

**STEM Activity Survey
East Tennessee State University
December 23, 2010**

(1) STEM Activities Occurring at ETSU

STEM departments and degrees offered. For the purposes of this survey ETSU defines STEM departments as those listed below. Several other departments, including the Department of Psychology in the College of Arts and Sciences, the Department of Physical Education and Sport Science in the College of Education, and virtually all departments in the Colleges of Clinical and Rehabilitative Health Sciences, Medicine, Nursing, Pharmacy and Public Health, also have significant STEM components.

Department of Biological Sciences

The department offers the B.S. degree in Biology, including the option of a biochemistry concentration, and the M.S. degree with concentrations in biology, microbiology, and paleontology.

Department of Chemistry

The department offers the B.S. degree with five different concentrations, including the chemistry, chemical physics, chemistry professional, ACS chemistry and biochemistry concentrations. The last two are certified by the American Chemical Society. The department also offers the M.S. degree.

Department of Computer and Information Sciences

The department offers the B.S. degree in Computing with concentrations in computer science, information systems science and information technology. The department also offers the M.S. degree with concentrations in applied computer science and information technology.

Department of Engineering Technology, Surveying and Digital Media

The department offers the B.S. degrees in Engineering Technology (concentrations in biomedical engineering technology, construction technology, electronics engineering technology, manufacturing engineering technology, industrial technology and product development), Surveying and Mapping Science, and Digital Media (concentrations in digital animation, digital interaction, digital visualization and production design).

Department of Geosciences

The department offers B.S. degrees in Geography and Geology, and has recently proposed the introduction of the M.S. degree in Geosciences with concentrations in geospatial analysis and paleontology.

Department of Health Sciences

The department offers the B.S. degree with concentrations in microbiology and human health.

Department of Mathematics and Statistics

The department offers the B.S. degree in Mathematics with concentrations in mathematical sciences, mathematical statistics, quantitative modeling, and mathematics education, and the M.S. degree in Mathematics.

Department of Physics and Astronomy

The department offers the B.S. degree in Physics, as well as minors in physics and astronomy.

Center of Excellence in Math and Science Education. Created in 2006, ETSU's Center of Excellence in Mathematics and Science Education (CEMSE) advances mathematics and science education, K-16, through direct services, technical assistance, partnerships, research, leadership institutes and workshops, and provision of standards-based resources to schools, districts, teachers and community members. The CEMSE is a collaborative effort of the College of Arts and Sciences and the Claudius G. Clemmer College of Education. While enhancing teacher preparation and professional development, the Center also supports programs to increase the supply of math and science educators in Tennessee.

Statewide Annual STEM Conference. Each spring the CEMSE sponsors a statewide STEM conference that brings together a science and math teachers, STEM faculty, parents, community leaders, business and corporate leaders, State Department of Education and Board of Education staff, policy makers, and scientists. The conference raises awareness of the role STEM education plays in enabling our region, state and nation to maintain an economic and technological edge in the global marketplace of the 21st century. The 2011 conference theme is "STEM Education and the Future of our State and Nation." The conference is funded by ETSU and CEMSE (\$27,000).

Governor's School in Scientific Models and Data Analysis. The overarching goal of the Governor's School is to broaden students' appreciation and knowledge of biology and mathematics through exposure to and integration of a wide range of contemporary biological and mathematical topics. Model building and data analysis are interwoven in a statistical and biological context. The school provides a series of courses, laboratories, projects, field trips, seminars, lectures, and other activities centered on mathematics, statistics, and biology. Each student receives undergraduate credit for BIOL 1110/11 and MATH 1530. The ETSU Governor's School in Scientific Models and Data Analysis is supported by a grant from the Tennessee Department of Education (\$120,000 per year).

Upper East Tennessee Science Fair. The Upper East Tennessee Science Fair is held annually in late spring on ETSU's Johnson City campus. The event is sponsored by the Johnson City Kiwanis Club and ETSU. It features approximately 400 exhibits submitted by 4th through 8th graders from approximately 40 schools in the region. ETSU faculty and professional scientists judge the competition. More than \$6000 in prize money, donated by the Kiwanis Club and Eastman Chemical Company, is awarded to student winners and their schools. Two \$100 prizes are awarded by ETSU's Center for Appalachian Studies and Services, four \$100 prizes are awarded by the Tennessee Academy of Science, and five \$100 prizes are awarded by Studsvik, Inc.

Tennessee Junior Academy of Science. The CEMSE, in partnership with the Tennessee Academy of Science, administers the Tennessee Junior Academy of Science (TJAS). The TJAS furthers STEM education in Tennessee by providing an annual meeting of capable high school students comparable to scientific meetings of adult scientists. Each year CEMSE receives approximately 150 scientific papers from juniors and seniors from throughout the state. These papers are read by an ETSU panel of readers and the 25 top papers are selected for presentation at the annual meeting, held on the campus of Belmont University. A panel of judges selects the top 10 papers for publication in the *TJAS Handbook and Proceedings*. The top two student papers receive \$500 each and the other eight top papers each receive \$200. The program is administered by ETSU's Center of Excellence in Mathematics and Science Education and funded by the Tennessee Academy of Science (\$10,000 annually).

Symbiosis Curriculum Project. In response to the National Research Council's report BIO2010 and supported by a \$1.7 million Howard Hughes Medical Institute grant, ETSU's Departments of Mathematics and Statistics and Biological Sciences have developed an innovative approach to teaching introductory biology and mathematics. In the *Symbiosis* curriculum students simultaneously enroll in Biology for Majors I (BIOL 1110/11) and Probability and Statistics (MATH 1530), followed in the second semester by Biology for Majors II (BIOL 1120/21) and, in the third semester, Biology for Majors III (BIOL 1130/31) and Calculus (MATH 1910). Biology is presented in a more quantitative manner, applications of mathematical concepts are biological in nature, and data are shared between the pairs of co-requisite courses. The *Symbiosis* curriculum was also offered to Governor's School students with support from the National Science Foundation (\$1 million, 2005-10 with no-cost extension until 2010).

CSCI 4800, Senior Project in Information Technology. The Department of Computer and Information Sciences' capstone course, CSCI 4800, Senior Project in Information Technology, sends students into the community to apply their knowledge. The course supports the department's PASTA ("Providing Area Schools with Technical Assistance") Project, in which each student spends five hours a week, for a total of 75 hours per semester, providing technical assistance to local schools. PASTA students become "help desks" for teachers, trying to solve whatever problems are reported. In addition, when ETSU departments and offices upgrade their computers every three to four years, Computer and Information Science students recycle the old computers by wiping the hard drives clean and reconfiguring the computers, then offering them to local schools to replace much older computers still in use. ETSU students process approximately 400 computers annually. The PASTA project is supported in part by a grant from the Appalachian Regional Commission (\$25,000).

Aerospace Education summer workshops. For more than three decades ETSU's Department of Engineering Technology, Surveying and Digital Media has offered basic and advanced Aerospace Education Workshops to teachers in elementary schools through college level. Participants hear presentations by experts in areas such as spacecraft operations and aviation systems and receive two hours of flight instruction. Since the program began, more than 1,500 elementary and secondary school teachers have taken the courses. The program is supported by the Tennessee Department of Transportation (\$107,102 in summer 2010).

