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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.

Field Trip Provides Students With Concrete Evidence

What ratio of water to cement do you need to make great concrete? More than 120 9th and 10th grade students got a chance to find out in an activity designed by STEP Fellows Bethany Bowling, Amy Dimmerling, and Bartley Richardson.



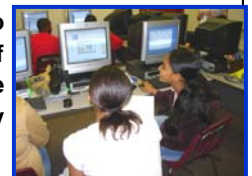
Students from Teaching and Technology in Hughes Center, Western Hills University High School, and Western Hills Design and Technology High School brought their concrete mixtures to the College of Engineering testing lab, where they load tested their samples and analyzed their findings. They also sat in on a college math class with Professor Dan Marketos,

and discussed educational opportunities with Engineering Recruiter Becky Barkema. Thanks to Dr. Richard Miller of CEE for sharing his vast expertise on concrete and to Mr. Ken



Simonson and the E³ students for encouraging students to study engineering at U.C.

“Now I know I want to go to the University of Cincinnati,” said one student. “It is a really great place to learn.”



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

Summer 2006 RET Teachers Announced

The NSF Research Experience for Teachers (RET) program will be conducted this summer between June 19th and August 1st. Civil and Environmental Engineering (CEE) offers this program to promote research and professional development in civil infrastructure renewal and rehabilitation. The program features four projects each summer for 7th to 12th grade teachers. This year, the projects and participants are:

Health Monitoring of a Retrofitted Bridge: Daniel Nieman, Tim Sorensen, and Cornelia Schwendeman

Drinking Water Treatment: Chad Husting, Gloria Ononye, and Eugene Jackson

Air Quality Sampling: Megan West, Linda Gillum, and Douglas Ford

Impact Analysis of an Intelligent Transportation (ITS) Infrastructure: Reta Vann, John James Clark, and Veronica Dean-Mann

The Participating Faculty for this year are Dr. Kukreti, Dr. Soled, Dr. Fowler, Dr. Sorial, Dr. Wei, and Dr. Lu.



Survivor Biome – Know Your World

Hughes Center High School– CAMAS

May 2006

Lesson Information



Grade Level
9-12



Subject Areas
Environmental Science/
Ecology

Duration
Three 70-minute
class periods



Setting
Standard classroom

Materials
Resource Books
Craft Items
Skit Props
Optional Video Camera



Background Knowledge

Students will need to be familiar with some properties of natural systems, for example the freezing and boiling points of water and that sunlight, water, and amiable soil are necessary to support large amounts of vegetation.

Additional Resources
Discovery Institute
www.discovery.org
National Geographic
www.nationalgeographic.org/education/

Developed by Fellows:

Sarah Pumphrey
& Sharon Bachman

Summary

Students will participate in a learning game similar to the hit television series, "Survivor." Students will be divided into "Tribes" and each tribe is assigned a different set of similar biomes. Among their challenges, they will have to determine safe and effective ways to obtain potable water from their assigned biomes. All tribes will gather at the end of the three-day lesson period to present what they learned in the final challenge: Tribal Council.



Students create props to show water filtration during their presentations.

Objectives

Students will be able to:

- **Participate** in a group learning activity.
- **Become experts** in knowledge about their "tribe's" biome.
- **Use** oral, performance and constructive skills to communicate the material they have learned to the rest of the class.
- **Identify** the major characteristics of, threats to, and general location of each biome as presented by their peers in *Tribal Council*.
- **Compare and contrast** biomes.
- **Determine** how to obtain potable drinking water from their biome.

Ohio Standards

From the Ohio Science Benchmarks:

Earth and Space Sciences

- Describe how Earth is made up of a series of interconnected systems and how a change in one system affects other systems.
- Explain that humans are an integral part of the Earth's system and the choices humans make today impact natural systems in the future.
- Explain how human choices today will affect the quality and quantity of life on earth.

Doing Scientific Inquiry

- Design and carry out scientific inquiry (investigation), communicate and critique results through peer review.

Earth Systems

- Explain ways in which humans have had a major effect on other species.
- Predict how human choices today will determine the quality and quantity of life on Earth.
- Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety, and aesthetics).

Scientific Ways of Knowing

- Explain how societal issues and considerations affect the progress of science and technology.

Teacher Profile

Sharon Bachman is in her 12th year of teaching, and currently teaches science in CAMAS at the Hughes Center for the 11th and 12th grades. She holds a Masters of Biology degree from Miami University at Oxford.

This is Sharon's second year with STEP, and last summer she participated in the RET Program. Sharon wants to see her students succeed in scientific fields, and notices a positive influence on her students' attitudes



Mrs. Bachman

about science as a result of her involvement with Project STEP. She enjoys the creativity and expertise in engineering brought to her classroom by the fellows.

