How to Teach...

Bridge Building

In your classroom

By Ask a Tech Teacher

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2014

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Bridge Building

Vocabulary	Problem solving	Big Idea
• *Abutment* • *Benchmark* • *Compression* • *Cross section* • *Deck* • *Dynamic load* • *Elevation* • *Joints* • *Load test* • *Loads* • *Magnitude* • *Members* • *Racking* • *Span* • *Static load* • *Structural* • *Truss*	• *How do I share in Google* • *This is hard (did you go through the tutorial first? Are you working with your group mates?)* • *The program froze (look around the screen—is there a dialogue box open?)* • *Can I download the program at home? (with parent permission)* • *Link doesn't work (Google for address)* • *The teacher isn't around and I need help (use problem solving strategies from last unit)* • *I don't like science—much less engineering (think of it as an online game)*	*Research and precise measurement are critical to many questions.*
Time Required *270 minutes*	**NETS-S Standards** *4b, 4c*	**CCSS** *CCSS.ELA-Literacy.SL.8*

Essential Questions

How can I use practical and theoretical knowledge to solve a problem?

Overview

Materials

West Point Bridge Designer, links on class start page, speed quiz links and rubrics

Teacher Preparation

- Have West Point Bridge Designer (Google for address) downloaded to all student computers including netbooks, laptops
- Talk with subject teachers to collaborate on physics, math, geometry, history—subjects that can be integrated into this project. This ties in well with science toothpick bridges. Find class time in these other subjects for students to work on their bridge project.
- Ensure that all required links are on lab computers

Skills

_____**Required skill level for this unit: basic understanding of internet tools.** If you've been following this SL curriculum for a few years, students are prepared.

_____Bridge building is an excellent way to update traditional 8th grade toothpick bridges project.

_____This project can tie into a variety of Common Core math and literacy standards. In this case, we focus on the student's ability to present their findings, emphasizing salient points in a

focused, coherent manner with relevant evidence, using sound valid reasoning, and well-chosen details.

_____Students will use theoretical knowledge (from research done for homework) in practical application of building a sample bridge. When done, they will reflect on the importance of both processes (theoretical and practical) in problem solving.

_____Divide students into project groups. Give them five minutes to prepare a class presentation (of about 5 minutes in length) on what goes into creating an effective bridge, based on research done to prepare for this unit.

_____Discussions should include bridge size, length, longevity, cost.

_____Use a backchannel program like Today's Meet or Socrative to determine student understanding during presentations and where you might offer assistance.

Best Practices

- *What is goal of a bridge ? Cost ? Weight ? Longevity? Size? Length?*
- *What materials are required to reach bridge goals ?*
- *Make the project fun*
- *Defuse intimidation of 'engineering'*
- *Work with math, geography, history subject teachers to make this unit more authentic*

_____When completed, each group will open West Point Bridge Designer (or similar) and begin. This is student-directed. You support, not teach.

_____Need help? Here are two YouTube tutorials:

- *https://www.youtube.com/watch?v=6w9VN7XeruU*
- *http://youtu.be/4Cb7Alttt8s*

_____Tweet daily about progress, problems, solutions. These are quick, concise, pithy. Accept difficulties as an opportunity to learn. What was learned in problem solving unit that can be used here? Additionally, use Common Core strategies:

- *Use appropriate tools strategically*
- *Attend to precision*
  - *Make sense of problems and persevere in solving them*
  - *Value evidence*
  - *Comprehend as well as critique*
  - *Understand other perspectives and cultures*
  - *Demonstrate independence*

Assessment Strategies

- *Assessment results*
- *Came to class with questions*
- *Used prior knowledge*
- *Submitted bridge project*
- *Used domain-specific language in entry, blog posts, tweets*
- *Worked well in a groups*

_____After bridge is successfully built, save to homework dropbox.

_____Submit contest entry in appropriate category (under 13 or over 13 years old).

_____Use Google Sites (or Weebly, Wix) to create a website about project. Include:

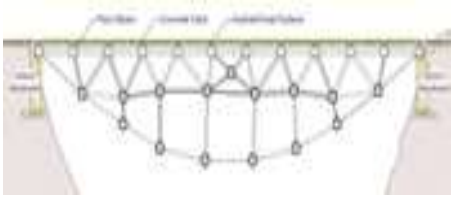
- *Explanatory text on design choice and how it worked*