Solid body electric guitar design and fabrication project. ETSU's Instructional Development Committee has provided \$5,000 in funding to the Department of Engineering Technology, Surveying and Digital Media for this innovative program in which undergraduate students apply knowledge in several STEM disciplines to a novel and highly engaging project. A grant from the Society of Manufacturing Engineers (SME) (\$3,000) will fund two workshops in spring and summer 2011.

Student-Faculty Collaborative Grants. ETSU's Honors College awards grants to encourage outstanding undergraduate students to complete organized, formal research projects during the junior or senior year. The maximum award per grant is \$1,000. In 2009-10 the college funded 37 proposals, most of which were in STEM fields (e.g., biology, chemistry, geosciences, mathematics, biochemistry).

Travel to present research at professional conferences. The Honors College provides funds to support undergraduate student travel for presentations at professional meetings. The College will underwrite up to \$500 (per student; two awards per career) for students presenting papers, posters or performances or participating in formal competitions at professional conferences. Departments or colleges often provide additional support. In 2009-10 the college supported travel to 12 professional organizations in STEM fields; 35 students presented at these conferences.

Undergraduate Summer Research Fellowships. The Honors College offers a limited number of Undergraduate Summer Research Fellowships; awards are highly competitive. Fellowships assist outstanding undergraduate students in making major progress on formal, organized research projects over the summer in collaboration with faculty mentors. In 2009-10 a total of 14 proposals were submitted. Three received full fellowships; four received partial fellowships. Funded fellowships included chemistry, mathematics and biochemistry projects.

Undergraduate Research Abroad. Students interested in pursuing formal undergraduate research projects in international settings may request funding via the Undergraduate Research Abroad Program. Funding for these opportunities is based on competitive grant proposal submission and is awarded as a combined Student Faculty Collaborative Grant and an ETSU Study Abroad Scholarship.

Research Discovery student worker positions. *Research Discovery* student-worker positions are assigned to faculty members in academic departments and are available through either the Federal Work Study (FWS) or Academic Performance Scholarship programs. Students work directly with faculty members in research environments, are exposed to ongoing research projects and receive work assignments that develop research skills. Our hope is that students will engage in more formal research projects during their undergraduate careers. In 2009-10, 22 undergraduates assisted faculty in various research activities; about half were in fields including anatomy, anthropology, biochemistry and biology.

Boland Undergraduate Research Symposium. ETSU's Honors College annually sponsors the *Boland Undergraduate Student Research Symposium* to enable undergraduate students to present their research in an informal, non-competitive environment, but with a professional conference format. The event encourages exchange and interaction among students and faculty and provides valuable feedback for undergraduate researchers. At the 2010 Boland Symposium 77 undergraduate students made research presentations, many of which were in fields including anatomy, biochemistry, biology, chemistry, computer sciences, mathematics, microbiology, molecular biology, and physics and astronomy.

Tennessee Posters-at-the-Capitol presentations. In conjunction with the Council on Undergraduate Research and in collaboration with other Tennessee universities, ETSU participates in an annual poster presentation in Nashville to highlight undergraduate research. In addition to presenting their research in the Capitol Rotunda, students meet with their State Representatives or Senators, as well as the Governor, Vice Governor, and other state and higher education board officials. In February 2010, six ETSU students were selected for this program, including students in biology, biochemistry and physics and astronomy.

Departmentally sponsored undergraduate research. In addition to support provided for undergraduate research by the Honors College, the university's STEM departments promote such research in other ways, sometimes drawing upon NSF funding or other sources. Over the past seven years, the Department of Physics and Astronomy produced 54 undergraduate student research projects and 19 research projects conducted through the Southeastern Association for Research in Astronomy's NSF-funded summer Research Experience for Undergraduates. In AY2010-11 alone eight faculty are engaged in research with 21 undergraduates in the Department of Chemistry. ETSU's Department of Mathematics and Statistics requires undergraduate research of all of its majors.

Institute for Quantitative Biology. ETSU's Institute for Quantitative Biology (IQB) includes faculty in the Departments of Biological Sciences, Mathematics and Statistics, Computer and Information Science, Nursing, Biostatistics and Epidemiology, Molecular Biology and Biochemistry and Pharmaceutical Sciences. IQB faculty work in computational biology and bioinformatics, computational and mathematical epidemiology, quantitative ecology and population genetics, computational statistics in health science and integrated mathematics and science education. Historically, undergraduate research in quantitative biology was the original focus of the IQB, having been founded by faculty in the Departments of Mathematics and Biological Sciences to administer an NSF undergraduate biology and mathematics project. Today the IQB is housed in the Division of Research and Sponsored Programs and continues to grow. Undergraduate research in quantitative bioscience is funded from a variety of sources, such as NSF's *Talent Expansion in Quantitative Biology*, ETSU's Honors College and the Ronald McNair Scholarship program. In addition, Masters level students conduct research at the interface of mathematical, statistical and computational sciences applied to life and health science. IQB faculty members are writing new curricula and textbooks for STEM courses, including *Statistics in a Biological Context* and *Calculus in a Natural Context*, both in preparation. The IQB Seminar Series has hosted scholars such as world-renowned mathematical epidemiologist Carlos Castillo-Chavez and Christine Heitsch, who uses combinatorial mathematics to study the geometry of viral capsids.

ETSU and General Shale Brick Natural History Museum. The ETSU and General Shale Brick Natural History Museum at the Gray Fossil Site, open just three and a half years, provides group and walk-in tours, programs, and activities to visitors of all ages—almost 250,000 thus far from every state in the nation and many countries. Sediment picking and dry/wet screening sediments are included in every K-12 field trip visit to replicate the tasks of paleontologists, and visitors observe technicians identifying, bagging, cleaning and cataloging fossil bone, seeds, leaf impressions and wood. Students in grades 5-12 may create data logs with output generated in the form of histograms and graphs. During eight weeks of summer camp, campers are taught field methods including surveying, excavating, screening, picking, and identification. Other STEM-related camp activities include study of water bears, predator-prey relationships, sinkhole formation, climate and earth sciences. Each camper group creates and installs an exhibit based on one of the themes studied during camp. The museum also offers badge-earning programs and overnights for Girl Scouts and Boy Scouts. In the interest of promoting lifelong learning, the Natural History Museum hosts traveling exhibits that change every 3-4 months on topics such as dinosaurs, extinction, rain forests, astronomy, bats, the ocean floor, and the study of animal scat. The museum has hosted several professional conferences, including the Tennessee Herpetology Symposium (2007); the Southern Appalachian Arthropod Conference (2007); the Karst Symposium (2008); the Southeast Vertebrate Paleontology Conference (2008); the American Association of Stratigraphic Palynologists (2009); and the Gray Fossil Site Symposium (2010). Each conference included sessions open to the public.