Sharon loves to be on the cutting edge of technology. She attends national conferences for science teachers, and publishes her ideas for new lessons.

PI Profile

Professor Emeritus Ted Fowler

has been with STEP since its beginning. Although officially retired after 30 years of university teaching, Dr. Fowler works on special projects and serves as Co-Director of the Southwest Ohio Center for Excellence in Science and Mathematics. He is also a curriculum developer and educational researcher at the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, preparing safety training materials for high school youth.



Dr. Fowler has worked with pre-service and in-service teachers, mentored doctoral candidates, held administrative positions, and supervised many new teachers in the field. He has worked extensively with business and industry to develop professional training programs and technical training materials. He holds five degrees, including Masters degrees from Harvard University and Rensselaer Polytechnic Institute, as well as a Doctor of Education degree from the University of Houston.

Student Profile(s)

Students participating in Sarah's recent STEP lessons have made the following comments:

"I liked the group project we did in the class."



"I liked how I learned something new that I could easily understand."

"I learned new things about the biomes..."



"I really enjoyed the activities today because it is something that I would want to do again."

Fellow Profile



Sarah Pumphrey

Sarah Pumphrey is a first year graduate student at the University of Cincinnati studying Environmental Engineering. Sarah has always cared a great deal about environmental issues, and now her area of concentration is water quality.

She also loves to learn about people and their cultures. The combination of

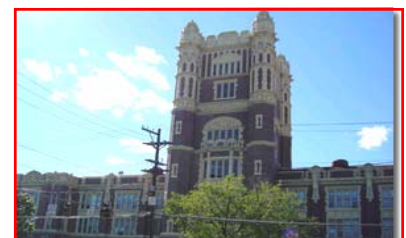
these passions has propelled her to pursue research abroad in Germany, Guatemala, and Tanzania.

Sarah aspires to bring her enthusiasm for the practical application of engineering technology to improve people's lives with her to the classroom. Project STEP has placed her in a science class in which her real-world experiences have been translated into appropriate lessons for both Chemistry and Ecology students.

School Profile

CAMAS is one of the six magnet schools at the Hughes Center in the Cincinnati Public School System. The acronym CAMAS stands for the Cincinnati Academy of Math and Science. They offer an enhanced curriculum in mathematic and scientific courses. Science courses offered in CAMAS focus either on Biomedical Studies or Engineering. Instead of the traditional Chemistry, Biology and Physics courses, CAMAS Curriculum combines these courses into an integrated learning experience.

Hughes Center





H₂O – What Do You Know?

Hughes Center High School– CAMAS

May 2006

Lesson Information



Grade Level
11-12

Subject Areas
Ecology / Chemistry

Duration
Two 70-minute class periods with additional time for a Science Fair Project

Setting
Standard Classroom

Materials
Kool-Aid
Sugar
Water
Jar with Lid
Dirt
Cup & Spoon

Background Knowledge
The students understand when the concentration of their beverages is not correct as determined by taste/color/etc. They may have heard of the pH scale and they are familiar with oxygen in air.

Additional Resources
Cincinnati Water Works
<http://www.cincinnati-oh.gov/water/pages/-3283/>
US EPA Drinking Water
<http://www.epa.gov/eftpages/waterdrinkingwater.html>

Developed by Fellows:
Sarah Pumphrey
& Sharon Bachman

Summary

Day 1 – The students will be introduced to several water quality parameters and will make observations using hands-on examples.

Day 2 – Students will learn the basic stages of water treatment. They will become familiar with how engineers model and design a water treatment systems, then they will start to make designs of their own.

Objectives

Students will be able to:

- **Understand** and be able to explain concentration as it relates to pH, turbidity, dissolved oxygen and presence of aquatic bacteria.
- **Discuss** the basic components of drinking water treatment.
- **Brainstorm** water treatment designs to be used in their science fair projects.

Ohio Standards

From the Ohio Science Benchmarks:

Earth and Space Sciences

- **Benchmark A** - Explain how technology can be used to gather evidence and increase our understanding of the universe.
- **Benchmark B** - Describe how Earth is made up of a series of interconnected systems and how a change in one system affects other systems.
- **Benchmark C** - Explain that humans are an integral part of the Earth's system and the choices humans make today impact natural systems in the future.

Life Sciences

- **Benchmark B** - Explain how humans are connected to and impact natural systems.
- **Benchmark E** - Explain the interconnectedness of the components of a natural system

Science and Technology

- **Benchmark A** - Predict how human choices today will determine the quality and quantity of life on Earth.
- **Understanding Technology** (Grade 11)- Explore and explain any given technology that may have a different value for different groups of people and at different points in time (e.g., new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to reproduce new characteristics).

Scientific Ways of Knowing

- **Benchmark A** - Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.



Students experiment with filtration.



Students present their systems.