Don’t Reinvent the Wheel: Creating Inquiry Experiences for Students

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Welcome!

This workshop will include learning, creating and sharing for the next hour and forty-five minutes.

After I work through some ideas and steps, you will have time to work on your inquiry experience.
I'M LAZY
I survived another meeting that should have been an email.
The Beauty of NGSS
## Disciplinary Core Ideas

### Life Science
- LS1: From Molecules to Organisms: Structures and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

### Physical Science
- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer

### Earth & Space Science
- ESS1: Earth’s Place in the Universe
- ESS2: Earth’s Systems
- ESS3: Earth and Human Activity

### Engineering & Technology
- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society
1. Cause and Effect
2. Structure and Function
3. Systems and System Models
4. Scale, Proportion, and Quantity
5. Stability and Change
6. Energy and Matter
7. Patterns
The Scary Part of NGSS
You already have it!
Create your own inquiry experiences
With stuff you already have
These steps aren’t always linear. Do you.
Step #1

Identify your DCI and SEP

(Content + Skill)

Real Life

- 2D Projectile Motion (PS2)
- Data Collection and Analysis

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Step #2

What is lab, demonstration or experience you already use to cover this content?


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Real Life

Target Practice: Full Projectile Launch

<table>
<thead>
<tr>
<th>Diagram</th>
<th>Variables in the x-direction</th>
<th>Variables in the y-direction</th>
</tr>
</thead>
</table>

Solve for hang time: (Which dimension do we usually use to solve time in?)
Step #3

How can you adjust this lab to meet your “skill”?

Real Life

- Taking additional data for angles
- Create your own data table
- Answer questions on data

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Step #4

When are you going to do this inquiry experience? What purpose does it serve?

Real Life

- Before we learn about 2D projectile motion
- For students to determine the max angle for distance in the x and max height by experimentation.


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Step #5

Adjust the purpose and guiding question based on inquiry.

Real Life

Original: Determine the time and distance from a projectile (ball launcher).

Inquiry: How does the angle affect the distance travelled in the x and maximum height?
Step #6

Determine what you want to “keep” from the original lab. Keep in mind your skill for this inquiry.

Real Life

- Set Up
- Data Table

https://bit.ly/2EodIH8  Vanessa L Wentzloff  @outoftheboxSTEM
Step #7

Create your inquiry experience. Remember, the best inquiry experience is student driven.

Real Life


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How does angle affect range and maximum height?
● Create Data Table
● Test angles starting at 5 degrees going up by 5’s to 90
● Answer follow up questions on Google Classroom

range = Δx/ΔX
max height = x/Δy

5° - 90°
Δx = max height

<table>
<thead>
<tr>
<th>angle</th>
<th>Δx</th>
<th>max height</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°</td>
<td>54cm</td>
<td>3 cm</td>
</tr>
<tr>
<td>10°</td>
<td>43 cm</td>
<td>4.5 cm</td>
</tr>
<tr>
<td>15°</td>
<td>58.5 cm</td>
<td>5 cm</td>
</tr>
<tr>
<td>20°</td>
<td>72.5 cm</td>
<td>8 cm</td>
</tr>
<tr>
<td>25°</td>
<td>85 cm</td>
<td>12 cm</td>
</tr>
<tr>
<td>30°</td>
<td>95.5 cm</td>
<td>17 cm</td>
</tr>
<tr>
<td>35°</td>
<td>102 cm</td>
<td>20 cm</td>
</tr>
<tr>
<td>40°</td>
<td>98 cm</td>
<td>23 cm</td>
</tr>
<tr>
<td>45°</td>
<td>108.5 cm</td>
<td>28 cm</td>
</tr>
<tr>
<td>50°</td>
<td>97 cm</td>
<td>33 cm</td>
</tr>
<tr>
<td>55°</td>
<td>103 cm</td>
<td>40 cm</td>
</tr>
<tr>
<td>60°</td>
<td>93.5 cm</td>
<td>45 cm</td>
</tr>
<tr>
<td>65°</td>
<td>83.5 cm</td>
<td>50 cm</td>
</tr>
<tr>
<td>70°</td>
<td>71 cm</td>
<td>53 cm</td>
</tr>
<tr>
<td>75°</td>
<td>61 cm</td>
<td>56 cm</td>
</tr>
</tbody>
</table>
How does angle affect range? 
If max height(y)?
5° to 90°
(θ = 0° vs θ)

