

ATLANTA
SCIENCE
FESTIVAL

Lesson Title	Three Billy Goats Gruff Engineering
Grade Band	2 nd Grade
Submitted by	Donna Barrett, Metro RESA
Georgia Performance Standards:	
<p>S2P3. Students will demonstrate changes in speed and direction using pushes and pulls. a. Demonstrate how pushing and pulling an object affects the motion of the object.</p> <p>S2CS1. Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works. a. Raise questions about the world around them and be willing to seek answers to some of the questions by making careful observations and measurements and trying to figure things out.</p>	
Safety Considerations:	
Materials & Time Required:	
<p>Materials Books, blocks Five 5x8 index cards per students Coin (or weights) of different sizes to represent the Billy goats Pictures of bridges - http://www.pbs.org/wgbh/buildingbig/bridge/index.html</p>	
Lesson Logistics (for teacher):	
<p>Resources:</p> <ul style="list-style-type: none">▪ http://www.pbs.org/wgbh/buildingbig/bridge/index.html▪ http://www.cpalms.org/Public/PreviewResource/Preview/32075	

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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Opening: ENGAGE</p>	<p>Engage</p> <p>Read: <i>The Three Billy Goats Gruff</i> by Paul Galdone – identify forces within the story (pushes and pulls)</p> <p>Questioning:</p> <ul style="list-style-type: none"> ▪ Besides the troll, what other problem do the Billy goats have? (need a bridge to cross the stream) ▪ How can you help? (build them a bridge) ▪ Can you build a bridge strong enough for the little Billy goat to cross safely and avoid the troll lurking below? ▪ Strong enough for the middle-sized Billy goat or the big Billy goat? ▪ For the whole family to cross together?
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Work Session: EXPLORE/EXPLAIN</p>	<p>Explore</p> <p>Show students the materials they will be using to tackle the bridge challenge:</p> <ul style="list-style-type: none"> ▪ Abutments: Books or Blocks ▪ Five 5"x8" index cards for bridge building ▪ Gram weights to represent Billy goats: 5g, 10g, 20g(Coins) ▪ Organize students into engineering teams ▪ Provide hands-on free exploration time ▪ Wrap-up making a class list of student discoveries during free exploration time <ul style="list-style-type: none"> ▪ Find out the least number of cards needed to support: <ul style="list-style-type: none"> ▪ one little billy goat (5 gram) ▪ one medium billy goat (10 gram) ▪ one big billy goat (20 gram) ▪ the family (5 + 10 + 20) ▪ class generated challenges <p>Explain</p> <ul style="list-style-type: none"> ▪ Did everyone get the same results? ▪ What is the relationship between the number of cards and the weight supported? ▪ Why might engineers try to build things with the least amount of materials?

- What have others done? Research primary style
- Students sketch what their bridge might look like or draw a bridge they've seen
- Explore local bridges with photos (easily available online) and/or by using children's books
- The kid-friendly PBS Building BIG website is an excellent resource for bridge photos and background information:
- <http://www.pbs.org/wgbh/buildingbig/bridge/index.html>

Engineering Report (with sentence starters):

"I chose _____ because it _____. This bridge was able to withstand the heavy load of coins because it had _____. I measured the bridge with _____ and it was _____ cm long. During the load test, it held _____ total coins. There were _____ quarters which equals \$_____, _____ dimes which equals _____, _____ nickels which equals _____, and _____ pennies which equals _____. The total amount of all of these coins is \$_____."

Documentation of Resources:

A similar activity can be found at:

<http://www.cpalms.org/Public/PreviewResource/Preview/32075>