THE UNIVERSITY of TENNESSEE KNOXVILLE
College of Arts and Sciences

Teacher Betsy Tillett (left) of Carpenters Middle School, with Angela Danovi (center) and Dr. Carol Harden of UT Knoxville

ACADEMIC OUTREACH

Spring 2007

Bridging our college & the community

WHAT'S **IN**SIDE

TAKING RESEARCH AND DISCOVERY TO RURAL MIDDLE SCHOOLS

by elise lequire | photographs by jeremiah harris

An innovative program launched in fall 2006 brings UT Knoxville researchers and graduate students to rural middle schools in an effort to enrich earth- and environmental-sciences curricula, create ties between schoolteachers and the research community, and debunk the myth that science education means memorizing known facts.

A 3-year grant from the National Science Foundation allows faculty members and graduate students from UT Knoxville's departments of geography and earth and planetary sciences to collaborate with teachers at seven middle schools in four districts in and around Knox County. The aim of the grant, "GK–12: Enriching Earth Science in Rural Tennessee Middle Schools through Research-Based Activities on Climate and Environmental History," is to use inquiry-based activities to introduce the scientific method and achieve the goal set by the National Science Education Standards of fostering scientific literacy in the United States.

The not-so-mad scientist

One program objective is to encourage science learning at a critical age when students, especially girls, may become discouraged, and to get students engaged in the discovery process. "If you asked a group of middle-school students to describe a scientist, they might evoke the image of an old guy in a white lab coat with weird hair," says Sally Horn, a professor of geography at UT Knoxville and the principal investigator on the grant.

Bringing university researchers in the earth and environmental sciences and their graduate students into the classroom gives middle-schoolers a glimpse of the many career opportunities open to young scientists and reinforces the idea of research as discovery. "The answers

Lynn J. Champion, Ph.D.
Director of Academic Outreach and Communications
College of Arts and Sciences

DEAR READERS,

A report released in 2005 by the National Academy of Sciences warned that the U.S. could risk its world leadership and compromise its citizens' quality of life if the nation does not stay competitive with the rest of the world in science and technology. Hence, encouraging student interest in STEM subjects (science, technology, engineering, and mathematics) has become both a national and a state priority.

This spring 2007 issue of "Academic Outreach" features four articles illustrating how the faculty of the College of Arts and Sciences at UT Knoxville is responding to this challenge. First, project investigator Professor Sally Horn describes a project funded by the National Science Foundation that enables earth science faculty members and their graduate students to partner with teachers in rural middle schools to share UT research with middle-school students and their parents. Professor Suzanne Lenhart is dedicated to encouraging students, particularly those from such underrepresented groups as women and U.S. minorities, who may be interested in studying mathematics. Professor Beth Mullin is one of a number of faculty members who open their research laboratories to mentor high-school students and engage them in inquiry-based learning. And the fourth article features the work of Professor Dan Roberts, who devotes a few months each year to directing the Junior Science and Humanities Symposium, hosted by UT Knoxville, which invites high-school students who have completed original research to present papers about that research at a real academic conference.

We welcome you to the pages of this newsletter and to the stories and photos of Tennessee students who are benefiting from the guidance and encouragement offered by our outstanding Arts and Sciences faculty.

Sincerely,
Lynn J. Champion, Ph.D.
Director, Academic Outreach and Communications

to research questions are not what you find in a library or on the Internet; this is new knowledge we are creating through research," Horn says. The big push in education now is to have schoolchildren do more hands-on, open-ended work and let them participate actively in the discovery of knowledge while integrating these activities with the school curriculum.

One such experiment is actually junior-varsity paleontological research, in which students produce new data for a real project in progress. Through its Mastodon Matrix Project, the Paleontological Research Institution in Ithaca, New York—which is affiliated with Cornell University—conserves the fossil-rich matrix from mastodon excavations and makes it available to middle- and high-school science classes and other groups. The matrix contains small shells, twigs, seeds, and other fossils that date to the time of the last glaciation period, when mastodons roamed the eastern part of the continent, including what is now Tennessee. Each batch of matrix is unique, so the students' analyses of the contents of the matrix have no predetermined outcome, just as in an actual field investigation. The new data students produce is reported to scientists at the Paleontological Research Institution, so both the scientists and the students benefit.

Schoolyard as classroom

Another unique aspect of this program is the strong research focus shared by the researchers and graduate students: "The program is designed to build on the research strengths of our departments," Horn says. For example, at Carpenters Middle School in Blount County, 6th-graders are studying soil erosion in an experimental plot near the school parking lot. The faculty associate at Carpenters is Carol Harden, a UT Knoxville professor of geography. Her research interests—soil erosion, watershed dynamics, and the human impact on the environment—have taken her from local watersheds to the Ecuadorian Andes.

Harden's advisee Angela Danovi is one of two graduate fellows at Carpenters. "Our graduate students are hand-picked," Harden says. "My role is as a second-tier resource person. Angela's research is well developed, and she is well trained in earth and environmental science."

Danovi, whose own thesis project explores phosphorous absorption in stream sediments adjacent to lands under different uses, spends

Below: Tanner Miller (left) and Cole Browning measure soil erosion, while Angela Danovi (in blue shirt) and student Geena Ausburn discuss their readings.

2 days a week in the 6th-grade classroom of teacher Betsy Tillett. Danovi has helped students plan and execute an original soil-erosion experiment near the school parking lot. She introduced the students to the concept of original research and the basics of soil erosion, helped them complete a research design worksheet, and established a research plot on a bank with visible erosion.