θ = 0° 90°

5° 10° 15° 20° 25° 30° 35° 40° 45° 50° 55° 60° 65° 70° 75°

y = 1/2 g t^2
v = \sqrt{2gh}

Distance (range) = \frac{v^2 \sin 2\theta}{g}

<table>
<thead>
<tr>
<th>θ</th>
<th>x (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°</td>
<td>1.8 cm</td>
</tr>
<tr>
<td>10°</td>
<td>3.6 cm</td>
</tr>
<tr>
<td>15°</td>
<td>5.4 cm</td>
</tr>
<tr>
<td>20°</td>
<td>7.2 cm</td>
</tr>
<tr>
<td>25°</td>
<td>9.0 cm</td>
</tr>
<tr>
<td>30°</td>
<td>10.8 cm</td>
</tr>
<tr>
<td>35°</td>
<td>12.6 cm</td>
</tr>
<tr>
<td>40°</td>
<td>14.4 cm</td>
</tr>
<tr>
<td>45°</td>
<td>16.2 cm</td>
</tr>
<tr>
<td>50°</td>
<td>18.0 cm</td>
</tr>
<tr>
<td>55°</td>
<td>19.8 cm</td>
</tr>
<tr>
<td>60°</td>
<td>21.6 cm</td>
</tr>
<tr>
<td>65°</td>
<td>23.4 cm</td>
</tr>
<tr>
<td>70°</td>
<td>25.2 cm</td>
</tr>
<tr>
<td>75°</td>
<td>27.0 cm</td>
</tr>
</tbody>
</table>

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1) What angle(s) give us the maximum range? 2) What angle(s) give us the maximum height? 3) What is Y range for each situation?

16

9

Turned in Assigned

All

1) 45°
2) 80°
3) y doesn't have displacement

Reply

Feb 5

35°-55 degrees, 65°-90 degrees.

Reply

Feb 4

1. 45° gives us max range
2. 90° gives us max height
3. 0cm

Reply

Feb 4
Class discussion the following day
Original Lab

- Knowledge based
- “Real Life” word problem practice
- Easy to copy
- Handed to students on a silver platter

Inquiry

- Student Driven and Student Choice
- Data Analysis Practice
- Students discover and find out key parts themselves
- Can be scaffolded

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A Biology Example
PART 1
1. Using Snow’s spot map (Figure 1), what observations can you make about the distribution of the cholera cases?
   Students should notice that most of the cases are near water pump A, and very little near water pumps B and C.

2. Which well would you pick as the most likely source of contaminated water?
   Well A.

3. Why wouldn’t you identify pump C as the possible source?
   Because very few cases of cholera occurred near pump C.

4. What reasons could explain why there were no cases of cholera in the people living in the two-block area around the brewery east of pump A?
   Most teams will probably say that those people drank beer instead of water. (They are correct, but the brewery also had a deep well used by the people that worked there.)

5. What could Snow do to test his hypothesis that the epidemic was caused by water from Pump A? (Remember that he couldn't actually test the water for bacteria.)
In 1854 an epidemic broke out in the slums of London. Throughout history this disease killed millions of people, and that hundreds died in the 1854 epidemic. One man, who is a doctor, discovered the source and stopped the epidemic. Your group will be given the same information that the doctor possessed and will try to solve the mysterious epidemic. Symptoms of this deadly disease include severe perspiration, diarrhea and vomiting.

Your Group's Task:
Doctor has some evidence on victims, you will be provided with a set of the same victim's information. You are your group are to draw a map and explain how the disease spread using the victim cards. (20 mins)

#1
The people living around Broad Street are poor. Large families are crowded into one- and two-room apartments. None has indoor plumbing; residents use outdoor toilets and haul their water from the nearest public pump.

#4
Matilda Wright refused to drink water from the faucets in her home. She would only drink the sweet-tasting water that her gardener hauled from the Broad Street pump.

#2
Thomas Sutterfield fell ill two hours after stopping off to visit his great-aunt "Tilda". He had tea, biscuits and sausages with his great aunt. It was a hot day and he took a drink of cool water before leaving.

#5
Ausley and Marthy Brown and their two children are the only people on Ely Street who didn't get cholera. Marthy's family lives in Soho. The Browns haul their water from the Soho pump, which allows them to visit their relations.

[Links]
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Why it was inquiry?

No map was given or background information

The “pump” information was not given- the student inferred it from clues

Students could choose how they used the information and created their map
Questions?
Let's dive in!
First, let’s find an activity/lab/demo you want to use.
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Share Out