

Lesson Plan

Subjects: Algebra/Geometry/Physical Science (8th-12th grades)

Lesson Focus: Structural Engineering/Truss Structure Designs

Course Level Expectations (Algebra I and II):

CLE 3102.1.7, CLE 3102.3.7, CLE 3102.3.9, CLE 3103.1.7, CLE 3103.3.4, CLE 3103.3.5

Course Level Expectations (Geometry): CLE 3108.1.7, CLE 3108.2.3, CLE 3108.4.4, CLE 3108.4.7, CLE 3108.4.8

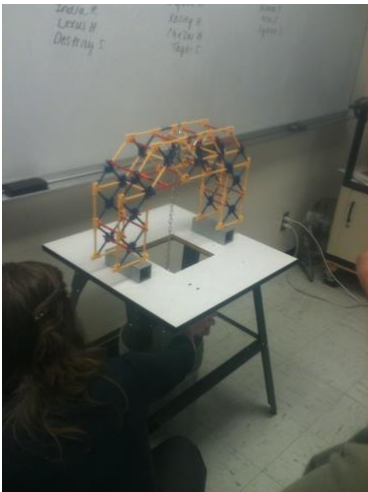
Course Level Expectations (Physical Science): CLE 3202. Inq.2, 3,4,5,6; CLE 3202.T/E.2; CLE 3202.Math.2; CLE 3202.3.1; CLE 3202.3.2; CLE 3202.3.3; CLE 3202.4.1; CLE 3202.4.2; CLE 3202.4.3

Materials (per group/pair):

[K'NEX Real Bridge building set](#) (\$209 each)

Ruler

Materials (for testing area):



[Pitsco's Structural testing device](#) (\$215)

Dried Beans to add weight to buckets

Scale

Preparing the lesson:

Divide students into groups of 3-4 students.
Set up testing area.

Teaching the Lesson:

CHALLENGE #1 (Build time: 35 minutes)

With the Knex materials supplied, build a structure that will support the most weight(mass) with the lightest structure, until the device fails.

The structure must rest on the two beams, cannot go below the opening of the table. When the structure breaks or is $\frac{1}{2}$ inch below the table plane, it is considered failure.

When time is called, each bridge will be weighed and tested. Record the weight of each bridge and the weight held by each.

Record on a spreadsheet to determine winners.

Engineering is an **iterative** process!! Try again.....

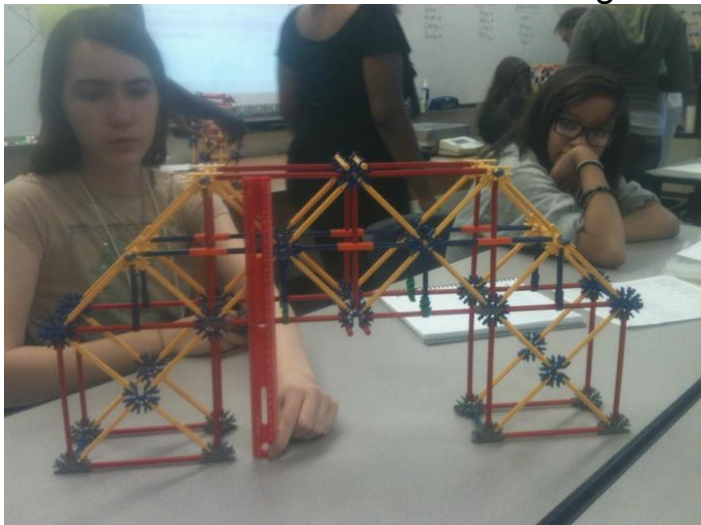
CHALLENGE #2 (Build time: 35 minutes)

After explaining concepts of compression and tension and the dynamics of the triangle.... Use same loading mechanism and same rules as Challenge #1, **except** the load must be at least 9 inches above the metal beams.

CHALLENGE #3 (Build time: 35 minutes)

Scenario: A group of students are going to Bolivia as part of the program “Engineers without Borders.” Transporting materials to a remote area poses an additional challenge. In this next building challenge, in addition to the mass supported by structure and the mass of the structure itself, the number of pieces in the structure will also be a factor used to measure success.

Additional design changes are that the structure must allow material to pass under it, a 6inch minimum clearance. The bridge must be the width of a yellow K'nex piece.



CHALLENGE #4 (Build time: 50 minutes)

[Final Challenge PowerPoint presentation](#)

Assessment: (See attached [Sample score sheet.](#))

Closing Activity: Journal writing- Have students reflect on their method(s) of problem solving and communicating. What could they have done differently to improve accuracy and efficiency?

Extension: Use software to design a successful bridge at lowest cost possible. Submit bridge design to West Point website for competition. For class presentation, see “Bridge Lessons” from 2011 programs. <http://bridgecontest.usma.edu/download.htm>
