

Inside this issue:

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About STEP	1
Open House 2006	1
Announcements	1
Lesson 1 - Arc Bridges and Arcs	2
Teacher Profile	3
PI Profile	3
Fellow Profile	3
School Profile	3
Lesson 2 - Everyday Genetic Engineering	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 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 has begun the hiring process for the year 2006-2007. For applying to any of the following 3 positions:

- Graduate Fellow
- Grant Coordinator
- Web Designer

Please visit our website at <http://www.eng.uc.edu/step/>.

- The University of Cincinnati College of Engineering Department of Civil & Environmental Engineering will host the fourth annual **Bridge Building Competition** for area

high school students on March 3, 2006.

For further information about the competition go to: <http://www.eng.uc.edu/resources/collegenews/bridge/>.

Open House 2006

Project STEP is excited to announce its **3rd Annual Open House**. This year it shall be held on **Thursday, March 30th, 2006** at the **University of Cincinnati Alumni Center** between 4:30 and 7pm.

The agenda for the 2006 Open House is as follows:

- 4:30—5:00: Exhibits and demonstrations
- 5:00—5:30: Project STEP overview
- 5:30—7:00: Exhibits and demonstrations

The demonstrations will emphasize real world applications

of STEM skills. You will also learn how to integrate standards and increase student interest in math and science.

Also take away with you a **free CD** containing about 45 ready to use integrated math, science and technology hands-on lessons. Refreshments will also be provided.

Please visit our website at <http://www.eng.uc.edu/step/> to register for the event.





Bridging Geometry & Engineering: Arch Bridges & Arcs

Hughes High School

Fall 2005

Lesson Information

Grade Level

10

Subject areas

Geometry

Duration

One 70-minute class period

Setting

Standard classroom

Materials

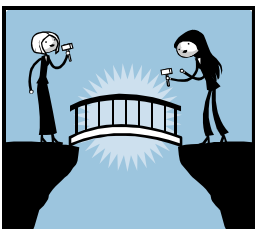
Handouts
Calculator
Power Point Presentation

Background Knowledge

This lesson forces students to apply their knowledge of triangles, circles, and arcs. They should be familiar with the concepts addressed in the standards listed before attempting the lesson.

Additional Resources

- <http://www.cincinnati-transit.net/>



Developed by Fellow:

Bethany Vice Bowling

Summary

In science and engineering, many different mathematical concepts are used in combination to solve problems. This lesson requires students to apply many different geometric and trigonometric concepts to real world situations and problems involving a local arch bridge, the Daniel Carter Beard Bridge.

There is a short introductory presentation which is followed by a handout with a series of situations/problems. Students must apply their knowledge of the concepts and use their problem solving skills. The students can work individually or in groups. This lesson is part of a series of lessons involving bridges and geometry concepts.



Two Hughes High School students working collaboratively.

Objectives

Students will be able to:

1. **Apply** the concepts of radius, diameter, and circumference to determine basic dimensions of the an arch bridge.
2. **Apply** the concepts of chords, radii, and arcs to solve problems involving an arch bridge.
3. **Identify** when to use trigonometric functions to determine the dimension of a triangle.

Ohio Standards

From the Ohio Math Benchmarks:

Geometry and Spatial Sense Standard

Grade 9

- Apply proportions and right triangle trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures.

Grade 10

- Formally define and explain key aspects of geometric figures, including: d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).
- Solve problems involving chords, radii, and arcs within the same circle.



Teacher Profile

Matthew Bye is a 10th grade math teacher at Hughes High School in the Teaching & Technology Program. He has been a teacher for 9 years and has taught all 9 years at Hughes.

Mr. Bye is originally from New York state near Niagara Falls. He now lives on the west-side of Cincinnati with his wife and four children. He was an electrical engineer for several years before changing professions.

Mr. Bye has been involved in Project STEP for the past two years. He feels that the program is a "crucial element of the classroom" and that "bringing in



the graduate fellow really enhances the curriculum." Mr. Bye also stated that the program "helps to develop a working relationship between the school and the University of Cincinnati."