Center of Excellence in Paleontology. The Don Sundquist Center of Excellence in Paleontology conducts paleontological research at ETSU's Gray Fossil Site and fossil localities around the world. The unit is composed of six Senior Researchers from ETSU's Departments of Geosciences and Biological Sciences, as well as Student Members, Research Associates, and Technical Associates from ETSU and other institutions. In addition to its research activities the center offers competitive travel grants and research scholarships for ETSU paleontology students; assists the ETSU and General Shale Brick Natural History Museum in developing scientifically accurate exhibits, activities and tours; supports visiting researchers who bring their paleontological expertise to ETSU; hosts an annual lecture series or conference that brings together Center members, other professionals, students, amateurs, and the general public to

share and discuss on-going paleontological research; and maintains a website that advertises paleontological research and educational activities of the Center.

Geosciences Club. ETSU's Geosciences Club has monthly field trips to local sites, culminating in a detailed field excursion to one distant locality a year during Spring Break. In 2010 it was the Grand Canyon, for 2011 it will be Puerto Rico.

Math Club and student chapter of the Mathematical Association of America. ETSU's Department of Mathematics and Statistics sponsors an active Math Club and a student chapter of the Mathematical Association of America (MAA). Undergraduates and graduate students routinely travel to conferences such as the Southeastern section MAA meeting, the Southeastern Combinatorics Conference, and the Atlanta Conferences in Combinatorics and Graph Theory. The department supports student travel using funds received from innovative cost returns from STEM grant funding and ETSU's innovative management of summer school revenue and cohort revenue.

Student Affiliate of the American Chemical Society. Within the past year ETSU's Student Affiliate of the American Chemical Society (SAACS) organized an Earth Day Science Fair for local Girl Scouts in conjunction with Johnson City's *Hands On! Museum*; created two activities for National Mole Day; created a venue in which students can learn about undergraduate research and opportunities for student support at weekly SAACS meetings; and planned and conducted a trip to Eastman Chemical Company to tour its facilities and meet potential employers.

NSF Robert Noyce Teacher Scholarship Program. Funds from NSF (\$900,000 for four years) support full scholarships for 24 ETSU math and science majors training to teach in high-need school districts. The Department of Mathematics and Statistics oversees the program.

National and international math conferences. The Department of Mathematics and Statistics has hosted several prestigious national and international conferences, including NSF-CBMS conferences (2002 and 2011), the Cumberland Combinatorics Conference; the 4th International Lattice Path Combinatorics Conference, the CUR Grant Writing Workshop, and the American Mathematical Society Southeastern Conference.

NSF Statcave. The Department of Mathematics and Statistics' Statcave, providing a high tech laboratory for teaching general education statistics to 2500 students annually, was funded by a \$250,000 NSF grant. Computers are replaced every three years by ETSU Technology Access Fees.

Information Technology Summer Camps for Girls. The Information Technology Summer Camp for Girls is designed for rising 7th and 8th grade female students in the region's schools. Sponsored by the Department of Computer and Information Sciences, the camp provides students with basic concepts and skills in a Windows NT environment. Students leave camp as proficient Internet users after learning to write and design their own World Wide Web pages. Other topics covered are graphics and Microsoft PowerPoint presentations.

Anatomy and Physiology on iTunes. Professor Allan Forsman has been at ETSU for 12 years, primarily teaching Anatomy and Physiology and Human Anatomy. To provide his students with a more in-depth and innovative learning experience, he began using digital media to support his in-class materials. In 2007 he began putting this material onto iTunes University, using ETSU's eLearning infrastructure. Rapidly, it became clear that this material was being used not only by ETSU students, but also by

students at other institutions both domestically and internationally. Currently Professor Forsman has 84 videos demonstrating anatomical models, 245 audio lectures for Anatomy and Physiology and 172 lectures for Human Anatomy uploaded to the iTunes University site. During a recent week, there were 64,937 downloads of Professor Forsman's material from iTunes. His material holds the top two ranks for most downloaded "anatomy" material from iTunes University worldwide and four of the top six positions. A recent quote from an unaffiliated website stated, "I don't go to ETSU, but I'm a first year med student in Australia – and found his podcasts on iTunes U. I can't say just how amazing I thought his musculoskeletal anatomy lectures were. Not to mention he makes it interesting and has a sense of humour."

(2) STEM Activities Recently Begun, Applied for or Completed

Recently Begun

Renovation of STEM Laboratories. In 2009 and 2010 ETSU received just under \$2 million in American Recovery and Reinvestment Act (ARRA) funding from the NSF and an additional \$200,000 in ARRA funding to renovate several STEM laboratory classrooms and research laboratories serving the Departments of Biological Sciences, Chemistry, Physics and Astronomy. The funds are being used to replace the electrical and HVAC resources for computer and instrument laboratories, to fully renovate a number research laboratories to better fit the faculty members' research activities, and to replace fume hoods, benches and casework in several additional laboratories.

National Summer Leadership Institute. The NSF Leadership Association (NSELA) will present a premier Leadership Institute at ETSU in summer 2011. The institute will focus on the best practices in professional development for STEM reform and will promote collaboration among the nation's top science education leaders, practitioners and researchers. Topics will include bringing math and science together in the K-8 classroom, making thinking visible through talk and argumentation, making thinking visible through representations, and applying institute content through professional learning communities.

Reaching for Excellence in Elementary School Science summer institute. Funded by the Tennessee Higher Education Commission for 2011 (\$75,000), *Reaching for Excellence in Elementary School Science* will permit 20 teachers in grades 3-6 to gain knowledge of robust science, incorporate embedded inquiry, learn new teaching strategies, investigate students' misconceptions in science, and become knowledgeable of Tennessee science standards. The program will comprise a 12-day summer workshop and follow-up training during the fall of 2011. The teachers will be from school districts in Greeneville City, Hawkins County, Johnson County, Kingsport City and Unicoi County. All school districts targeted in this proposal qualify for "High-Need LEA Poverty Designation."

Student-centered action research and practice at ETSU. Creating a more sustainable environment is a must-do agenda in the 21st century. Funded by ETSU student sustainability fees, the project supports sustainability action research and projects by ETSU students on the campus, thereby benefitting the university and the surrounding community. The project also enables students to take advantage of future opportunities in the area of sustainability.

Student Attraction and Retention in Physics and Astronomy scholarships. Funded by the Tennessee Space Grant Program (\$18,000 for 2010-11), this program funds nine \$2000 scholarships for freshman

physics majors. These students will take a new course, PHYS 1500, Research Methods, which will introduce them to data analysis and scientific programming using Linux workstations.

Applied For

Aerospace Education Workshop. The Department of Engineering Technology, Surveying and Digital Media has applied to the Tennessee Department of Transportation for support for the summer 2011 Basic Aerospace Education Workshop (amount requested: \$44,000).

Collaborative Redesign of Science in Tennessee (CREST). CEMSE joined with eight other Tennessee public institutions of higher education in writing a proposal to develop a major project addressing high school science in the state. The other collaborating universities included Middle Tennessee State University, University of Memphis, Tennessee State University, Tennessee Technological University, Austin Peay State University, the University of Tennessee at Chattanooga, and the University of Tennessee at Martin. If funded the project will provide professional development for high school science teachers and implement Physical World Concepts (PWC) in the 9th grade, chemistry in the 10th grade, and biology in the junior year, thus advocating an inverted high school science curriculum. The proposal was submitted to NSF in October 2010 (amount requested: \$10 million over five years).

