Project STEP

Issue 7— http://www.eng.uc.edu/step/

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

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.

Announcements

- Project STEP is organizing An Open House on March 30th, 2006 in the Alumni Center from 4:30-7:00 PM. We will be showcasing STEP lessons, modules & activities. All are welcome.

- The University of Cincinnati is hosting its first-ever Showcase 2006 on April 21-22 at the Tangeman University Center. This will be a major event that will focus on the impact of the university on the society around it.

The participants will use a wide range of demonstrations and posters to showcase the research and creative excellence of the various academic divisions of the university.

For further information please visit the following website: http://www.uc.edu/showcase/.

2006 Science & Engineering Expo

At the 2006 Science & Engineering Expo, held at the University of Cincinnati, Project STEP participated by awarding a prize for the best student projects related to issues of the city. There were approximately 400 student projects in various topical areas from environmental science to engineering. Of the 400, 42 were identified as relating to the issues of the city. Project STEP awarded first place ($50) and second place ($25) awards to those projects that were exceptionally creative and well executed. Congratulations to the winners:

1st - Raymond Tan from William Mason High School (9th grade) for his project on "Alternative Fuels to Petroleum"

2nd - Meredith McNair and Shannon Mohan from Walnut Hills High School for their project "The Effectiveness of Safety Restraints"

Project STEP was also represented in the exhibitor portion of the Expo with a hands-on demonstration of the effect of earthquakes on structures. Participants were able to build a structure out of various materials (toothpicks, pipe cleaners, marshmallows, popsicle sticks, tape, etc.) and then watch as it withstood vigorous shaking.

Project STEP
www.eng.uc.edu/step/

Inverse Functions and Hurricanes

Western Hills University High School **Fall 2005**

Lesson Information

Grade Level
12

Subject areas
Algebra 2

Duration
Two 70 minute class periods

Setting
Standard classroom

Materials
Mug

Microwave

External TI temperature Sensor

One calculator per student

Handouts

Background Knowledge
Students will need to be able to solve simple algebraic equations and be able to find a regression line using their calculators.

Additional Resources
none

Developed by Fellow:

Matthew Estes

Summary

This activity will allow the students to record their own data periodically, in this case temperatures using some Texas Instruments external calculator hardware. They will then derive an equation relating time of year to ocean temperature. They will also use a function for the chance of a hurricane based on the ocean's temperature to explain the frequency of hurricanes during a particular season. By finding the inverse of the two functions, the one they found as well as the one they were given, they will be able to convert between three different data sets.

Students complete the inverse functions worksheet

Objectives

Students will be able to:

- Calculate an inverse function.
- Understand the practicality of inverse functions in the real world.

Ohio Standards

From the Ohio Science Benchmarks:

Mathematics

- Create a scatter plot of bivariate data, identify trends, and find a function to model the data.
- Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.
- Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions.
- Represent the inverse of a function symbolically and graphically as a reflection about $y = x$.

Teacher Profile

Rita Seifert is the 12th grade mathematics teacher at Western Hills University High School. This is her 13th year with the district. Rita holds a Bachelor of Arts degree in mathematics and a master's degree in education. She earned National Board Certification in 2001 and was a 2002 semi-finalist for the Presidential Award for Excellence in the Teaching of Math and Science.

This is Rita's first year working with Project STEP. She says the Fellows bring a real-world perspective into the classroom that stimulates the students to try harder on assignments. She feels Project STEP is a win-win situation for everyone involved.

Rita at her desk

She says: "Nothing can replace interesting lessons that demonstrate an application of mathematics relating to the student's world."

Student Profile (s)

The Students participating in Matt's recent STEP lessons had the following comments.

"It was a real world problem and it was interesting."

"This lesson was very easy to relate to. I really liked learning about how to choose a good stock"

"It helped me understand math more."

"I liked most how it can be used the find a simple solution in our everyday life activities."

"What I liked the most had to be the computer search."

Fellow Profile

Matt Estes is a 3rd year PhD student at the University of Cincinnati.

Matt completed his B.S. degree at University of California at Berkeley in BioEngineering in 2003.

