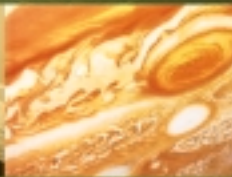




Thinking Science

North Carolina Science,
Mathematics, and Technology
Education Center
Annual Report 2004





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The North Carolina Science, Mathematics, and Technology Education Center was launched in 2002 to promote and support innovation in science, mathematics, and technology learning in the state’s elementary and secondary schools. We’re doing that by serving as a catalyst for innovation and change in education; advocating for research-based instructional programs in schools; providing tools, learning methods, and technical help to educators; and recruiting community and business leaders to encourage and promote advanced science and mathematics learning at all ages.





Samuel H. Houston Jr., Ed.D.
President and CEO

From the President

North Carolina has a wealth of scientific resources and knowledge that is at the heart of our state's economy. A trip through the Research Triangle Park, with its collection of dedicated scientists and hard-working entrepreneurs, or a visit to one of the research universities, where the best and brightest are training, can be exhilarating and enlightening.

Our state already ranks among the top five biotechnology regions in the country, is one of the top five telecommunications centers in the world, and has more than twice the national average of technology-intensive jobs.

The state's high-tech industries continue to express their desire to see more North Carolinians participate in this hot segment of the economy. And yet, despite North Carolina's wealth of resources, education in mathematics and the sciences has failed to live up to its potential, and our students—who should be tomorrow's RTP scientists and graduate school researchers—are falling behind at a time when business and industry need them to pull ahead.

This concern isn't new. Ten years ago, the Public School Forum of North Carolina surveyed the status of science and mathematics education in the state and issued a report alerting us to the

urgent need for better science and mathematics education. North Carolina has made some progress in boosting science education during the past decade but still has a long way to go. Fortunately, the Public School Forum's alert has been moved to the top of the state's agenda

The Burroughs Wellcome Fund, with its connections to top scientists across the country and commitment to supporting young scientists, launched the North Carolina Science, Mathematics, and Technology Education Center in 2002. Our mission is to systematically improve performance in science, mathematics, and technology pre K-12 education so that all N.C. students will have the necessary knowledge and skills in science, mathematics, and technology to have successful careers, be good citizens, and advance the economy of the state.

And we're doing just that, through collaborations with other education reform organizations and private funding agencies, and with the guidance of a 22-member board of directors comprising state leaders in education, business, and government. Our goal is to help North Carolina achieve its vision of having the best public schools in the nation by 2010—by advancing science, mathematics, and technology pre K-12 education.

From the President

The following strategies form the core of the Center's mission:

- To articulate a vision for science, mathematics, and technology education in North Carolina, to broaden awareness of the need for a scientifically literate workforce, and to solicit support for high quality programs of instruction;
- To work with government, industry, the education community, and parents to promote continuously improving levels of performance in science, mathematics, and technology by all children in pre K-12; and to advocate for equitable and adequate resources for all pre K-12 children;
- To mobilize expertise and leverage resources to reach all pre K-12 children in each of North Carolina's 117 school systems, and to foster comprehensive and challenging programs of instruction in science, mathematics, and technology by distributing tools and learning methods and providing technical assistance to educational leaders (including principals and teachers); and
- To work with existing organizations, such as the N.C. Institute for Education Policymakers, to research, develop, and disseminate information on the state of science, mathematics, and technology pre K-12 education to policymakers and the media in order to improve decision-making and to identify gaps that need to be addressed.

One of our key efforts involves a partnership with the New Schools Project, a statewide plan to create small and innovative secondary academies. The Project is funded with \$11 million from the Bill and Melinda Gates Foundation, as well as matching funds from a host of state and private sources. The SMT Center supports a project at Scotland High School in Laurinburg to transform the 1,800-student school into six schools-within-a-school. Students there will soon be spending more time with a core of teachers as they focus on one of six career-oriented subject areas, such as health sciences or mathematics, science, and technology. See a profile of that effort on page 9.

But teachers also need training in the sciences, so we created the Teacher Link Program (TLP) to find new ways to link scientists and teachers, and to make new efforts to reform the way those teachers engage their students in the sciences. The scientists, known as TLP Fellows, serve as mentors in helping teachers make the transition to curriculum units that allow for better hands-on learning for young students. Inquiry-based science puts students in the role of scientists. The well-researched teaching technique eases classroom management, levels the playing field between advantaged and disadvantaged students, and offers ample opportunity for developing writing skills, as well as mathematics. It is documented that language arts end-of-grade test scores also improve with inquiry-based science learning. Through a partnership with Duke University, Sigma Xi, and the National Science Foundation, TLP Fellows

are currently reaching teachers in Chatham, Harnett, Iredell, Statesville, Orange, Alamance, and Burlington school systems.