Educational technology proposal to address STEM education in Tennessee. The proposed “Classrooms in the Clouds” Project will use Cloud Computing and Web 2.0 technology in the pre-service elementary teacher education program at ETSU and investigate the extensive implications of such technology for K-16 education. A department-wide effort by students, faculty and staff will create a learner-centered, Google-Apps-laden and web-based learning environment. A pilot project with 28 pre-service elementary teachers using web-based platforms was conducted in spring 2010. The proposed project will expand the previous study to 250 pre-service teachers in the Department of Curriculum and Instruction at ETSU. The pre-service teachers will work with the faculty team in various content, methods and practicum courses. Potentially the project could be expanded to the populations of K-12 in-service teachers. The proposal was submitted to State Farm Foundation in October 2010 (amount requested \$21,200).

Weather station and pollen collection station. ETSU’s Natural History Museum has submitted a proposal to King Pharmaceuticals for \$5,195 plus a \$1,200 match from the Department of Biological Sciences to add a weather station and pollen/spore collection station to the rooftop classroom of the museum’s soon to be completed education annex. When completed the weather and pollen/spore collection station will be used to teach K-12 students and visitors of all ages to read, interpret and report levels of pollen, spores, precipitation and temperature to the GLOBE Program (“Global Learning and Observation to Benefit the Environment”), area allergists and the media.

Research Experience for Undergraduates in Paleontology. ETSU’s Don Sundquist Center of Excellence in Paleontology is currently applying for an NSF Research Experience for Undergraduates (REU) supplement to support paleontological research by undergraduate students. This hands-on program has proven to be a highly effective way to train young scientists.

Ensuring Success in General Education Statistics proposal. In November 2010 the Department of Mathematics and Statistics submitted a pre-proposal to the Bill and Melinda Gates Foundation’s Next Generation Learning Challenge (amount requested \$750,000). If approved the project will fund technology and pedagogy to improve student learning in MATH 1530, Probability and Statistics.

Recently Completed

ETSU/Nuclear Fuel Services, Inc., math project. Funded by Nuclear Fuel Services, Inc. (\$20,000), this project was a collaborative effort between ETSU and the Unicoi County School System. The project sought to increase student achievement and reduce achievement gaps in elementary and middle school math for grades 4-9 students by helping elementary and middle school teachers learn advanced math content, acquire instructional materials, and apply standards-based instructional strategies.

ETSU/Morrill Motors math project. Funded by Morrill Motors (\$5,000), this project was a collaborative effort between ETSU and the Unicoi County School System. The project sought to increase student achievement and reduce achievement gaps in elementary and middle school math for grades 4-9 students by helping elementary and middle school teachers learn advanced math content, acquire instructional materials, and apply standards-based instructional strategies.

ETSU/NN Ball & Roller math project. Funded by NN Ball & Roller (\$5,000), this project was a collaborative effort between ETSU and the Unicoi County School System. The project sought to increase student achievement and reduce achievement gaps in elementary and middle school math for grades 4-9 students by helping elementary and middle school teachers learn advanced math content, acquire instructional materials, and apply standards-based instructional strategies.

Reaching for Excellence in Middle and High School Science Partnership. Funded by the Tennessee Higher Education Commission (\$1.7 million over six years), *Reaching for Excellence in Middle and High School Science Partnership* (State APR ID: Tennessee TN070111) concludes in December 2010. The project built strong partnerships between ETSU and nine school districts in Northeast Tennessee, most of them rural, low-income, and low-achieving. The project sponsored a 12-day summer science leadership institute, taught by ETSU science faculty, designed to help middle and high school science teachers gain enhanced content, teaching skills and standards-based resources in science. Participants engaged in investigations in biology, chemistry and physics, and topics for investigation were driven by participants, student data and local and state science standards. After participants returned to their respective schools to implement the science program during the academic year, seven ETSU science faculty visited each participant over six days. During these visits university faculty modeled science lessons to students, provided in-service sessions for teachers, and supported teachers in the classroom environment. ABT Associates rated this professional development model the third best in the nation. It was one of the three final projects whose evaluations passed the rigorous guidelines set forth in the *Criteria for Classifying Designs of MSP Evaluations*.

Talent Expansion in Quantitative Biology. The *Talent Expansion in Quantitative Biology* Project was a joint offering between the Departments of Mathematics and Statistics and Biological Sciences. The project sought to graduate 60 majors in a high-demand, non-traditional concentration—quantitative and computational biological/biomedical science. Students participated in research projects from the start of their college careers, as compared to beginning to do research in the junior or senior year.

Through the Eyes of a Scientist: Jet Propulsion Laboratory and International Storytelling Center Program. In partnership with the Jet Propulsion Laboratory (JPL) and the International Storytelling Center, the CEMSE sponsored two annual professional development storytelling workshops, entitled *Through the Eyes of a Scientist*. Each two-day conference showed ETSU pre-service teachers and local in-service teachers how storytelling and science instruction can be integrated using NASA curricular

materials featuring the theme *Through the Eyes of a Scientist*. Scientists from JPL played a major role in the program.

NSF-TBR-ATE Advanced Technological Education (ATE). Funded by NSF (\$1.2 million dollars over 2005-09), this grant coordinated efforts by community colleges and 4-year institutions to prepare teacher candidates for licensure. The project was initially funded by Pellissippi State Community College.

GEAR-UP Math Project. Funded by THEC (\$147,000, January 1–August 31, 2008), the GEAR-UP Math Project helped teachers in Campbell, Cocke, Johnson and Union Counties acquire enhanced content knowledge and teaching skills in high school mathematics. It disseminated instructional materials precisely aligned with the challenging new state standards. The project modeled research-based instructional strategies that enabled teachers to improve student achievement in mathematics.

Experimental course in Predictive Modeling in Bioscience. In fall 2009 ETSU and Georgia Technological University cooperated in a novel curricular experiment. ETSU's Institute for Quantitative Biology (IQB) offered an experimental course in Predictive Modeling, coupled with a Biomedical Engineering Laboratory at The Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University. In one course project ETSU students produced models that could be implemented experimentally, and Georgia Tech engineering students designed experiments that implement the ETSU mathematical models and produced data used to estimate parameters in the models. The project resulted in a paper published in *Life Sciences Education*, a journal of the American Society of Cell Biology.

The Study of Variable Stars as a Pathway to Teaching Physical Science for Middle and High School Teachers. Dr. Beverly Smith of ETSU's Department of Physics and Astronomy was Principal Investigator of a NASA LTSA Education/Public Outreach Grant for \$59,968, titled *The Study of Variable Stars as a Pathway to Teaching Physical Science for Middle and High School Teachers* from 2003 through 2010. As part of this grant, the department ran the *Summer Opportunities for Research in Astronomy for Teachers* program, in which middle and high school teachers conducted research in astronomy during three consecutive summers, mentored by Physics and Astronomy faculty. The NASA award also supported summer research experiences for elementary and secondary teachers, in the hope that they would draw upon their workshop and research experiences in their science courses.

(3) STEM Activities in Surrounding Community

Virtually all of the activities cited previously in this report provide outreach to the surrounding community and region. In addition, the following activities also demonstrate ETSU's commitment to advancing STEM education in the region.

