls. He realizes his limits. So, he thinks carefully about where he should skate and what challenges he should take on. He hopes that by age 17 he is taking on big air ramps and parks. Grant mows lawns for neighbors, and he is a big saver.



Selena, 14
Experience Skating: 4 years
Current Savings: \$55
Notes: She prefers long, continuous runs. She doesn't really want big air. She is very laid back. She focuses on smooth technique, clean tricks, and flow through the run. Selena is very active in after school sports, so she does not have time for a steady job. She saves her money from birthday presents and extra chores. She would like to keep as much of it as possible.



- **Skate Park Simulation**
www.tinyurl.com/ampitup8
- **Passcode:** odyssey

1. Skater
Speed Check

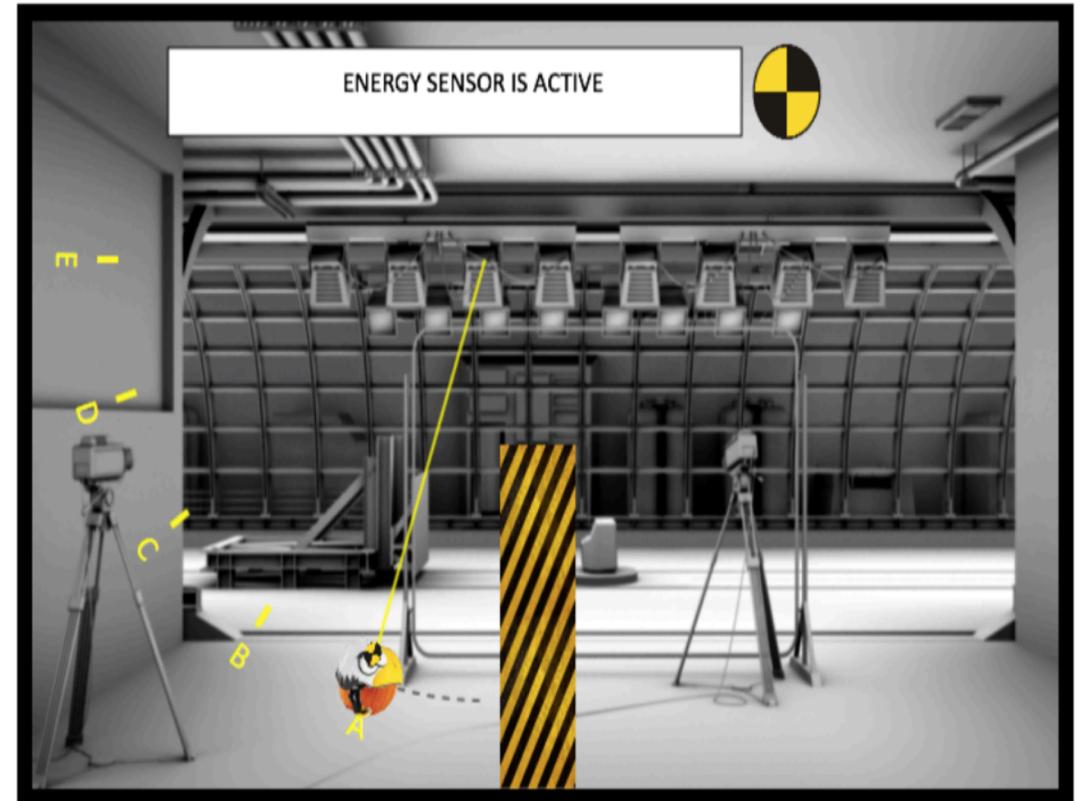
2. Smashing
Pumpkins

3. Smashing
with Sensor

4. Sensor with
Helmet

5. Helmet
Tests