The students placed pins in the ground, measured how much of the pin was showing aboveground, and returned after 3 months to measure changes, using centimeters as the units of measure. "If it's science, it's centimeters," Danovi tells the class. This study helps students use measurement and calculation to learn about the environment, underscoring the practical importance of math class.

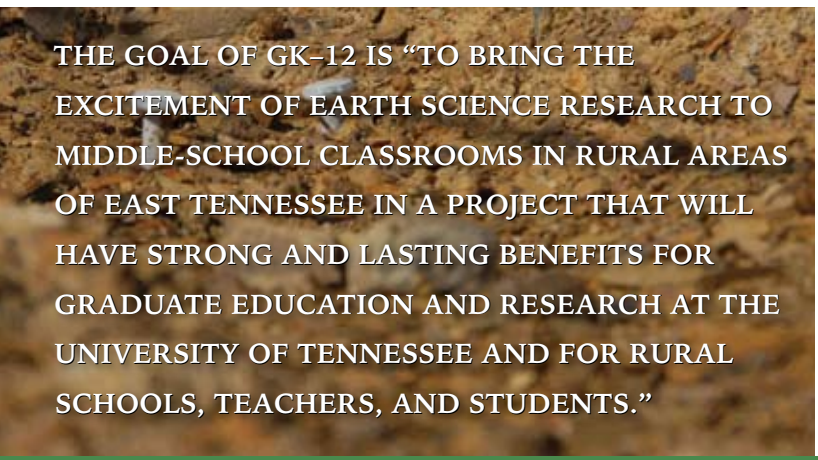
"Angela has been a huge help," says classroom teacher Tillett. "I love hands-on activities, but planning them takes a really long time." Fellows typically spend 10 hours a week in class and 5 hours in preparation.

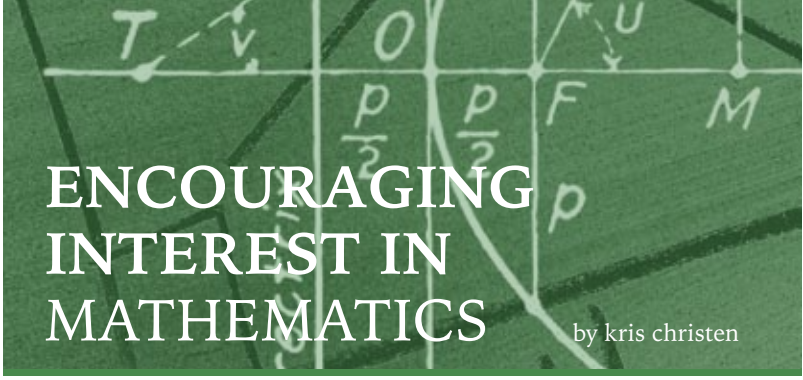
Linking rural communities to the university

"We chose to concentrate the GK–12 grant on rural areas for several reasons. One is the opportunity in rural settings for such field activities as the soil-erosion experiment. Furthermore, fewer families in rural areas have direct links to the university, even though it is only a short drive away," says Horn.

To strengthen the ties among rural communities, students, teachers, and the research community, the faculty associates plan "Family Science Night" events in the middle schools, and their open houses at the university's research labs bring parents and students to campus to interact with faculty members and fellows and tour facilities where fellows are conducting their research. Faculty associates have also worked to involve students and teachers in the Science Olympiad, Earth Science Day, and Geographic Awareness Week on campus, and schoolteachers have traveled with UT Knoxville researchers on research-oriented field trips.

These activities, and more, advance the goal of the GK–12 grant to improve student performance and eventually train more professionals in science, technology, engineering, and mathematics (STEM) disciplines and help the state and the nation remain productive and competitive in the global environment. **AO**





ENCOURAGING INTEREST IN MATHEMATICS

by kris christen


Dr. Suzannne Lenhart

Mentoring young people, especially girls, to consider careers in math and science has been a lifelong mission of Dr. Suzanne Lenhart, a professor in the Mathematics Department of UT Knoxville.

Since 1998 she has regularly organized the math sessions at a twice-yearly workshop called SHADES, or "Sharing Adventures in Engineering and Sciences," which is geared toward middle-school girls. Other SHADES sessions involve biology, chemistry, and engineering. About 50 students, many from rural counties, attend each workshop, where they are exposed to new ideas in science and to career opportunities. The program is highly interactive, with demonstration-oriented exhibits and presentations aimed at showing young girls that these disciplines are fun and interesting.

The idea, Lenhart says, is to reach out to these girls at a point in their lives when mentoring and intervention can make a crucial difference. "Keeping their interest in math and science is key at this stage so that they'll have the background to choose that type of career later on," she explains.

Lenhart also has been organizing after-school math club activities at local schools for the past 8 years. Currently active at Bearden High School in Knoxville, she has been going there once a week since 2002 to lead between 10 and 12 students in enrichment activities and prepare them for Mu Alpha Theta (the national math honor society) competitions and conventions. To date, she's taken students to five state and three national conventions. Lenhart is closely involved with those who regularly come to math club activities and occasionally writes recommendation letters for them when they apply to colleges.

Lenhart's mentoring efforts do not stop at the K-through-12 level. She has served as president of the Association for Women in Mathematics (AWM) and counsels graduate students through the AWM Mentor Network. She is also active in organizing career workshops at national meetings for students from the undergraduate to the post-doctoral level, as well as activities for the local chapter of the Association for Women in Science. She frequently speaks on panel discussions at professional math meetings and organizes conferences on the theme of connecting women mathematicians to industrial and applied mathematics.

In fact, Lenhart has done so much to increase the participation of women in scientific careers that she is helping to change the face of mathematics, wrote her department head in nominating her recently for a prestigious national mentoring award. **AO**