Matt's undergraduate research centered on space suit design for use on Mars, as well as studies on the possibility of liquid water on Mars. He also spent some time researching a biofuel cell capable of turning sugar into electricity. Matt's current research is focused a variety of lab-on-a-chip micro devices.

This is Matt's 1st year with Project STEP. He is currently assigned to four twelve grade math classes at Western Hills University High School and is working closely with Rita Seifert.

In his spare time, he enjoys soccer, basketball, and poker.

PI Profile

Kelly Oberski is a doctoral candidate in the College of Education, Criminal Justice and Human Services. Kelly is currently focusing her research on the long term implications of participation in a National Foundation Fellowship. This is her second year as the STEP Grant Coordinator.

Kelly holds a 7-12 comprehensive science certification in chemistry, biology, and environmental science and a 7-8th grade physics certification. Kelly previously taught biology, environmental science, anatomy & physiology, and physical science at the Hughes Center, Western Hills High School and Purcell Marion. Kelly also teaches various undergraduate and graduate courses at the University of Cincinnati.

In her "free" time, Kelly enjoys kick boxing, theater, gardening, and traveling.

School Profile

Western Hills University High School is a Project GRAD school. Project GRAD works to ensure a quality public education for all children in economically disadvantaged communities, so that high school graduation rates increase and graduates are prepared to enter and graduate from college.

Western Hills University High School

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Solar Hallway

University of Cincinnati

Hughes Center High School- Health Program **Spring 2005**

Lesson Information

Grade Level
9

Subject Areas
Physical Science

Duration
Four 70 minute class blocks

Setting
Traditional classroom with access to a long hallway or gym floor.

Materials
Computer, projector and screen
Power Point Presentation
The SKY computer program (more details at http://www.bisque.com/products/thesky6/)
Guided Notes Handout
Solar Hallway Handout
30m of string (for each group)
Duct Tape
Meter Stick
Tape
Marker
Construction Paper
Compass
Ruler
Measuring Tape

Background Knowledge
Ratios, scales, basic understanding of the solar system

Students measuring the planet's scaled distances

Developed by Fellows:
Michelle Daniel

Summary

In this activity, students explore the "enormousness" of our solar system. Through this exploration, student groups will create a scale model of the distances between the planets as well as a scale model of one of the planets. Creating scale models is a major aspect of engineering and is a part of the design process. Scale models enable engineers to see their final product without the expensive of creating a full-sized model. Scale models also allow people to see very large and expansive things (solar system, earth, space shuttles, etc.) on a small, tangible scale.

Student working on the activity

Objectives

Students will:

- Understand that the formation of elements, beyond H and He, within the universe is directly linked to catastrophic explosions of stars (super novas).
- Understand and be able to describe the current scientific evidence that supports the Big Bang.
- Construct and interpret a physical model of the solar system.
- Apply their mathematical knowledge of data precision and rounding of calculation operation.
- Understand the idea that reliable scientific evidence improves the ability of scientists to offer accurate predictions.
- Understand that science has changed over time & almost always is built on earlier knowledge.
- Students will utilize scientific notation to express numbers.
- Be able to calculate planetary distances using ratios.
- Apply mathematical knowledge and skills in the science class.
- Understand Aerospace Engineering and its application to transportation technologies (rockets), particularly GE Aircraft and Wright Pat Air force.

Ohio Standards

Science

Standard: Earth and Space Sciences: ***Benchmark A*****:** Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe [1 and 2].

Standard: Scientific Inquiry: ***Benchmark A*****:** Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations [3 & 4].

Standard: Scientific Ways of Knowing: ***Benchmark A***: Explain that scientific knowledge must be based on evidence; be predictive, logical, subject to modification and limited to the natural world [3]. ***Benchmark B:*** Explain how scientific inquiry is guided by knowledge, observations, ideas and questions [7].

Technology

Standard: Designed World: ***Benchmark B:*** Classify, demonstrate, examine and appraise transportation technologies [1].

Mathematics

Standard: Numbers, Number Sense and Operation: ***Benchmark A:*** Use scientific notation to express large numbers and numbers less than one. ***Benchmark G:*** Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent and explain solutions.

Standard: Mathematical Processes: **Benchmark B:** Apply mathematical knowledge and skills routinely in other content areas and practical situations.