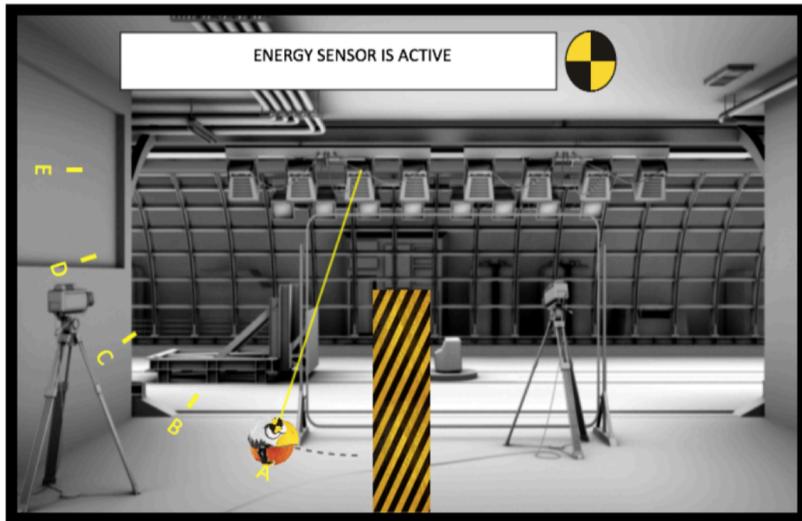
- Students will have completed Simulations 1-4 in Helmet Challenge and can transfer data to Skate Park Challenge.



Skate Park Sim Investigation #1

How does helmet type affect the amount of energy transferred to the pumpkin?

Each group is assigned a helmet to test in the simulation and will run the simulation with no helmet and their assigned helmet



Part A

Position	Pumpkin Energy (no helmet)
A	
B	
C	
D	
E	

Part B

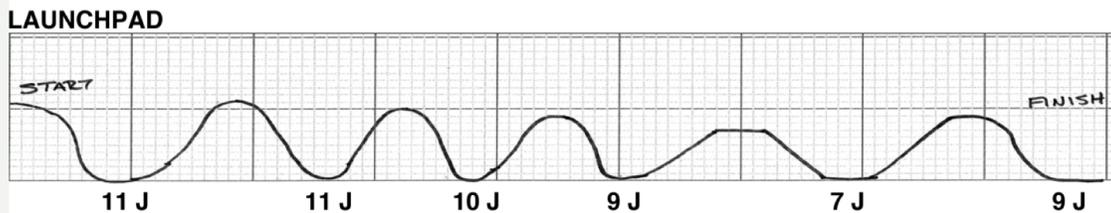
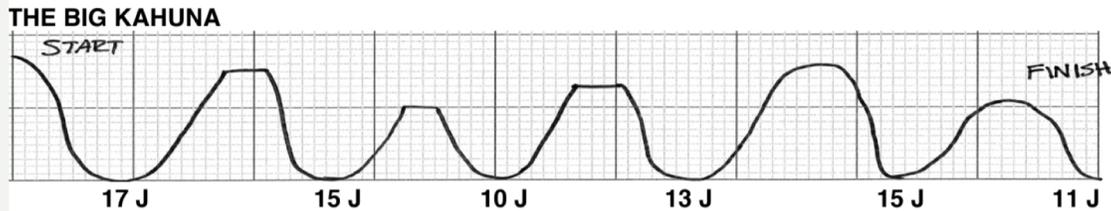
Position	Pumpkin Energy (with your helmet)
A	
B	
C	
D	
E	

Pumpkin, No Helmet – Pumpkin, with Helmet = Energy Absorbed by Helmet

Max Energy Absorbed (Joules) by Each Helmet Type					
	Red			Pink	
	Black			Eagle	
	Blue			Green	

SKATE PARK: EXPLAIN

Students look at kinetic energy profile of each skate park and calculate “Injury Energy” for each helmet