National Chemistry Olympiad in Northeast Tennessee section; Eastman National Chemistry Week. The Northeast Tennessee Section of the American Chemical Society participates in the U.S. National Chemistry Olympiad (USNCO). The program stimulates interest and achievement in chemistry among high school students throughout the United States and recognizes outstanding chemistry students, teachers and schools. Two hundred sixteen participants from seven local high schools took local exams in March 2010. Based on the exam results, six students were nominated for the USNCO national examination, which was administered by ETSU's Department of Chemistry in April. Each participating student and teacher received an ACS certificate. The program is co-sponsored by ETSU and Eastman Chemical Company.

Upper East Tennessee Regional Science Olympiad. Faculty in ETSU's Departments of Biological Sciences, Chemistry and Physics and Astronomy annually support the Olympiad, which celebrates and recognizes the outstanding achievement middle and high school students and teachers in science and technology. The Olympiad allows each school-based team to bring 15 students who cross-train for a variety of events, providing a rich apprentice and mentoring system for all involved. A portion of the events are rotated to reflect the ever-changing nature of chemistry, physics, technology and other disciplines. Emphasis is placed on problem solving, hands-on learning and group participation. The Olympiad encourages students, teachers, parents, principals and business leaders to bond as they work toward shared goals.

(4) Partnerships with Outside Organizations to Assist STEM Activities

Virtually all of the activities cited previously in this report would not be possible without the strong partnerships ETSU has forged with many businesses, organizations and educational institutions. The following activities provide additional examples of such partnerships.

Center of Excellence in Math and Science Education partnerships. The center is actively engaged in a variety of state and national STEM education organizations, agencies, and programs, including the Tennessee Academy of Science (TAS), the Tennessee Junior Academy of Science (TJAS), the Tennessee Science Teachers Association (TSTA), the Tennessee STEM Leadership Council, the National Science Education Leadership Association (NSELA), the National Science Teachers Association (NSTA), and the American Association for the Advancement of Science (AAAS). The Director of the CEMSE has leadership roles in each of these groups and represents NSELA as one of the AAAS affiliates. The CEMSE also enjoys strong partnerships with Eastman Chemical Company; Niswonger Foundation; Nuclear Fuels, Inc.; Morrill Motors; NN Ball & Roller, Inc.; the Howard Hughes Medical Institute; the Eastman Credit Union and the Wal-Mart Foundation.

Institution for Quantitative Biology partnerships. Members of the IQB collaborate with the National Institute for Mathematical and Biological Synthesis (NIMBioS) at the University of Tennessee, Oak Ridge National Laboratories, the Bioinformatics Institute at Virginia Tech, the Translational Science Institute at Wake Forest University, the Department of Biomedical Engineering (a joint department with Georgia Tech and Emory University), the University of Georgia's Institute for Bioinformatics and Computational Systems Biology Laboratory, and the Georgia Tech School of Mathematics. These activities enrich academic opportunities for ETSU students engaged in STEM educational projects and coursework.

Geosciences partnerships. The Department of Geosciences works with Penn Virginia Resource Partners, L.P., to better understand coal and gas reserves in Southern Appalachia. Geosciences faculty also collaborate with the Tennessee and North Carolina Departments of Transportation to understand engineering hazards related to road construction.

Astronomy partnerships. ETSU's Department of Physics and Astronomy is a founding member of SARA, the Southeastern Association for Research in Astronomy. The department also enjoys strong partnerships with the National Aeronautical and Space Administration (NASA), and the Astronomical Society of the Pacific (ASP).

Natural History Museum partnerships. The museum enjoys strong partnerships with many organizations. Recent partnership activities include the following:

- Eastman Chemical Company and the American Chemical Society annually provide K-12 learning experiences.
- NHM and the Hands On! Regional Museum offer admission to both museums for one reduced price. The Natural History Museum provides STEM education for ages 5 and up including senior citizens, while Hands On! provides STEM education for infants through 7 years.
- The museum and Bays Mountain Park and Planetarium in Kingsport, Tennessee, will offer a combination ticket in 2011.
- The North Dakota Geological Survey has provided a long-term loan of a Triceratops cast.
- The Shenandoah Valley Discovery Museum has provided a long-term loan of dinosaur fossils.
- The Smithsonian Institution and the National Museum of Mongolia have participated in personnel and exhibition exchanges with the NHM.
- The Colburne Museum in Asheville, North Carolina, presented a Gray Fossil Site exhibit in 2009-2010.
- The American Museum of Science and Energy presented a Gray Fossil Site exhibit in 2009.
- Since 2008 the NHM has enjoyed exclusive excavation, prepping, storage and exhibition of Ice Age fossils in Saltville, Virginia.

Center of Excellence in Paleontology partnerships. The CEP works with the Museum of the Middle Appalachians in Saltville, Virginia, to provide summer paleontological excavation experiences for K-12, undergraduate and graduate students, teachers and volunteers.

(5) Grant Monies and Other Funding for STEM Activities

Funding for STEM education projects, active and pending. Fiscal year 2011-to-date, the following STEM education projects are currently funded. Total funding from grants and contracts in this category is \$8.2 million (Table 1). An additional \$4 million of funding for STEM-related activities is pending (Table 2). NOTE: These tables do not include funding for STEM-related education in units not covered by this report, such as ETSU’s Departments of Psychology and Exercise and Sport Science and its Colleges of Clinical and Rehabilitative Health Sciences, Medicine, Nursing, Pharmacy and Public Health. We would be pleased to provide this information upon request.

Table 1
Active Funding for STEM Education Projects
East Tennessee State University
December 21, 2010

Funding Agency	Title	Amount	ETSU Department
National Science Foundation	Science First!	2,994,971	College of Arts and Sciences
National Science Foundation	NSF/CBMS Regional Conference in the Mathematical Sciences--'Mathematical Epidemiology with Applications'-July 18-22, 2011	38,726	Mathematics
National Science Foundation	Talent Expansion in Quantitative Biology	998,372	Mathematics
National Science Foundation	REU Site: Probability, Combinatorics and Graph Theory	339,747	Mathematics

Funding Agency	Title	Amount	ETSU Department
National Science Foundation	Collaborative Research: RUI Tracing the Spectropolarimetric History of Circumstellar Structures from High-Mass Stars through Supernovae	616,994	Physics and Astronomy
National Science Foundation	REU Supplement Request for Tracing the Spectropolarimetric History of Circumstellar Structures from High-Mass Stars through Supernovae	9,270	Physics and Astronomy
Howard Hughes Medical Institute	Symbiosis: An Introductory Integrated Mathematics & Biology Curriculum	1,700,000	Biological Sciences
National Science Foundation	The Northeast Tennessee Robert Noyce Scholarship Program	894,066	Mathematics
National Science Foundation	RUI: Identification and characterization of cellular effectors of SABP2, its subcellular localization, and role in non-R-gene mediated disease resistance in plants	175,079	Biological Sciences
Niswonger Foundation	ETSU/Niswonger Foundation Math Initiative	243,000	Curriculum and Instruction
TN Dept of Education	Governor's School for Scientific Models and Data Analysis	119,998	CEMSE
TN Office of Aeronautics	Advanced Aerospace Education Workshop 2010	56,135	Engineering Tech., Surveying and Digital Media
TN Office of Aeronautics	Basic Aerospace Education Workshop 2010	50,967	Engineering Tech., Surveying and Digital Media
TN Dept of Education	Teacher education activities for Technology Engineering Education 2010-2011	4,616	Engineering Tech., Surveying and Digital Media
	TOTAL	8,241,941	