PI Profile



Dr. Dan Oerther is an Associate Professor in Civil and Environmental Engineering at the University of Cincinnati.

Dr. Oerther earned his B.A. in molecular biology and biochemistry and his B.S. in environmental engineering from Northwestern University in 1995. He completed his M.S. and Ph.D. in environmental engineering from the University of Illinois, Urbana in 1998 and 2001, respectively. Dr. Oerther came to UC in 2000.

Dr. Oerther's research team uses environmental biotechnology to understand the microorganisms that are the catalysts of biological treatment systems and microorganisms that pose significant public health threats. He is currently in Bangalore, India as a Fulbright Scholar where he is conducting research and teaching courses in environmental engineering and molecular biology.

Student Profile (s)

"I felt like we were finally applying math to real life things."



"The activity was challenging and made me think more about things."



"I like doing the hands-on tasks."



"I liked working with a group."

School Profile

Hughes High School is a team-based magnet school with six programs that focus on different professions or content areas, including: Teaching & Technology, Zoo Academy, Paideia, Health, Communication, and Cincinnati Academy of Math & Science (CAMAS). The school administrators and teachers believe that every student can be successful in a rigorous college preparatory curriculum.



Hughes High School

Fellow Profile

Bethany Vice Bowling is a 2nd year Ph.D. student at the University of Cincinnati in the Interdisciplinary Studies Program focusing on Biology Education.

Bethany has a B.A. in biology from Thomas More College and an M.S. in biology from UC.

This is Bethany's 2nd year with Project STEP. She is currently working with Matthew Bye at Hughes High School in 10th grade math classes. Last year Bethany collaborated with several



teachers at Western Hills University High School and was involved in math and science classes.

In her free time, Bethany enjoys playing basketball, soccer, volleyball, and tennis.



Everyday Genetic Engineering

Western Hills University High School

Fall 2004

Lesson Information

Grade Level

10

Subject Area

Biology

Duration

One 70-minute class

Setting

Standard classroom with flat tables/desks

Materials

Power Point Presentation
Handouts
DNA extraction materials:

- Liquid soap
- Bottled water
- Sodium chloride
- Rubbing alcohol
- Parafilm
- Pipettes
- Small graduated beakers

Background Knowledge

Students will need some background on basic genetics concepts including: the molecular structure of DNA and DNA replication.

Additional Resources

- www.genome.gov

- www.greenpeace.ca/shoppersguide/browse.pho

- <http://biology.about.com/index.htm>

Developed by Fellow:
Bethany Vice Bowling

Summary

Students are introduced to genetic engineering and its impact on society (e.g., genetically modified foods, pharmaceuticals). A game of “The Genetics is Right” helps illustrate how prevalent genetically modified foods are in our diet. A review of basic genetics concepts and discussion of more advanced concepts of genetic engineering allow students to understand biotechnology and its significance to their lives. Students then participate in the first step of genetic engineering, DNA extraction, by extracting DNA from their own cheek cells.



West High students extracting DNA.

Objectives

Students will be able to:

1. **Discuss** how genetic engineering affects their lives.
2. **Give** examples of genetically modified foods.
3. **Describe** how genetic engineering is possible and the basic process of genetic engineering.
4. **Identify** the different components of a scientific activity and lab report.



Ohio Standards

From the Ohio Science Benchmarks:

Grade 10

Heredity

- Illustrate the relationship of the structure and function of DNA to protein synthesis and the characteristics of an organism.
- Explain that a unit of hereditary information is called a gene, and genes may occur in different forms called alleles (e.g., gene for pea plant height has two alleles, tall and short).

Diversity and Independence of Life

- Describe ways that human activities can deliberately or inadvertently alter the equilibrium in ecosystems. Explain how changes in technology/biotechnology can cause significant changes, either positive or negative, in environmental quality and carrying capacity.

Historical Perspectives and Scientific Revolutions

- Analyze and investigate emerging scientific issues (e.g., genetically modified food, stem cell research, genetic research and cloning).

Understanding Technology

- Describe examples of scientific advances and emerging technologies and how they may impact society.