THE BIG KAHUNA

START FINISH

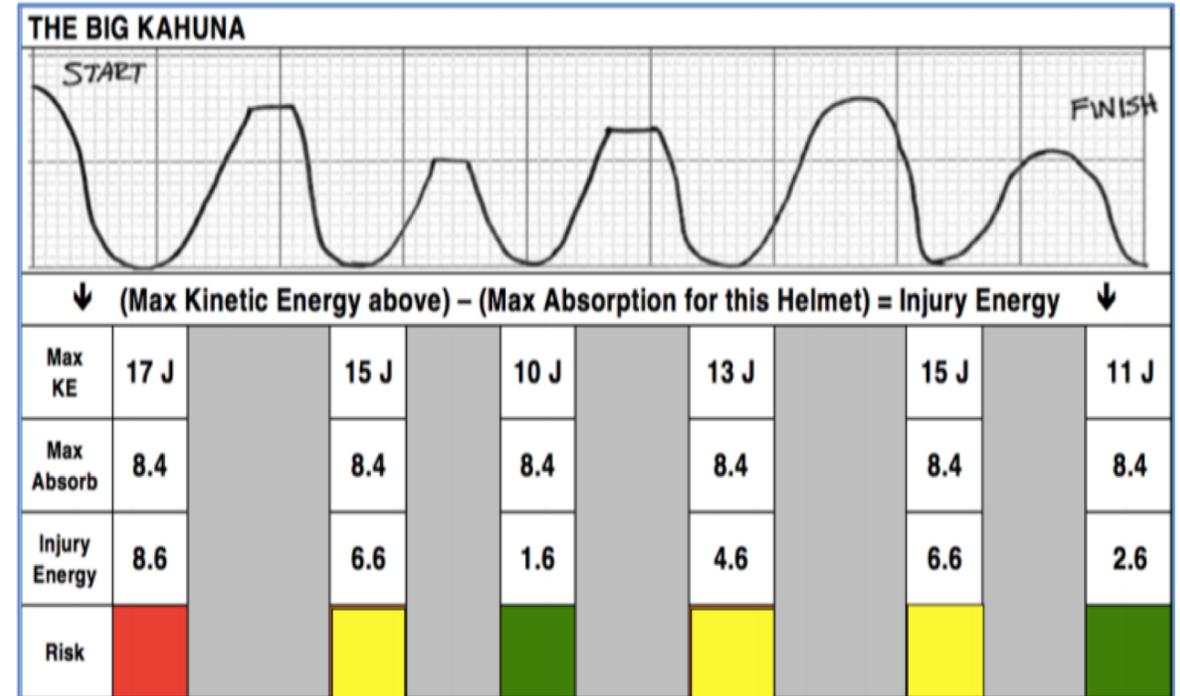
↓ (Max Kinetic Energy above) – (Max Absorption for this Helmet) = Injury Energy ↓

Max KE	17 J	15 J	10 J	13 J	15 J	11 J
Max Absorb	-					
Injury Energy	=					
Risk						

SKATE PARK: EXPLAIN

Students will color code the risk for each helmet on each run of the two skate parks.