Table 2
Pending Funding for STEM Education Projects
East Tennessee State University
December 21, 2010

Funding Agency	Title	Total Award	ETSU Department
THEC	Reaching for Excellence in Elementary School Science	68,129	Curriculum and Instruction

Funding Agency	Title	Total Award	ETSU Department
TN Dept of Education	Governor's School for Scientific Models and Data Analysis	119,998	CEMSE
Google	Google Apps and Web-based Platforms for Pre-service Elementary Teachers	100,656	CEMSE
State Farm Insurance	Classroom in the Clouds	21,200	CEMSE
TN Office of Aeronautics	Basic Aerospace Education Workshop 2011	44,000	Engineering Tech., Surveying and Digital Media
National Science Foundation	RUI: Diameter, Total Domination, and Structure	218,947	Mathematics
Howard Hughes Medical Institute	Symbiosis II: Implementation of a Model Curriculum across Biology and Mathematics	2,199,960	Biological Sciences
National Science Foundation	RUI: Function and Structural Characterization of Secondary Product Glucosyltransferase Clones from Citrus paradisi	367,375	Biological Sciences
National Science Foundation	REU Site: Undergraduate Research in Integrative Developmental Biology	223,185	Biological Sciences
National Science Foundation	Collaborative Research RUI: Illuminating the Systematics of Star Formation in Tidal Spirals, Bridges and Tails (The SB&T Project)	367,783	Physics and Astronomy
Vanderbilt University	Student Attraction and Retention in Physics and Astronomy (SARPA) Scholarships	18,000	Physics and Astronomy
National Science Foundation	Expanding Undergraduate Research Experiences, Knowledge and Achievement (EUREKA)	192,409	Biological Sciences
THEC	Achievable Inquiry in High School Classrooms	74,877	Chemistry
	TOTAL	4,016,519	

Center of Excellence in Mathematics and Science Education donations and grants. In addition to awards processed through ETSU's Office of Research and Sponsored Programs the CEMSE has received donations and grants from several organizations and companies. The projects funded are described elsewhere in this report.

- Eastman Chemical Company
- Nuclear Fuel Services, Inc.
- NN Ball & Roller
- Morrill Motors
- Johnson City Kiwanis Club
- Tennessee Academy of Science
- Studsvik

- Wal Mart Foundation
- Jet Propulsion Laboratory

Funding for faculty research in STEM-related disciplines. Fiscal year 2011-to-date, ETSU has received external support for faculty-initiated research projects, most of which include support graduate and undergraduate students, totaling \$2.8 million (Table 3). An additional \$3.5 million in funding is pending (Table 4). NOTE: These tables do not include funding for STEM-related research in units not covered by this report, such as ETSU's Departments of Psychology and Exercise and Sport Science and its Colleges of Clinical and Rehabilitative Health Sciences, Medicine, Nursing, Pharmacy and Public Health. We would be pleased to provide this information upon request.

Active Funding for Research in STEM Disciplines
East Tennessee State University
December 21, 2010

Funding Agency	Title	Total Award	ETSU Department
National Science Foundation	Collaborative Research: Global Change and the Terrestrial Paleoclimate Record from Eastern North America: 600,000 years BP to Present	\$136,411	Geosciences
TN Valley Authority	Modeling of containment transport on the Beaver Creek Drainage of Boone Reservoir	30,000	Geosciences
National Science Foundation	Effects of Environmental Cues and Informal and Official Warnings on Behavioral Responses to Tsunamis...	458,513	Geosciences
Vanderbilt University	Monitoring Post-AGB Stars for Variability	24,191	Physics and Astronomy
National Aeronautics and Space Administration	The Fastest Stellar Winds as New Sources of Hard X-rays	35,800	Physics and Astronomy
National Aeronautics and Space Administration	X-rays from Magnetically Confined Hot Plasma in Tau Sco	20,926	Physics and Astronomy
Eureka Scientific Institute	A Study of Wind Clumps and Bow Shock Structures in Hot Star Winds	60,289	Physics and Astronomy
National Science Foundation	Enhancing and Enlarging the Scientific Impact of the SARA Consortium	382,144	Physics and Astronomy
National Aeronautics and Space Administration	Exploring Connections Between Magnetism and X-ray Emission in Massive Stars	65,143	Physics and Astronomy
National Aeronautics and Space Administration	Wolf-Rayet 1: A Study of X-ray Production from a Structured and Massive Wind	38,477	Physics and Astronomy
Johns Hopkins University	Chemical Approaches to DNA Topoisomerase Inhibition and Function	7,000	Chemistry

Funding Agency	Title	Total Award	ETSU Department
National Science Foundation	Virtual Ecology: An Inquiry-based Online Learning Environment	198,532	Biological Sciences
National Science Foundation	Exploring the Neogene Plant Record of Global Vegetational and Climatic Changes in Eastern North America	421,657	Biological Sciences
Jet Propulsion Laboratory, CA Institute of Technology	An Interferometric Snapshot Survey to Constrain Mass-Loss Dynamics and Physics in AGB Stars	21,293	Physics and Astronomy
American Conifer Society	Conifers: Biogeographic Relationships and Selections	2,400	Biological Sciences
National Park Service	Ice Age Natural History and Test Excavations in the Western Grand Canyon	32,983	Biological Sciences
US Dept of Agriculture	Time memory control of honey bee foraging behavior	183,000	Biological Sciences
University of Rochester	Solid State Radiation Chemistry of DNA	42,631	Physics and Astronomy
Jet Propulsion Laboratory, CA Institute of Technology	Mid-Infrared Imaging of the Taffy Colliding Galaxy Pairs	13,890	Physics and Astronomy
Jet Propulsion Laboratory, CA Institute of Technology	SAINTS: Star Formation & the ISM in Nearby Tidal Streams	36,440	Physics and Astronomy
Smithsonian Astrophysical Observatory	ChInGeS: The Chandra Interacting Galaxies Survey	72,000	Physics and Astronomy
National Science Foundation	Galaxy Wars: Star Formation and Stellar Populations in Interacting Galaxies	15,000	Physics and Astronomy
National Science Foundation	Evolution of Placental Calcium Transport in Reptiles-Request for a REU Supplement	6,000	Biological Sciences
American Chemical Society Petroleum Research Fund	Studies of Charge Transfer Across the Interface between a Small Aqueous Phase (<1femto liter) and a Bulk Organic Phase	50,000	Chemistry
East Tennessee State University Research Foundation	Highly efficient adsorbents for post-combustion CO2 capture	12,731	Chemistry
National Science Foundation	Systematic Sampling of the Gray Fossil Site Vertebrates: A Unique Mio-Pliocene Fauna from the Southern Appalachians	\$425,256	Geosciences
	TOTAL	\$2,792,707	

Pending Funding for Research in STEM Disciplines
 East Tennessee State University
 December 21, 2010