The federal No Child Left Behind legislation requires states to assess students' knowledge of science content in elementary and secondary schools. To assist the state with this task, this past year TLP Fellows worked with the North Carolina Department of Public Instruction to revise the state's science curriculum and supporting documents. Teachers and scientists worked alongside policymakers in the same room to reach consensus on such subjects as biology and chemistry. Having the TLP Fellows be a part of this decision-making process will benefit our children. A profile of one of our Teacher Link Fellows begins on page 7.

We're also building the SMT Center website (www.ncsmt.org) into a comprehensive and informative online resource. We want it to be a destination for all teachers and parents who seek new and exciting ways to make science and mathematics relevant to students. One of the SMT Center's first objectives for our website was to provide a comprehensive list of science, mathematics, and technology programs across the state.

To accomplish this task, the Center worked with the Research Triangle Institute to conduct an inventory of such programs in North Carolina. The inventory is now on our website and available to parents, teachers, and students. Last year, we had more than 64,000 visitors to the site, and we plan to continue growing the site to serve the state's future SMT needs.

In the coming year, we will continue to spread our message about the urgent need for innovation in science, mathematics, and technology education, and we will continue to reach out to scientists, teachers, students, and community members who want to work together for better education in North Carolina. To carry the message from community to community, we have enlisted the help of community and business leaders who have been trained to talk about the SMT Center and its mission and have been given printed materials to distribute to gatherings across the state. You can read more about our community "Think Science" advocates program on page 6.

Together, we can achieve great things.

Samuel H. Houston Jr., Ed.D.

Programmatic Framework

The SMT Center's Board of Directors worked diligently to craft a work plan for the first year of this organization. Board member Dr. Jerry Boarman, of the North Carolina School of Science and Mathematics, chaired the program committee that held countless meetings and telephone conferences to draft the following three key strategies that have guided our work.

- Educate the public on the importance of SMT education for all children
- Build the capacity of teachers in SMT education
- Recognize successful schools for their efforts in SMT education

Our programs support these strategies, as well as the work of those who are committed to improving the way science, mathematics, and technology are taught and learned in North Carolina.

Think Science Advocates

The strength of the American labor force will depend on our capacity to produce a steady supply of young people well prepared in science, mathematics, and technology. As technology continues to transform the way we work, we recognize that our students must become more globally competitive, and we know that in order to improve the educational system, we need the help and support of all members of the community. To spread this message to all parts of the state, the SMT Center has recruited volunteers from business, nonprofits, and the higher education communities to serve as advocates who will spearhead the "Think Science" effort.

The more we speak out, the more we can prompt North Carolinians to think about the importance of science in their lives. The National Science Board reported that the U.S. science, engineering, and technology workforce has grown at more than four times the rate of total employment, in large part because of the country's ability to integrate large numbers of foreign-born scientists and engineers into the labor force. Since 9/11,

however, this supply of human capital is declining, so we must grow our own young scientists.

Think Science Advocates are trained and equipped to speak to communities about the need for better science and mathematics education. Each Advocate gets a black messenger's bag filled with informational packets (a series of pages with relevant statistics, SMT program outlines, and key educational innovation messages) and a DVD that explains how important it is for children to be comfortable asking questions and exploring the answers.

Advocates are asked to give a minimum of four presentations a year to business groups, policy makers, and other community leaders and continue to work across the state, spreading the Think Science message.

We're still looking for leaders to serve as Advocates. If you'd like to join this group of committed citizens or would like to recommend someone, please call the SMT Center at (919) 991-5111.

Are Our Students Prepared?

- Only 32 percent of 8th grade students in North Carolina were proficient in mathematics.
- Only 35 percent of N.C. high school students took chemistry, physics, or advanced sciences.
- More than 50 percent of U.S. students in the 12th grade do not take any science at all.



Teacher Link Program

Dr. Amy Sims Mentors Teachers and Engages Students From Elementary to Middle School

In the laboratory, Amy Sims, Ph.D., is hot on the trail of SARS, the deadly viral infection that burst onto the world scene in 2003. As a post-doctoral researcher at the University of North Carolina at Chapel Hill lab of coronavirus expert Ralph Baric, she assists researchers around the world in searching for ways to stop SARS from reappearing.

If new infectious agents like SARS are as frightening as the experts warn, then we want Sims to stay in the lab.

But Sims also has an important role in the classroom, where she's a role model to elementary school students and a mentor to their teachers. Sims volunteers as a Teacher Link Program Fellow. Since teachers typically don't have time to reach out to the professional community, TLP brings top professionals like Sims to the teachers. Educational research published by the American Association for the Advancement of Science, the National Research Council, National Science Foundation, and other organizations has shown that students learn best when they can practice science by asking and then investigating their own questions.