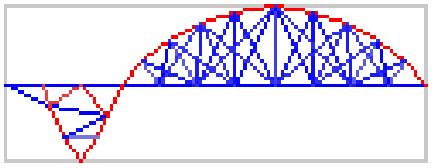
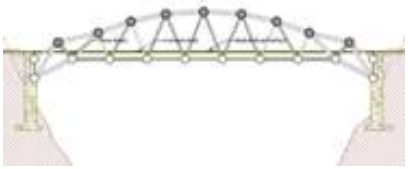
- *Screenshots and screencasts of work*

Well-constructed websites:

- *convey information and offer insights and analysis*
- *teach others*
- *use multiple sources and "quote or paraphrase data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources."*
- *include facts, definitions, details, examples related to topic*
- *use domain specific language— bridge building vocabulary and terms. If readers won't know a word, include a glossary*
- *include headings, illustrations, charts, graphs, multimedia useful in understanding material. They should orient reader to what is being shared.*
- *use appropriate transition words*

_____Once registered, submit as many designs as student group would like.
_____Here are winning designs from prior years (if you have a PDF, click for more info):



Extension:

- *If you live in Mississippi, consider Mississippi Department of Transportation Bridge Building Competition (http://sp.mdot.ms.gov/Public%20Affairs/Pages/TRAC.aspx)*
- *This unit also fulfills the following Common Core standards: CCSS.ELA-Literacy.W.8.7-9*

More Information:

- *Building Bridges, Domes, Skyscrapers, Dams & Tunnels*
  http://www.pbs.org/wgbh/buildingbig/index.html
- *Model bridge Design*
  http://garrettsbridges.com/category/design/
- *Bridge basics*
  http://www.pghbridges.com/basics.htm
- *Nova's Build a Bridge*
  http://www.pbs.org/wgbh/nova/tech/build-bridge-p1.html
- *Pictures of bridges*
  http://nisee.berkeley.edu/godden/
- *World's Strangest Bridges!!*
  http://www.popularmechanics.com/technology/engineering/architecture/4335705

Engineering/Design Assessment

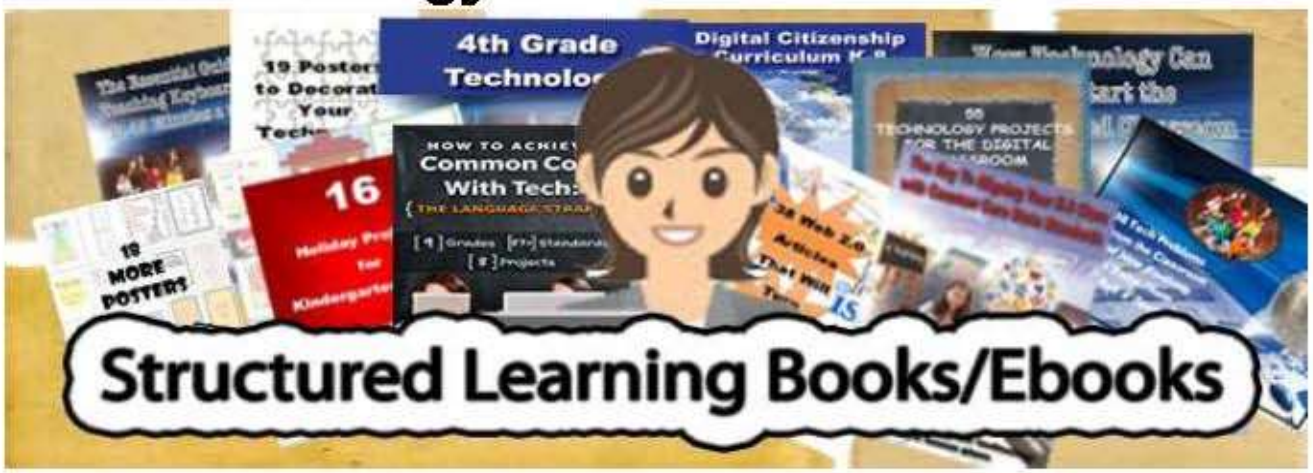
Project: Bridge Building	Student/Team:

