

Inside this issue:

Issue 5 — <http://www.eng.uc.edu/step/>

January 30, 2006

| | |
|---|---|
| About STEP | 1 |
| Students from Hughes visit UC | 1 |
| Announcements | 1 |
| Lesson 1 - Build the Brent Spence Bridge | 2 |
| Teacher Profile | 3 |
| PI Profile | 3 |
| Fellow Profile | 3 |
| School Profile | 3 |
| Lesson 2 - Make 'n Shake | 4 |



About STEP

Project **STEP - Science and Technology Enhancement Program** is a University of Cincinnati & National Science Foundation Grant designed to educate, nurture, and facilitate science, math, and technology graduate students into bringing their experiences and knowledge into middle and high school classrooms while preparing them to become

future educators.

We currently work with four high schools in the Cincinnati Public School District, Hughes Center, Shroder Paideia Academy, Western Hills University High School, and Western Hills Design Technology High School.

STEP involves eight graduate Fellows, nine secondary

science and mathematics teachers, a project coordinator, an evaluation Fellow, a web designer, and ten faculty members (from the College of Engineering and the College of Education).

Project STEP began in July of 2002. A wide variety of lessons are available on our website.



Program funded by National Science Foundation Grant #0139312 & matching funds by University of Cincinnati.



<http://www.eng.uc.edu/step/>

Announcements

- Project STEP will soon begin the process of hiring Fellows for the year 2006-2007. Please visit <http://www.eng.uc.edu/step/> for further information.
- An Open House will be held on March 30th, 2006 in the Alumni Center from 4:30-7:00 PM. We will be showcasing STEP lessons, modules & activities.

Students from Hughes visit University of Cincinnati

STEP Fellow, Bethany Vice Bowling had arranged to bring her 10th grade math students from Hughes Center to visit to the University of Cincinnati's College of Engineering. With the help of Julie Burdick the students were introduced to the different types of job opportunities for engineers, engaged in different types of engineering activities, and were informed about the preparations necessary to get into an engineering program or college.

Before leaving the Hughes Center the students were asked to list 3 things they knew about the University of Cincinnati and 3 things they know about engineering in general. The topics were then used to stimulate further class discussions.

After arriving on campus individuals from Admissions, Access and Transition, Ethnic and Cultural Affairs, and Engineering spoke with the students about preparing for college and other general concerns about life after high school. Afterwards the students toured the various engineering labs and were given demonstrations on various engineering projects. These included everything from cars to robots, to ligament strength tests.

The speakers, former Hughes Center graduates, were able to share their previous and current experiences



with the Hughes students. The Hughes students were immediately intrigued and interested in what was being. The speakers felt that they were able to have a positive impact on the high schools students because of their unique perspective.

The student had some great things to say about their visit to University of Cincinnati -

"This tour gave me a better understanding of engineering and a better interest. Now I am sure I want to major in engineering."

"I really enjoyed the tour. It made me want to come to UC."

"It was great. I'm now interested in bio-medical engineering."



Build the Brent Spence Bridge

Western Hills University High School & Hughes Center

Fall 2005

Lesson Information

Grade Level

10

Subject areas

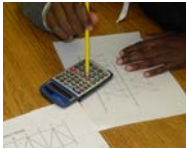
Geometry

Duration

Four (4) 80-minute class periods

Setting

Standard classroom with large tables



Materials

Handouts
Calculator
Ruler
Protractor
Building Materials
Power Point Presentation

Background Knowledge

Students should have some basic knowledge of geometry conjectures and theorems including but not limited to triangle similarities. Students should also be familiar with scale factors and constructing figures using a ruler and protractor.

Additional Resources

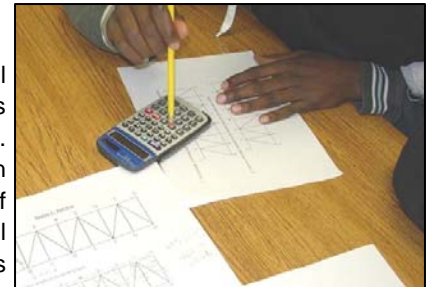
- <http://earth.google.com/>

Developed by Fellows:

Amy Dimmerling &
Bethany Vice Bowling

Summary

This lesson requires the students to do the job of a steel fabricator for a truss bridge. The bridge used in this lesson is the Brent Spence Bridge in Cincinnati, Ohio. This bridge was divided into 8 different sections. Each group of students will be responsible for one section of the bridge. They will use their geometry skills to find all of the angles and lengths of each member of the truss in their section. The students will then scale down these members to create a scale drawing. From these drawings the students will build a scale model of their section of the bridge and then combine it with the other sections to create one large bridge.



Two Western Hills University students work diligently to build their section of the bridge.



Objectives

Students will be able to:

1. Utilize the basic geometric conjectures and theorems to determine missing angles and member lengths.
2. Use ratios to scale down their bridge section.
3. Develop scaled drawings using their measurements.
4. Construct a model of their bridge section.

Ohio Standards

From the Ohio Math Benchmarks:

Geometry and Spatial Sense Standard

- Construct congruent figures and similar figures using tools, such as compass, straight-edge, and protractor or dynamic geometry software.
- Apply proportions to solve problems involving missing lengths and angle measures in similar figures.
- Determine and use scale factors for similar figures to solve problems using proportional reasoning.
- Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures).



Teacher Profile

Emma Massie is a 9th and 10th grade math teacher at Western Hills University High School. This is her 4th year with Cincinnati Public Schools. She received two Bachelor Degrees from the University of Cincinnati in Mathematics and Secondary Education. She is currently also pursuing her Masters at UC.