TLP is a collaborative program to improve K-8 science education by connecting scientists with teachers and helping those teachers get more hands-on science in their classrooms. Together with Duke University's Teachers and Scientists Collaborating (TASC) program and Sigma Xi, TLP is providing intensive teacher training, an inquiry-based curriculum, and scientist support for teachers. Duke University received a \$5.3 million grant from the National Science Foundation that made this program a reality.



Using a "creature" of her own design, Dr. Amy Sims challenges her students' powers of observation.

TLP Fellows include scientists, mathematicians, and engineers. Each Fellow receives two days of training in the nationally approved curriculum units, as well as a small stipend to assist with travel to schools in low wealth areas of the state. Fellows and teachers communicate primarily through telephone and email. The SMT Center is finding, however, that once paired with teachers, TLP Fellows are making personal visits to classrooms and attending social gatherings throughout the school year.

"I'm lucky to have been able to get a great education," says Sims, "especially coming from a small town in Alabama. And now I'm glad to have the chance to give something back to the community."

She does that by sharing her enthusiasm and passion for science—mentoring teachers and visiting with students in Harnett County, where she helps kindergarteners with the wood and paper curriculum, third graders with the human body unit, and seventh graders with the more involved human body systems unit.

"I started working in a basic science lab at the beginning of my sophomore year in college, and that was the first time I was expected to do an experiment and integrate not only what information

I was getting from there but information from other sources,” she says. Graduate school, where she had to devise experiments never done before, was more challenging.

“How wonderful it would have been if I had been taught to do that from the kindergarten level,” Sims says.

Sims requested Harnett County, she says, because it’s one of the smaller, more rural counties in the state. “These students don’t have parents who work in Research Triangle Park or in university settings. It was more important to me to be able to interact with them, because where I’m from, science is not cool.”

As a young girl, Sims says, she liked science and playing with bugs—to the horror of her mother. Along the way, she recalls, many teachers advised her against science, but she also had supportive teachers.

“What really appeals to me about the Teacher Link Program is being able to go to the classroom and say, ‘Hey, look, anyone can be a scientist. It’s fun.’”

When Sims makes classroom visits, she takes along an animal creature of her own design, which has the head of an elephant, the body of a caterpillar, and the feet and tail of a pig. This new species of creature presents an exercise in observation that helps prepare students for the hands-on experimentation of the new units. What can you tell me about it, Sims asks, and what can’t you?

“One of the things we’re trying to stress is asking questions about something,” Sims relates. Students are encouraged to keep a lab journal where they can record their observations.

Constance Matthews, a third grade teacher at Highland Elementary School a dozen miles south of Sanford, tells her 23 students to make predictions

in their journals, such as what might happen to a seed when it’s planted. Matthews divided her classroom space into different centers where the students, working in small groups, could have hands-on exposure to the soils unit activities.

Once she was done with the soils curriculum, Matthews returned it to TASC, which refills the kit with new supplies and sends it on to a new classroom. Between the holiday breaks, Matthews was trying to get the most of the human body unit, with its chicken bone props for learning about joints and hinges, before she needed to send that on.

“Kids don’t sit still,” she says. “They move around a lot and need to keep active.” She says the active learning promoted by TLP and TASC is more effective than having kids get the knowledge from a book alone. Of course, active kids in a small space have consequences. “My classroom is noisier,” says Matthews.

Matthews met Sims at a TASC training session early in the school year and asked her to address all the third graders at Highland School. The students enjoyed Sims’ visit, says Matthews. “They went home and told their parents about the scientist who came to visit,” she says.

When her students stumped her with questions about whether West Nile virus can be killed with antibiotics, Matthews wrote to Sims, whom she knows is an expert in viruses. Sims was happy to help (antibiotics are used to treat bacteria, not viruses).

“I completely and utterly respect teachers,” says Sims. “Here are people who have the grand job of teaching the youth of the country. If I can help them, I feel I should.” When teachers and scientists like Matthews and Sims connect, students benefit.



New Schools Project

Scotland County High School: Breaking Down the Whole Into Greater Parts

At the head of the driveway leading to Scotland High School in a small town called Laurinburg, school administrators have erected a billboard that identifies the “S.A.T. word of the week,” and as students were preparing for their semester exams in early December, the word for that week was “intrepid.”

That seems an appropriate adjective to describe the teachers, administrators, and students there, for the entire school is courageously remaking itself. Scotland High School is in the process of transforming a giant school—there are 1800 students and 150 teachers and staff—into six schools-within-a-school, smaller and more focused academies that will train students for the careers of the 21st century.