Pts	Investigate	Design	Plan	Create	Evaluate	Group
0	*Team does not complete work to standard discussed in class*	*Team does not complete work to standard discussed in class*	*Team does not complete work to standard discussed in class*	*Team does not complete work to standard discussed in class*	*Team does not complete work to standard discussed in class*	*Team does not complete work to standard discussed in class*
1-2	*Team states problem/challenge in general terms. Students have difficulty solving building problems.*	*Team creates a basic bridge design, but it does not satisfy all requirements.*	*Team struggles to define a plan, understand bridge building concepts, that result in a successful bridge.*	*Team has difficulty building bridge to requirements; is unable to solve all/most problems independently*	*Team sometimes evaluates problems resulting from their original plan and sometimes cannot solve problems without assistance*	*Team has difficulty working as a group and remaining positive about problem solving.*
3-4	*Team states problem/challenge clearly. Team shows evidence of researching topic to solve bridge building problems independently.*	*Team creates a successful bridge design that is affordable and competitive in the competition. Additionally, they defend in well in blog and tweets.*	*Team produces a solid bridge building plan that results in a successful bridge and a good contest entry. Adapts theory of bridge building well to practical aspects*	*Team bridge plan results in a successful bridge that is competitive in the competition. Able to solve all problems using strategies discussed in earlier unit*	*Team successfully evaluates problems in bridge building design, adapts design to practical applications, and does required research to solve problems.*	*Team works well as a group, differentiates for team member strengths, and seems to revel in solving problems.*
Subtotal						
Total						**/20**

Other Single Lessons from Structured Learning

- *Debate*
- *Gamification of the classroom*
- *Genius Hour*
- *Google Apps*
- *Khan Academy*
- *Service Learning*
- *Write an Ebook*

SL Technology Books for Your Classroom



Which book	Price (print/digital/ Combo)	How Many
K-8th Tech Textbook (each)	*$29.99-32.99/23.99-26.99/48.58-53.99+p&h*	
K-6 Combo (all 7 textbooks)	*$190.74/$153.84/$344.57 + p&h*	
K-8 Combo (all 7 textbooks)	*$246.52/$200.62/$447.14+ p&h*	
35 More Projects for K-6	*$31.99/25.99/52.18 + p&h*	
55 Tech Projects—Vol I, II, Combo	*$32.99 /$59.38–digital only (free shipping)*	
K-8 Keyboard Curriculum	*$29.95/25.95/50.31 + p&h*	
K-8 Digital Citizenship Curriculum	*$29.95/25.99/50.38 + p&h*	
Common Core—Math, Lang., Read	*$26.99 ea/72.87 for 3–digi only (free ship'g)*	
K-5 Common Core Projects	*$29.95/23.99/48.55 + p&h*	
16 Holiday Projects	*$14.99 (digital only) + p&h*	
19 Posters for the Tech Lab	*$6.99 (digital only)*	
18 More Posters for the Tech Lab	*$12.99 (digital only)*	
98 Tech Tips From Classroom	*$9.99 (digital only) + p&h*	
760+ Tech Ed Websites	*$14.99 (digital only) + p&h*	
Tech Ed Scope and Sequences	*$14.99 (digital only) + p&h*	
New Teacher Survival Kit (K-5)	*$338.21/$287.85/$567.08+ p&h*	
New Teacher Survival Kit (K-6)	*$370.20/$314.84/$620.16 + p&h*	
New Teacher Survival Kit (6-8)	*$280.83/$261.83/$415.74 + p&h*	
Bundles of lesson plans	*$7.99 and up—digital only (free shipping)*	
Mentoring (1 hr. at a time)	*$50/hr*	
Year-long tech curriculum help	*$100 per year (online)*	
Consulting/seminars/webinars	*Call or email for prices*	
	Total	

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