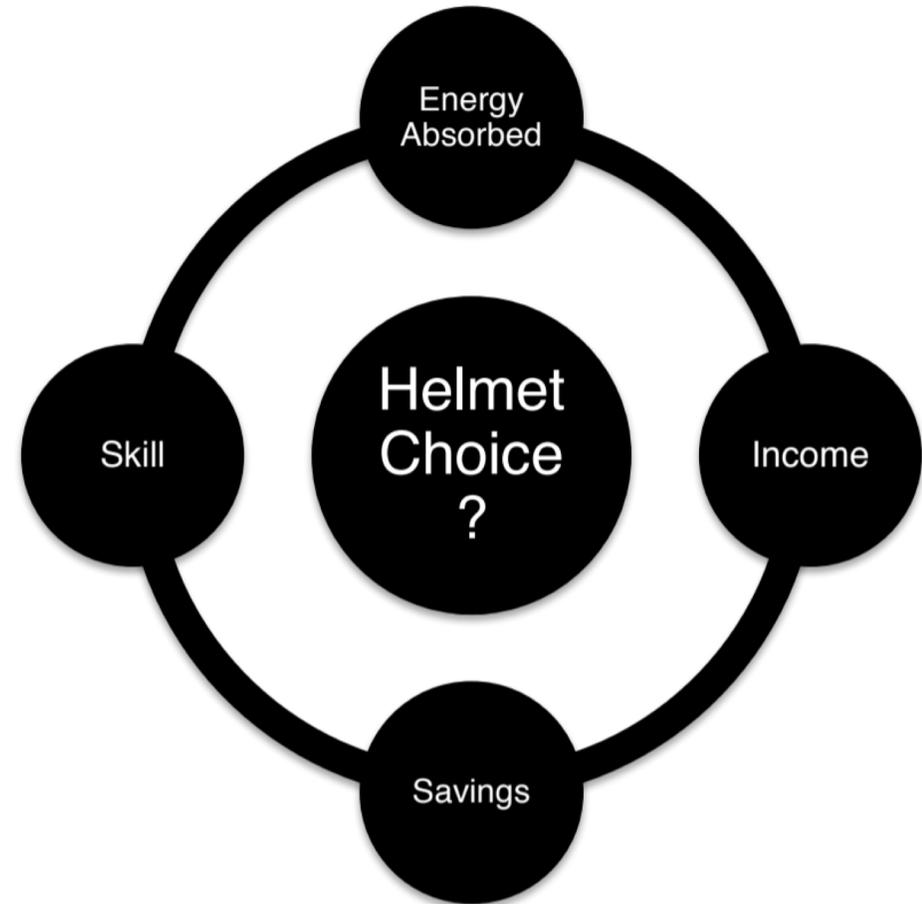
Amount of Energy	Effects on the Brain	Risk
0 – 3 Joules	No effect, possible headache	GREEN
4 – 6 Joules	Headache, possible confusion or mild concussion	YELLOW
7 + Joules	Concussion, possible brain injury	RED



SKATE PARK: ELABORATE

Students combine multiple sources of information such as energy absorption of helmet, cost of helmet, and income and skill of skater to make a decision using a matrix of which helmet would be the best fit for each skater.

Helmet Design	Cost
 Red Helmet	\$60
 Black Helmet	\$15
 Blue Helmet	\$45
 Pink Helmet	\$100
 Eagle Helmet	\$70
 Green Helmet	\$25



SKATE PARK: ELABORATE/EVALUATE

Skate Park Decision Matrix



Grant, 13
Experience Skating: Less than a year
Current Savings: \$200
Notes: Grant really likes skateboarding. He is definitely a beginner, and he has had his share of falls. He realizes his limits. So, he thinks carefully about where he should skate and what challenges he should take on. He hopes that by age 17 he is taking on big air ramps and parks. Grant mows lawns for neighbors, and he is a big saver.

Helmet Type	Injury Risk Big Kahuna	Injury Risk Launchpad	Skill Fits Risk	Effect on Savings & Income	Finalist for Skater?
 Red \$60					
 Black \$15					
 Blue \$45					
 Pink \$100					
 Eagle \$70					
 Green \$25					

Students complete a decision matrix for each skater.

Helmet Recommendations

As a Product Reviewer for SkateTech, select a helmet for each skater. Write a recommendation based on the data you have collected. Your recommendation will appear on Skate Tech's website, and thousands of readers will view it. Your recommendation should address:

- The Safety Need of the Skater
- The Skills of the Skater
- The Savings and Income of the Skater

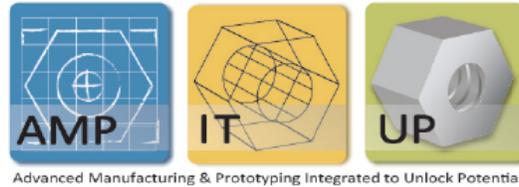
Your recommendation should use evidence that you have collected during this module. Use the *Skate Park Analysis* student sheets and the *Skate Park Decision Grid* student sheet to help you make a choice. You should include those pieces of evidence to support your decision in this written recommendation. You may find that your recommendation only will work for one of the tracks, which might be all right for an individual skater.