Emma began working with STEP 3 years ago and has thoroughly enjoyed the program. She says it is great to have the Fellows in her classroom. They always have new and exciting ideas of how the lesson could relate to some kind of project. The students are



Emma at her desk

always asking Mrs. Massie when the Fellow is going to do another lesson. Emma says that it is reviving for the students and also a reminder to the teacher to strive to incorporate more real life into the curriculum. “When you bring in pictures and situations that the students can imagine or relate to they instantly care more about the project. They end up collaborating and completing the projects at a much higher level than is expected.”

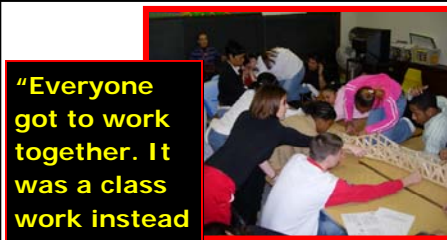
Student Profile (s)

The **Students** participating in Amy’s recent STEP lessons had the following comments.

“This activity was fun and different from any other math project I’ve done before. We got to work with many tools.”



“We got to learn new things (triangles) can actually deal with real things in the world.”



“Everyone got to work together. It was a class work instead of individual work making it more fun.”

“There wasn’t anything that I didn’t like.”

“It was fun building the bridge.”

Fellow Profile



Amy Dimmerling is a 2nd year PhD student at the University of Cincinnati.

Amy completed her B.S. & M.S degrees at UC in Civil Engineering. After graduation in 2002, Amy went to work for a consulting firm, Parsons Brinckerhoff (PB). At PB she analyzed, designed, and inspected bridges. After two years of consulting Amy returned UC to pursue her PhD to ultimately

become a professor of engineering.

This is Amy’s 2nd year with Project STEP. She is currently assigned to two cross-categorical math classes and two Geometry classes at Western Hills University High School. Her past STEP experiences have included teaching in four geometry classes at Western Hills Design and Technology High School.

In her spare time, she enjoys running, reading, tap dancing, and travel.

PI Profile

Dr. Richard Miller is a Professor of Civil and Environmental Engineering at the University of Cincinnati. He earned his Bachelor of Civil Engineering degree from the Cleveland State University in 1982. Dr. Miller then attended Northwestern University where he earned a Master of Science degree in 1984 followed by a Doctor of Philosophy degree in 1989. He joined the faculty of the University of Cincinnati in September 1988.



Dr. Miller teaches courses on construction materials, structural analysis and concrete design. Most notably, he teaches the prestressed concrete design and the concrete bridge design course.

Dr. Miller has been married to his wife, Patti, for 21 years and they have 3 sons; Benjamin (16), Timothy (14) and Gregory (10).

School Profile

Western Hills University High School is a ‘school of choice’ high school in Cincinnati Public Schools dedicated to the Project GRAD program. The mission of Project GRAD is to ensure a quality public education for all children in economically disadvantaged communities, so that the high school graduation rate increases and graduates are prepared to enter and graduate from college.

Western Hills University High School

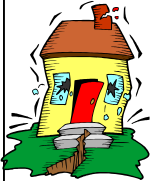


Make 'n Shake

Family Science Academy—University of Cincinnati

Summer 2005

Lesson Information

**Grade Level**

4-7

Subject Areas

Math and Science

Duration

2-hours

Setting

Standard classroom with large tables

Materials

Power Point Presentation

Computer

Projector

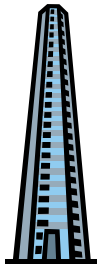
Handouts

Building materials (adjust supplies for group size as needed)

- Marshmallows
- Straws
- Toothpicks
- Playdoh
- Pipecleaners
- Tape
- Fake money
- Craft sticks

Testing Materials

- Meter stick or measuring tape
- Shake table
- Timer



Background Knowledge

Students should be familiar with basic concepts of earthquakes, although these will be reviewed in the introductory presentation.

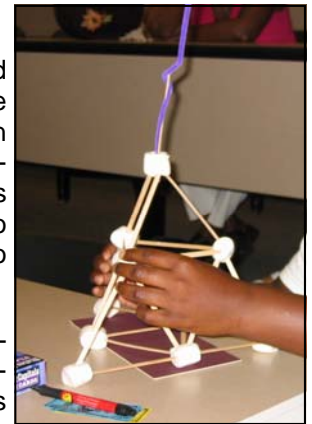
Developed by Fellows:

Jim Allen, Bethany Bowling, Michelle Daniel, Amy Dimmerling, Matthew Estes, Sarah Pumphrey, Michael Rust, & Bartley Richardson

Summary

This activity is centered on the design, construction, and testing of structures by students and their families at the Family Science Academy. The students are asked to design and build a structure to achieve maximum height and earthquake resistance while working within specific constraints such as limited materials and budget. The students go through the entire design process and enter a competition to determine the top overall design.

The teaching philosophy for this lesson is cooperative learning and team-based design. Since many engineering applications involve teams of engineers working together, it is important to give students experience with this work style.



Student constructs structure for testing.

Objectives

Students will be able to:

1. **Design** and build a 3D structure to achieve maximum height and shake resistance.
2. **Analyze** the most economical design.
3. **Develop** skills to work together as a team.

Ohio Standards

From the Ohio Mathematics Benchmarks:

Number, Number Sense and Operations Standard

- Solve problems involving counting money and making change, using both coins and paper bills.

Data Analysis and Probability Standard

- List and explain all possible outcomes in a given situation.
- Compare what should happen (theoretical/expected results) with what did happen (experimental/actual results) in a simple experiment.

From the Ohio Science Benchmarks:

Science and Technology

- Describe, illustrate and evaluate the design process used to solve a problem.
- Revise an existing design used to solve a problem based on peer review.
- Explain how the solution to one problem may create other problems.

Earth and Space Sciences

- Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion.