PROJECT STEP: TRACK II

Issue 11 — http://www.eng.uc.edu/STEP/ | November/December 2006

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Program funded by the National Science Foundation Grant #0139312 and matching funds by the University of Cincinnati

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

The *Project STEP: Track II Building Stemcinnati City newsletter* is published six times per year. For subscriptions, changes of address, or submitting news items and articles, please contact the Editor, Dr. Karen Davis, at karen.davis@uc.edu, or the STEP office at 513-556-1534.

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 the Academy for Math and Science (CAMAS), and the Teaching and Technology High School at Hughes Center, Western Hills Design Technology High School, Norwood High School, and Newport High School.

STEP involves five graduate Fellows, 20 science and mathematics teachers, a project coordinator, an evaluation coordinator, a technology coordinator, and faculty members from the Colleges of Engineering and Education. Project STEP began at UC in July of 2002. A variety of lessons and activities are available on our website.

Track II Participants Get The Word Out

STEP participants presented or published 16 papers resulting from their STEP activities over the past year, listed on the web site at: http;//www.eng.uc.edu/step/publications/.

For example, Co-Principal Investigator Dr. Suzanne Soled presented a paper at the Frontiers in Education conference in October titled, "Partnering Engineering Graduate Students and Secondary Science Teachers to Teach Water Quality." The paper was co-authored by STEP Fellows Michelle L. Daniel and Sarah I. Pumphrey, as well as STEP teacher Sharon M. Bachman. This paper discussed several lessons concerning drinking water treatment both locally and internationally that were developed through the collaborative efforts of Project STEP and RET (Research Experience for Teachers) and implemented in eight environmental science classes.

Locally, students explored drinking water treatment in Cincinnati, and the processes that treatment plants perform. Internationally, students explored drinking water issues in South Africa and participated in a UC Research project that brought drinking water treatment to a small village in Tanzania. Students discussed issues of water quality and quantity, global water sustainability and reuse, and protection of public health. Students also constructed sifting screens which were then transported to Tanzania and used to make a water filter at an elementary school.

Dr. Soled presented a second paper at the FIE conference "Life after National Science Foundation Fellowships: The Implications for a Graduate Students' Professional Endeavors" co-authored by former STEP Grant Coordinator Kelly J. Obarski. Over the past four years, Project STEP (Science and Technology Enhancement Program) has funded 18 graduate and undergraduate Fellows. This study examines the long term impact of participation in an NSF Fellowship and impact that it has on their educational and professional choices once Fellows leave the program. The theoretical framework surrounding this study is framed around Preparing Future Faculty Literature, socio-cultural cognition, and other GK-12 projects. Interviews, historical tracking documents, and attitude surveys are being used in order to ascertain themes that will be further studied as this work-in-progress develops.

Submissions to upcoming conferences and journals from Fellows and STEP participants are currently under preparation. For more information, or to volunteer as a reviewer, contact Dr. Karen Davis at karen.davis@uc.edu.

Who's Your Daddy? A Lesson in Relatedness

Hughes Center High School | **November Lesson**

Lesson Information

Hughes Center students studying locomotive strategies

Grade Level
10th

Subject Areas
Biology

Duration
Three 70-minute class periods

Setting
Standard classroom and computer laboratory

Materials
Assorted hardware such as nails, screws, and nuts
Containers for sorting hardware
Blank, white paper for constructing cladograms
Small, live creatures such as pillbugs, worms, minnows, and flies collected from the surrounding area and housed in appropriate container

Background Knowledge
Basic zoology information should be known by the students. Students should be familiar with the various types of living organisms.

Additional Resources
Lesson plans and handouts can be found on the STEP website.

Summary

This lesson is designed to teach the process of developing a hierarchical classification of organisms that shows information about relative evolutionary relationships. The students first learn the process of classification using hardware, practicing the art of asking meaningful questions. After mastering the necessary skills to develop a family tree, they then repeat the procedure using live organisms. New organisms are added after the classification is done to see what impact the addition of new data can have on scientific interpretations.

Objectives

Students will be able to:

- *Create* a hierarchical classification system on their own by developing a set of dichotomous questions
- *Ask* pertinent questions
- *Develop* a cladogram to represent relatedness of organisms
- *Learn* the Linnaean Classification System
- *Modify* their existing models to incorporate new ideas
- *Gain* a working understanding of how organisms are classified in higher level groupings.

Rationale

This lesson and activities encourage students to think critically about structural and locomotory strategies, and exposes them to organisms found in their own urban environments.

Ohio Standards [From the Ohio Science Benchmarks]

Science:

Life Sciences, Grades 9-10, Benchmark E: Explain how evolutionary relationships contribute to an understanding of the unity and diversity of life.

Life Sciences, Grade 10, Indicator 12: Describe that biological classification represents how organisms are related with species being the most fundamental unit of the classification system. Relate how biologists arrange organisms into hierarchies of groups and subgroups based upon similarities and differences that reflect their evolutionary relationships.

Inquiry:

Inquiry, Grade 10, Standard 3: Use models to predict and analyze natural phenomena.
Inquiry, Grade 10, Standard 5: Explain how new scientific data can cause any existing scientific explanation to be supported, revised, or rejected.