The smaller schools will emerge in stages. The health sciences academy is already up and running, and the engineering and skilled trades academy will begin in 2005. In 2006, a mathematics, science, and technology academy and a business and finance academy will open. Academies for leadership and community service and arts and communication follow in 2007.

Scotland High’s reform effort is sponsored by the SMT Center as part of the New Schools Project. The New Schools Project has begun awarding grants to create up to 100 new small high schools across the state to serve as models of academically



rigorous curricula that prepare all students for college and work.

Scotland High School principal Roger Edwards says such training is especially needed in Scotland County, which has been challenged by closing industries and a high youth poverty rate. But Laurinburg does have a full service hospital with a collection of specialist physicians, a nearby community college, and businesses willing to let high school students be interns. The partnerships the school is building with the community will be essential to strengthening the move to the smaller academies, says Edwards.

Laura Horne, project coordinator for the effort, says that the transition to smaller learning communities, while challenging, has already brought benefits. During the initial planning phase, the faculty met to brainstorm about new ways to approach education. Further discussions by the teachers outlined a number of concerns to be overcome, says Principal Edwards. “But none of those concerns were student issues. They’re all

adult issues.” The only things standing in the way of better education for students, it seemed, were the fears of their elders.

But Scotland High soldiered on—they are the fighting Scots, after all. Now that the transformation is underway, each teacher serves on one of 11 committees charged with finding solutions to various challenges. “Teachers that don’t necessarily interact are interacting,” says Horne.

At first, school officials thought they could have incoming students begin in one of the smaller academies, but then they worried that the middle schools weren’t preparing 8th graders for such a new and different experience. “Many 9th graders fall behind in their studies and get poor grades, because they’re not used to the intensity and independence of high school,” says Edwards.

The solution is a 9th grade academy, in which the 580 freshmen are divided into four groups. Each group is assigned teachers from the range of subjects 9th graders must take. “Normally, an English teacher might interact with a student only in English class, and not outside of that class,” says Horne. In a core group of teachers that have regular interaction, the English teacher can share any concerns or observations about a student with the mathematics teacher or the science teacher.

Teachers who know more about their students can also help steer students to subjects and fields

in which they might excel. This blurs the traditional distinction between teachers and school guidance counselors, says Horne, who most recently was special populations guidance counselor. Still, it should lead to students who perform better in their studies and know where those studies will take them.

In the 10th grade, then, students will get to choose their small learning community and will spend the next three years taking classes centered on that area, while still fulfilling common graduation requirements.

The engineering academy won’t get started until fall 2005, but already students studying the skilled trades can take advantage of a lab filled with high-tech equipment, including a robotic arm and a computer-run lathe. That lab fills the space once used as a weight training room, which was moved to a new fitness center a couple of years ago.

Edwards and Horne expect more shifting and growing as Scotland High molts into its new form. The building may or may not grow, but the teachers and students definitely will.

The project, says Edwards, won’t be as efficient and effective in the beginning as when all six academies are up and running and everyone’s had a chance to adjust to the innovations. But if you look beyond the moment, he says, the potential impacts are inspiring.



Financial Position

North Carolina Science Mathematics and Technology Education Center trial balance as of the end of the fiscal year 2004*

	June 30, 2004	
	Debit	Credit
Checking account	\$40,658.34	
Grants receivable	16,062.50	
Program services payable		10,000.00
Unrestricted (retained earnings)		15,497.83
Earned revenues: interest-savings/short-term investment		13.77
Earned revenues: miscellaneous revenue		10,000.00
Earned revenues: program service fees		25,000.00
Grant income		25,000.00
Grant Income: permanently restricted		37,986.00
Grant and contract expense: contracts – program related	10,000.00	
Grant and contract expense: grants to other organizations	1,000.00	
Miscellaneous expenses:	1,586.00	
New Schools Project	5,276.41	
New Schools Project: catering deposits	4,975.00	
Other personnel expenses: professional fees	1,600.00	
Teacher Link Program: computer services	3,587.50	
Teacher Link Program: stipend/honorarium	20,500.00	
Travel and meetings expenses	1,296.43	
Travel and meetings expenses: conference, convention, meeting	16,955.42	
	<u>\$123,497.60</u>	<u>\$123,497.60</u>

*North Carolina Science, Mathematics, and Technology Education Center is supported in part by the Burroughs Wellcome Fund. Several expenses not reflected on this trial balance were paid by the Burroughs Wellcome Fund. For a copy of the Burroughs Wellcome Fund's audited financial statements, please refer to www.bwffund.org.

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