

Horizontal Structures - Bridges

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VITAL INFORMATION

Subject(s)	Design & Technology Education
Topic or Unit of Study	Construction/Horizontal Structures/Bridges Forces that act upon structures: Tension, compression, torque, shear and bending Structural members: columns, beams, trusses, triangles/distribution of forces
Grade/Level	Grade 6
Objective	Design Challenge Project: The purpose of this lesson is to introduce students to the overall project specifications and information necessary to begin the research/design/build phase of this unit. After this lesson: Students will create a design solution: build on specifications, with an understanding of the constraints (e.g.weight,tolerances) that affect minimum performance expectations for the unit. Students will Include 2D or 3D models of their design, with labels/dimensions for critical components; Including Math calculations to "estimate" overall weight of finished project. Drawings will include steps and sequences for efficiently building a prototype that conforms to the specifications. Students will test the prototype and use the results to describe how to modify the design to improve strength.
Summary	This unit is within the broad Design & Technology Education area of Construction and specifically within horizontal structures - Bridges This particular lesson introduces students to the overall requirements for the project and allows them to gain an understanding of the materials and final testing procedure. After this lesson students will be prepared to begin the "research" "brainstorming" and "drawing" phase of the project.

IMPLEMENTATION

Learning Context Prior learning:

Safety rules and expectations have been reviewed.

Students have taken and passed a safety test with a 100% score. This will allow students to use power tools and work in "shop" area.

Students understand the definition of a structure.

Students have been part of a discussion relating to and have seen examples of the following forces: tension, compression, torque, shear, bending, deflection.

Students have been given definitions and have seen examples of the following structural members: columns, beams, trusses.

Partners have been selected for this approx. 10 day unit.

Procedure

Teacher:

I will demonstrate samples of beams and columns and ask probing questions related to the expected strength of these structural members.

I will explain the project specifications (followed by a handout for each team) (information is also available on class website).

I will explain the testing procedure.

I will show and describe the wood, hot glue and cutting procedures (later lesson on use of scroll saw and small belt sander)

I will describe the requirements of the drawing process.

Students:

Student partners will collaborate on possible solutions: Using the various resources on the class website and information from previous classes students will research various truss bridge designs and brainstorm solutions to the Challenge Project through a series of rough sketches culminating in a neatly done side view drawing. Building will begin after drawings are approved.

Differentiated Instruction

I will use the confidential information sheet to identify those students not meeting AYP and or IEP/504 students

I will work to assure appropriate pairing with a partner compatible with any special needs/AYP/504 student. I will provide individual and group help as necessary throughout the project.

Grading flexibility may be allowed depending on students educational level.

Sample Student Products

Attachments:

1. [DSC01282.JPG](#)
2. [DSC01286.JPG](#)

Links:

1. [Grade 6 Tech Ed web page](#)

**Collaboration
Time Allotment**

Students will work collaboratively. Students will work in groups of 2.
10 class periods. 45 Min. per class.

**Author's Comments &
Reflections**

This entire unit usually takes about 10 class periods from start to finish. This particular lesson falls on approx. day 3 of initial introductory information.

***Allow enough enough time for varied abilities and learning styles.

Groups of two work best for this project. I usually allow groups of three with uneven class sizes or as support for a special needs student.

Stress the concept that we are really looking for "really good quality work" as opposed to just doing something quickly in order to be done with it. There is usually a 1-2 day lag between those who finish early and those still needing to work until the deadline date.

As the first group completes the actual building of bridges and are ready to test move them on to initial work on grade sheets including beginning research on "famous bridges". Test all bridges on the same day.

MATERIALS AND RESOURCES

Instructional Materials

http://web.me.com/vermont3/CBMSTechEd/Grade_6.html

Attachments:

1. **[Bridreq.webarchive](#)**
2. **[EfficiencyFormula.doc](#)**
3. **[Grade Sheet Grade 6 Structures Design Challenge.doc](#)**

Resources

- Materials and resources:
 - Bridge Tester
 - Hot Glue
 - Balsa Wood
 - scissors
 - Tape measure
 - ruler
 - Scroll Saw
 - Small Belt Sander
- Technology resources:
 - Dig. Cameras, Firefox, Inspiration, Word, Digital Scale
 - Calculator
 - Computer
- The number of computers required is ?.
- NOTE: Bridge tester, Firefox/computer, Scale, ruler/tape measure Used for this lesson. Other resources will be introduced with other lessons.

STANDARDS & ASSESSMENT

Standards

Display: Collapse All Expand All

▼ **VT- Vermont Framework of Standards**

▼ **Framework:** The Standards: The Fields of Knowledge

▼ **Type:** Science, Mathematics, and Technology Standards

▼ **Area:** Design and Technology

▼ **Standard 7.19:** Designing Solutions Students use technological/engineering processes to design solutions to problems.

▼ **Grade Range:** 5-8

Benchmark aa: Create a design solution: Build on specifications, with an understanding of the constraints (e.g., cost, weight, environment), and tolerances that affect performance; Include mathematical and/or mechanical models of their design; Include steps and sequences for efficiently building a prototype that conforms to the specifications; Test the prototype; Use the results to modify the design

Benchmark bb: Understand that the sequence in which these steps occur is critical to the efficiency and effectiveness of a solution

Assessment/Rubrics

This rubric used to monitor collaborative work.

Rubrics:

1. [Group Work Bridge Project Rubric Grade 6](#)