How to Teach...

Bridge Building

In your classroom

How to Teach...

Bridge Building

In your classroom

V.2.0

Ask a Tech Teacher™

Version 1 2014 Version 2.0 2018 Visit the companion website at <u>http://askatechteacher.com©</u> for more resources to teach K-12 technology

To receive free technology tips and websites, <u>click here</u>

ALL MATERIAL IN THIS EBOOK IS PROTECTED BY THE INTELLECTUAL PROPERTY LAWS OF THE USA.



No part of this work can be reproduced or used in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, Web distribution or information storage and retrieval systems—without the prior written permission of the publisher

> For permission to use material from this text or product, contact us by email at: <u>info@structuredlearning.net</u> <u>structuredlearning.net</u>

Printed in the United States of America by Structured Learning LLC

© 2008 Structured Learning LLC. All Rights Reserved

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 | NETS-S Standards | CCSS |
| 270 minutes | 3a, 3c, 4c, 4a, 5a | <u>ELA-LITERACY.SL.8</u> |

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

- Download <u>WestPoint Bridge</u> <u>Designer</u> (freeware—also available <u>here by the creator</u>). You may also use one of the options mentioned under the *Extensions* section of this lesson.
 - 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.

- Bridge building is an excellent way to update traditional toothpick bridges project with a digital design that differentiates for student needs.
- 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 wellchosen 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.

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 the intimidation inherent in the word 'engineering'
- Work with math, geography, history subject teachers to make this unit more authentic
- _____Divide students into project groups. Using the research they did in preparation for this class, give them five minutes to prepare a class presentation (of about 5 minutes in length) on what goes into creating an effective bridge. During the presentation, they should include evidence from their research and citations as needed.
- _____Discussions should include bridge size, length, longevity, and cost.
- <u>Use a backchannel program like Today's Meet, Socrative, or Twitter (if that suits your classroom group) to determine student understanding during presentations and where the presenters or you might offer assistance.</u>
- _____When completed, each group will open the class Bridge Designer (see options in the *Extensions* portion of this lesson plan) and begin. This is student-directed. You support, not teach.
 - ____Need help? Here are two <u>YouTube tutorial</u>s:
 - <u>https://www.youtube.com/watch?v=6w9VN7XeruU</u>
 - <u>http://youtu.be/4Cb7Alttt8s</u>
 - ____Students will tweet daily about progress, group interactions, problems, and solutions. These are quick, concise, and pithy. They may include not only text but images and video updates. Students should show that they accept difficulties inherent in this activity as an opportunity to learn and grow. What was learned in other class discussions on problem solving can be used here. Additionally, apply <u>Common Core</u> (or similar) problem-solving strategies including:
 - 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.

_____Students will create a summative blog to share their work on this project. Blog posts will include:

- explanatory text on design choice and how it worked
- anecdotal discussion of their progress, problems, how they solved issues, and the general ups and
 - downs of a successful bridge strategy
- screenshots and screencasts of work

Well-constructed blogs will:

- convey information and offer insights and analysis
- \circ teach others
- \circ use multiple sources and

Assessment Strategies

- 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
- "quote or paraphrase data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources"
- o include facts, definitions, details, examples related to topic
- use domain specific language bridge building vocabulary and terms. If readers won't know a word, students can include a glossary of terms defining them in layperson speak.
- include headings, illustrations, charts, graphs, and multimedia useful for understanding the material. These should orient the reader to what is being shared.
- use appropriate transition words

You may decide to have students complete EITHER tweets or blog updates. This will depend upon how much time students have in your class to complete this project.

_After the bridge is successfully built, save it to the student digital portfolio (Google Classroom, the class LMS, or similar). If you are participating in a bridge building contest, submit the contest entry in the appropriate category. Check *Extensions* in this lesson plan for suggestions of national contests students could participate in.

____Here are winning designs from prior years:









Extension:

- Instead of the West Point Bridge Designer, try:
 - <u>Bridge Constructor</u> (a free app)
 - <u>Bridge Designer</u> by SourceForge
 - <u>Open Bridge Modeler</u> (software download)
 - o <u>Structural Bridge Design</u> by Autodesk (free)
- Bridge Building competitions are a great way for students to learn bridge building. Here's a short list of those available (mostly for high school):
 - o <u>Brookhaven National Laboratory Annual Bridge Building Contest</u>
 - o <u>DiscoverE High School Bridge Building Competition</u>
 - o <u>Mississippi Department of Transportation Bridge Building Competition</u>
 - <u>National Society of Professional Engineers</u>
 - o <u>North Carolina Department of Transportation</u>
 - <u>Vermont Tech</u> (middle or high school)

More Information:

- Building Bridges, Domes, Skyscrapers, Dams & Tunnels
- <u>Model bridge Design</u>
- <u>Bridge basics</u>
- Nova's Build a Bridge
- <u>World's Strangest Bridges!!</u>



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/challeng e 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 and/or 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 it well in blog and tweets. | Team produces a solid bridge building plan that results in a successful bridge. Adapts theory of bridge building well to practical aspects | Team bridge plan results in a successful bridge. They are 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. |
| To tal | | | | | | /20 |

Other Singles from Structured Learning

- <u>15 Digital Tools in 15 Days</u>
- <u>Blogging in the Classroom</u>
- Brainstorming
- <u>Bridge Building</u>
- Debate in the Classroom
- Digital Book Report
- <u>Digital Note-taking</u>
- Digital Quick Stories
- <u>Digital Quick Writes</u>
- <u>Digital Timelines in the Classroom</u>
- <u>Gamification of the Classroom</u>
- Genius Hour
- Google Apps in the Classroom
- Internet Search and Research
- Khan Academy
- <u>Presentation Boards in Class</u>
- Service Learning and Tech
- <u>Twitter in the Classroom</u>
- <u>Write an Ebook</u>

Thanks for purchasing!

Terms of Use according to American Copyright Laws

<u>Please visit me</u>

BL Og

DO... Use this item for personal use, your Review/share your experiences online provided you link back to the AATT store Buy additional licenses

DON'T ... Copy, email, or post to a shared account Post this item or a portion (> 10%) be it to your website, school server, another Share it, sell, claim it as your own Use any part of this to create another product for sharing, selling