Developed by Fellow:

Anthony Kramer

More Information

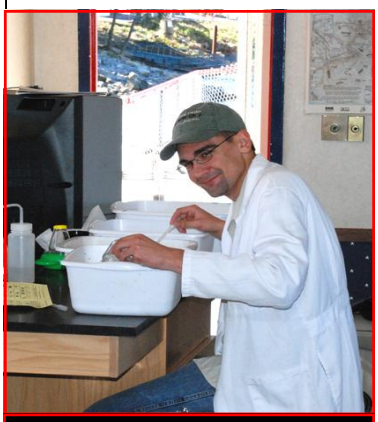
For more information, including lesson plans and handouts, visit the STEP website at http://www.eng.uc.edu/step/activities/.

STEP Fellow Focus

This issue focuses on Neal Wiggermann and Anthony Kramer.

Neal is working with Norwood High School and teacher Leslie Hadaway, as well as teacher coordinator Megan West. His lesson plan on biophysics and ergonomic is featured in this issue, and arose from some of the classes he took in his Master's specialty in Ergonomics and Safety Engineering. "The STEP Program will help me use my interest in education to share my love of engineering, math, and science with some of the students in local schools," says Neal. In doing so, he hopes to help students see some of the connections between engineering and their daily environments. "Engineering has given me many career opportunities, and the chance to use my mind to make the world a better place," Neal explains. "Anything I might be able to do to empower the next generation to find such a path will be a great success."

Neal



Tony

Anthony "Tony" Kramer is working with the Cincinnati Academy of Mathematics and Sciences, and the Health Services Program, two of the five programs at Hughes Center High School. His teacher coordinator is Sharon Bachman, and the teacher participants are Anna Hutchinson, Debra Hutchinson, and Rebecca Richmond. Tony's background is in marine biology, invertebrate paleontology, and field geology. He is excited to be working with high school students because, as he says, "I've had seven years of teaching but none in a secondary education setting."

"Actually," he adds, "I find little difference between working with the students at CAMAS and Health Services and the students I have had at Eastern Michigan, Wright State, and UC." Tony's advisor is Dr. Carl Brett, Professor of Geology at UC. Dr. Ted Fowler and Dr. Dan Oerther, STEP Co-Principal Investigators, meet regularly with Tony to guide his educational experiences.

Hughes Center High School

Evaluation Matters

STEP is made possible through funding provided by the National Science Foundation (NSF). One of the requirements for receiving these funds is that STEP participants collect and analyze data on the progress of the grant in meeting its goals, and report this back to the NSF. Data is collected from all participants of the grant. Through evaluation, the team is able to provide the data that is disseminated through the NSF, conferences and publications to share with other educational institutions the findings of STEP.

Patricia

The team responsible for the evaluation process consists of two members: Dr. Suzanne Soled, Education Chair of Northern Kentucky University, who is in her fifth year with STEP, and Patricia McNerney, who is in her second year as evaluation Fellow and who is also a second-year doctoral student in the College of Education at UC.

The team thanks all STEP teachers and Fellows for their work in disseminating and collecting evaluation data. The team recognizes the work involved in obtaining the data.

Evaluation is an important component of the grant. Without documentation of STEP successes, funding and dissemination of data would not be possible.

Norwood High School

Tooling Up: Design for Ergonomics

December Lesson

Lesson Information

Grade Level
11-12

Subject Areas
Anatomy and Physiology

Duration
Two 50-minute class periods for lecture; one 50-minute class period for the laboratory

Setting
Standard classroom

Materials
Traditional and ergonomic tools of the teacher's choice, such as cooking utensils, office implements, and hand tools. Sufficient tools for 12 stations.

Background Knowledge
Students should be familiar with basic physiological principles, as well as the physical concepts of force and pressure.

More Information
Lesson plan and handouts on the STEP website.

Developed by:
Neal Wiggermann
and Leslie Hadaway

Summary

This lesson is designed to enrich content relating to the musculoskeletal system, and the study of basic, ergonomic concepts. After a lecture on ergonomics and physiology, students visit 12 mini-lab stations set up around the room, answering written questions at each station. The students spend about five minutes at each station, evaluating tools, naming associated body parts, identifying possible occupational injuries resulting from repeated physical stress, and recommending design changes. At one station (station 6), students will be required to collect data on force as it relates to the angle of a joint, and draw conclusions from their data.

"It taught us about the way technology is evolving."

"It showed how different tools can be."

Objectives

Students will be able to...

- *Understand* the relationship between ergonomics and physiology, other sciences, and engineering
- *Validate* concepts in a lab
- *Evaluate* the appropriateness of various tool designs and recommend improvements
- *Identify* important anatomical characteristics and associated ailments related to the use of tools that have been improperly designed

Rationale

Ergonomics is a relevant topic both at home and on the job. In addition to reinforcing knowledge of physiology, this lesson about ergonomics will provide students with a means of making more informed decisions about their own health, as well as the health of their friends and their fellow employees in the future. The study of ergonomic design provides an excellent opportunity for problem-solving using an engineering process.

"I liked comparing two tools with the same concept."

Ohio Standards [From the Ohio Science Benchmarks]

Science and Technology

Benchmark A. Predict how human choices today will determine the quality and quantity of life on Earth:

- Predict how decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment and/or humans.

Technology

Standard 6. Design, Benchmark A. Identify and produce a product or system using a design process, evaluate the final solution, and communicate the findings.

- Discuss how the requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other
- Evaluate and rate the quality of an existing household product or system
- Explain and use appropriate design processes and techniques to develop or improve products or services in one of the technological systems (energy and power, transportation, manufacturing, construction, information and communication, medical, and agricultural and related biotechnologies).