Funding Agency	Title	Total Award	ETSU Department
National Aeronautics and Space Administration	Unraveling the Mysteries of the Leo Ring: An Absorption Line Study of an Unusual Gas Cloud	9,640	Physics and Astronomy
THEC	Building Dual Enrollment and Advanced Placement Capacity in Upper East Tennessee	74,950	Mathematics
National Oceanic and Atmospheric Administration	Incorporating Social Science into NOAA's Tsunami Program	500,000	Geosciences
Vanderbilt University	Synoptic Observations of Variable Stars in the Northern and Southern Hemispheres: Visible Light Photometry and Polarimetry	4,037	Physics and Astronomy
National Aeronautics and Space Administration	X-ray Study of tau Sco-like Stars	TBD	Physics and Astronomy
National Aeronautics and Space Administration	Understanding the weak winds: High-resolution Chandra spectroscopy of mu Col	TBD	Physics and Astronomy
National Aeronautics and Space Administration	The rotation powered magnetospheres of HR7355 and HD142184	TBD	Physics and Astronomy
National Aeronautics and Space Administration	X-rays at the latest stage of a massive star's life: A thorough study of the Wolf-Rayet star WR6 with XMM-Newton	TBD	Physics and Astronomy
Canada France Hawaii Telescope	The magnetic topology of tau sco analogues	TBD	Physics and Astronomy
European Southern Observatory	Search for magnetic fields in the most-evolved massive stars	TBD	Physics and Astronomy
European Southern Observatory	Massive stars as cosmic engines	TBD	Physics and Astronomy
National Aeronautics and Space Administration	Why evolved massive single stars create x-rays: Analysis of XMM observations of WR6	7,789	Physics and Astronomy
National Science Foundation	Stellar Polarimetry: From Birth to Death	22,190	Physics and Astronomy
National Institutes of Health	Molecular Recognition of cytosines Towards Epigenetic Study-R15	417,769	Chemistry
Cracker Barrel Foundation	Documenting and Communicating the Flora of Rocky Fork, TN	4,600	Biological Sciences

Funding Agency	Title	Total Award	ETSU Department
TN Wildlife Resources Agency	Exotic control and hemlock preservation in the Rocky Fork Tract	5,970	Biological Sciences
National Aeronautics and Space Administration	Mercury remediation feasibility study by understanding its source, transport and speciation in Holston River Watershed	148,174	Geosciences
National Aeronautics and Space Administration	The 4.5 Micron Excess from Dwarf Galaxies: The Role of Morphology, Interactions, and Metallicity	89,426	Physics and Astronomy
National Aeronautics and Space Administration	The Ultraviolet Arp Atlas: A GALEX Legacy	TBD	Physics and Astronomy
National Aeronautics and Space Administration	Deep UV Imaging of Hi-Rich Tidal Features in Interacting Galaxies	TBD	Physics and Astronomy
National Aeronautics and Space Administration	The Archaeology of Interactions: Jewels within the crown as signposts of sustained star formation	TBD	Physics and Astronomy
National Aeronautics and Space Administration	The 4.5 Micron Excess from Dwarf Galaxies -- Spitzer program	TBD	Physics and Astronomy
National Aeronautics and Space Administration	Quantifying and Interpreting Star Formation Enhancements in Interacting Galaxies	TBD	Physics and Astronomy
National Aeronautics and Space Administration	The 4.5 micron Excess from Dwarf Galaxies—ADA program	46,072	Physics and Astronomy
National Aeronautics and Space Administration	Spirals, Bridges, and Tails: The Herschel View of Dust in Interacting Galaxies	TBD	Physics and Astronomy
National Aeronautics and Space Administration	Rapid Galaxy Evolution in Galaxy Groups: Interstellar Matter in the Transitional System NGC 4410-Herschel	TBD	Physics and Astronomy
National Science Foundation	Collaborative Research RUI: A multi-wavelength study of star formation in evolving tidal structures	341,376	Physics and Astronomy
National Science Foundation	Calcium transport by extraembryonic membranes of squamate reptiles: Modeling the embryonic response to variation in uterine calcium secretion	445,522	Biological Sciences
Environmental Protection Agency	Novel functionalized materials for reducing greenhouse gases emissions from fossil fuels	8,500	Chemistry
American Chemical Society Petroleum Research Fund	Enantioselective hydrogenation of prochiral imines and ketones on immobilized metallocenes	50,000	Chemistry

Funding Agency	Title	Total Award	ETSU Department
National Science Foundation	Use of 3D scanning and printing technology for specimen reproduction and cataloging: A case study	625,761	Geosciences
National Institutes of Health	Forgiveness and Alcohol Outcome: Direct, Indirect, and Intervention Effects-R15	346,274	Psychology
National Institutes of Health	Genomics of Dietary Restriction in Drosophila	178,750	Biological Sciences
Michigan State University	Dimensions: Collaborative Research: Lake Baikal responses to global change: The role of genetic, functional and taxonomic diversity in the plankton	154,632	Biological Sciences
National Institutes of Health	Genomics of Lifespan Extension by Dietary Restriction in Drosophila-R15	321,750	Biological Sciences
Oak Ridge Associated Universities	Scorpionate Zinc(II) Complexes Modeling Active Sites of Metalloenzymes	5,000	Chemistry
	TOTAL	\$3,808,182	

(6) K-12 Partnerships Related to STEM

The following activities illustrate ETSU's many partnerships with K-12 STEM educators in surrounding communities, the state and nation. Many items cited previously in this report, such as the ETSU and General Shale Brick Natural History Museum, the Governor's School in Scientific Models and Data Analysis, the Department of Computer and Information Sciences' PASTA Project and the Upper East Tennessee Science Fair, also provide outreach to K-12 students and educators.

Science First! This \$3 million project funded by the National Science Foundation Division of Graduate Education's GK-12 Program is a collaboration between ETSU's College of Arts and Sciences and the Johnson City, Tennessee, Schools. The grant provides stipends for graduate students in mathematics, biology, chemistry and paleontology who spend up to 15 hours per week at North Side Elementary School of Math, Science and Technology working with teachers and students in pre-kindergarten through 5th grades. The project's aims are to improve the graduate fellows' communication skills and broadly prepare them for professional and scientific careers in the 21st century. The fellows prepare and deliver lessons and hands-on activities and bring aspects of their graduate research into the elementary classroom. They are also constructing on-line resource centers that will remain with the school after the conclusion of the grant in 2013.

ETSU/Eastman Scholars Mathletes Program. The ETSU/Eastman Scholars Mathletes project builds on a strong partnership among the university, Eastman Chemical Company, and school districts in Bristol City, Hawkins County, Johnson City, Kingsport City, Rogersville City, Sullivan County and Washington County (all of which participate in Eastman's *Putting Children First* (PCF) initiative.) The project addresses increasingly challenging state math standards by increasing teacher content and pedagogical knowledge, providing training on standards-based resources and materials, thereby increasing the number of highly-qualified mathematics teachers. The project consists of summer and academic year components. The summer component trains 65 to 70 elementary and middle school math teachers

(grades 3-9), during a 10-day institute on ETSU's Johnson City campus, followed by ongoing professional development for each participant during the academic year. Now entering its fifth year, the project currently has more than 150 alumni. Math coordinators in the participating school districts provide ongoing support for teachers by visiting them throughout the academic year, presenting in-service sessions and serving as resources for the teacher participants. An important part of follow-up visits is observing teachers to confirm pedagogical practices and ensure lessons are aligned to state math standards. The specific components of the project address the Tennessee curriculum math standards, National Council of Teachers of Mathematics (NCTM) Focal Points, needs of local partnerships and school improvement plans. Eastman Chemical Company has committed \$1 million to this effort over a five-year period.