You may find that it is not always clear-cut which choice you should make for an individual skater. In that case you should write about aspects of the helmet or skater that might suggest another decision. In the end, however, tell us why you made the decision you did.

Module Curriculum Includes:

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

EE Stage	Student Activities	Teacher Activities
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Life Science Data-Driven Decision Making “Don’t Wreck the Reef.” Coral Reef Challenge Materials List

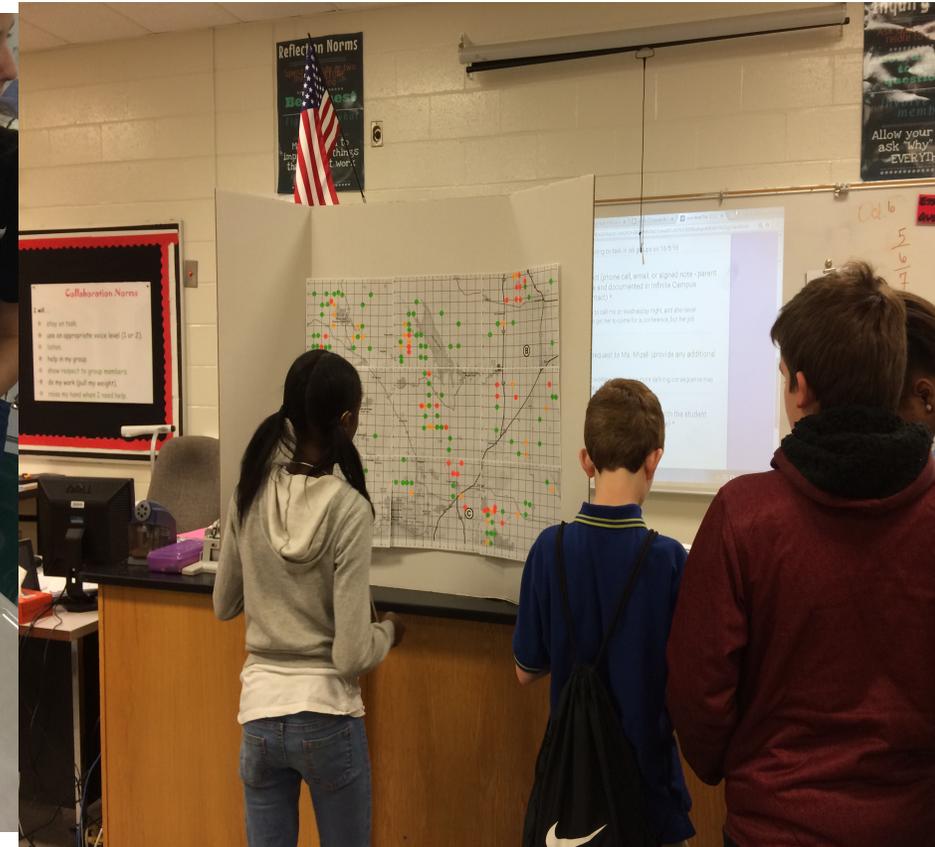
This material list provides supplies to accommodate five class periods of thirty-five students each. Please be sure to review the teacher’s edition for more detailed material descriptions.

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/B00EHK27Z2/ref=pd_cart_m_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/B00EHK27Z2/ref=pd_cart_m_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/B00EHK27Z2/ref=pd_cart_m_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/B00EHK27Z2/ref=pd_cart_m_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 <i>Recommended to be printed on Avery Label Number 5160 (address labels)</i>			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 <i>Recommended to be printed on card stock</i>			18	\$0	\$0
Coral Reef Sorting Sheet (1 per pair of students)	Document is inside of the Supplemental Materials folder <i>Recommended to be printed on card stock</i>			18	\$0	\$0
Coral Reef Digital Decision Matrix	Document is inside of the Supplemental Materials folder <i>Share document electronically with students for the activity</i>			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



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



@ Georgia Tech

Friday 12:30-1:30

*Georgia World Congress Center,
B402*