ETSU/Niswonger Foundation *Reaching for Excellence in Math Partnership*. This project builds strong ties among the university and school districts in the western portion of the First Tennessee Congressional District, most of them rural, low-income and low achieving. Now in its third year, the project provides math teachers (grades 4-9) opportunities to learn advanced math content and standards-based teaching strategies, thereby increasing student achievement and reducing math achievement gaps in elementary and middle school. The project has been implemented in the Carter County, Cocke County, Greene County, Greeneville City and Jefferson County school districts. To date, more than 90 teachers have participated. In contrast to grade-level mastery objectives, which are endpoints for learning, the Niswonger math project focuses on instruction that gives students a foundation for increasing their understanding as they encounter more challenging mathematics at the high school level. The project is supported by ETSU with funding from the Niswonger Foundation (\$243,000 over three years).

Alternative energy projects at David Crockett High School. With support from a GEAR UP (“Gaining Early Awareness and Readiness for Undergraduate Programs”) grant and local business, ETSU’s Department of Engineering Technology, Surveying and Digital Media has engaged students at David Crockett High School in several alternative energy projects on the school’s 72-acre campus, including the following:

- student-built outdoor classroom, featuring solar-powered audiovisual systems;
- outdoor greenhouse, with solar- and wind-powered instrumentation and control systems;
- solar-powered, student-built campus radio station;
- solar-powered outdoor kiosk with remote wildlife cameras, partially built by students.

Middle School Math and Science Scholars Program. In summer 2010 faculty in the Departments of Biological Sciences, Chemistry, Physics and Astronomy, Computer and Information Sciences, and Mathematics and Statistics, the CEMSE, and 15 local school districts conducted the first annual Middle School Math and Science Scholars Program on ETSU’s Johnson City campus. The program exposed academically able students (rising 6th, 7th, 8th, and 9th graders) to current developments and research in STEM fields. Students engaged in the inquiry process by asking questions, describing objects and events, testing their ideas, and communicating what they learned with scientific posters. The curriculum provided an interdisciplinary learning environment that strengthened the students’ ability to solve problems and fostered the excitement of discovery through scientific research. The program will become an annual event.

Franklin Math Bowl. The Franklin Math Bowl competition for middle school students is held on ETSU’s Johnson City campus annually in early November. Hundreds of students representing schools from throughout Northeast Tennessee participate. The competition consists of an individual test and a team

problem solving test. The Bowl has four contests: 6th grade, 7th grade, regular 8th grade, and 8th grade algebra I. Individual and school awards are given in each contest, usually split between large and small school divisions if sufficient numbers of students are registered. The Franklin Math Bowl is co-sponsored by ETSU's Department of Mathematics and Statistics and the Upper East Tennessee Council of Teachers.

CEMSE project management team. The CEMSE's Project Management Team (PMT) includes K-12 math and science teachers, curriculum supervisors, science coordinators, principals, ETSU faculty, business and industry, and CEMSE staff. Through its quarterly meetings the PMT identifies the needs of the math and science community, permitting the CEMSE to provide a wide array of services, technical support and resources to K-16 educators.

Recognition of outstanding STEM educators in Tennessee. In partnership with the Tennessee Academy of Science, the CEMSE annually identifies an outstanding science teacher in each of Tennessee's three regions and presents each with a plaque and an award of \$100 at the Annual meeting of the Tennessee Junior Academy of Science. Each fall the center identifies a distinguished secondary science teacher in the state and presents a plaque and \$500 award to that individual at the Annual meeting of the Tennessee Academy of Science.

Dual enrollment STEM courses. ETSU's Department of Mathematics and Statistics offers dual enrollment courses on site in the Carter County schools, Johnson City schools and Elizabethton schools.

(7) Other STEM Activities

STEM education publications. ETSU faculty participate in the national conversation on STEM education through their books, articles and conference presentations. For instance, well over half of ETSU's Biological Sciences faculty publish papers on STEM pedagogy in educational journals, averaging 10-15 publications per year.

CEMSE publications. The Center of Excellence in Math and Science Education edits *Science Educator*, a nationally refereed publication of the National Science Education Leadership Association, and edits and publishes the *Tennessee Junior Academy of Science Handbook and Proceedings*. The CEMSE has edited six books published by the National Science Teachers Association:

Rhoton, J. (2010). *Science Education Leadership: Best Practices for the New Century*, ed. National Science Teachers Association, Arlington, VA: NSTA Press.

Rhoton, J. & Shane P. (2005). *Teaching Science in the 21st Century* (Eds.). Co-published by the National Science Teachers Association and the National Science Education Leadership Association. NSTA Press: Arlington, VA.

Rhoton, J. & Bowers, P. (2003). *Science Teacher Retention: Mentoring and Renewal*. Co-published by National Science Teachers Associations and the National Science Education Leadership Association, NSTA Press: Arlington, VA.

Rhoton, J. & Bowers, P. (2001). *Professional Development Planning and Design*. Co-published by National Science Teachers Association and National Science Education Leadership Association, NSTA Press: Arlington, VA.

Rhoton, J. & Bowers, P. (2001). *Professional Development Leadership and the Diverse Learner*. Co-published by the National Science Teachers Association and National Science Education Leadership Association, NSTA Press: Arlington, VA.

Rhoton, J. & Bower, P. (1998). *Issues in Science Education*. Co-published by the National Science Teachers Association and the National Science Education Leadership Association, NSTA Press: Arlington, VA.

Publications related to the Symbiosis curricular project. ETSU's Symbiosis project, a ground-breaking curriculum that integrates science and math education, is beginning to yield numerous contributions to the scholarship of teaching and learning. Recent publications include the following:

- Depelteau, A.M., K.H. Joplin, A. Govett, H. A. Miller, III, & E. Seier. (2010). SYMBIOSIS: Development, Implementation, and Assessment of a Model Curriculum across Biology and Mathematics at the Introductory Level. *CBE Life Sciences Education*, 9:342–347
- Depelteau, A.M., K.H. Joplin, H.A. Miller, III, A. Govett, M. Helfgott, E. Seier, T.C. Jones, D. Kumar, & J.R. Knisley. (In Press). SYMBIOSIS II: Implementation of a Model Curriculum Across Biology and Mathematics at the Freshman Level. *CBE-Life Sciences Education*.
- Marsteller, P., L. de Phillips, A. Findley, K. Joplin, J. Pelesko, K. Nelson, K. Thompson, D. Usher, & J. Watkins. (In Press). Toward Integration: From Quantitative Biology to MathBio-BioMath? *CBE-Life Sciences Education*.
- Joplin K.H., A. Depelteau, H.A. Miller, III, M. Helfgott, E. Seier, T.C. Jones, D. Kumar, & J.R. Knisley. (Submitted). The SYMBIOSIS Experience: From Flies and Bees to Introductory Math/Biology Curriculum. *CBE-Life Sciences Education*.