

Science Center Partnership: Outreach to Students and Teachers

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A university, medical school, and science center along with numerous K-12 public schools, university departments, local businesses, funded grant projects, and federal, state and private grants all work in concert to produce a unique partnership focusing on outreach to public school teachers and students. This article shares the history, work, vision, and future expectations of this partnership and proposes this model as one which can be replicated elsewhere.

The ultimate goal of the public school system is to prepare its students for the future. Whether that future is attending a four-year college or pursuing a career in industry, school-university partnerships can help in achieving this goal. These partnerships allow for alignment among agencies that are all working towards similar interests (Bullough, Birrell, Young, Clark, Erickson, Earle, Campbell, Hansen, and Egan, 1999). A key component of this form of collaboration is that together the agencies can overcome some obstacle or challenge that the individual agencies could not accomplish independently (Corrigan, 2000). Both the school and the university receive benefits from a partnership (Thorkildsen and Stein, 1996). Many university faculty and business/industry leaders have the expertise and the means that many classroom teachers lack, while classroom teachers have the capability and the audience with which to incorporate these assets. Through outreach and partnerships, university faculty members are able to administer procedures they have found beneficial to a wider audience (Russell and Flynn, 2000) as well as practices that require further research. The students involved in partnerships will also reap the rewards from such collaboration. Outreach programs aimed at low-performing, minority or at-risk groups can help close the gap between these groups and others in their retention in and entrance into post-secondary education (Loza, 2003; Martin, 1999).

While most agree that school-university partnerships have countless benefits, others caution that pitfalls that may be encountered along the way. Corrigan (2000) pointed out

that collaboration should not be expected to produce immediate successes due to the time it takes to build a faithful relationship between entities. Russell and Flynn (2000) suggested that effective collaborations could be described by the following: (a) the collaborations are sustainable; (b) all agencies have an optimistic outlook; (c) all partners are given a uniform voice and vote; and (d) common goals are achieved more efficiently through the partnership than individually. Along with these characteristics, Thorkildsen and Stein (1996) add that partner commitment to participation, time, outside support for the program, distribution of information, and the presence of continuous assessment were also characteristics of successful collaborations. In essence, dynamic partnerships are characterized by all participants recognizing their symbiotic relationships within the partnership.

This article describes the development of a successful school-university partnership between the East Carolina University Department of Mathematics and Science Education and K-12 schools in Greenville, NC.

Greenville is a small city with a population of 63,000 located in eastern North Carolina. It boasts a vibrant business community and is consistently ranked among the top places nationally in which to live, work, study and play. It is home to East Carolina University (ECU) and Pitt County Memorial Hospital, a member of University Health Systems of Eastern North Carolina and the teaching hospital for the ECU School of Nursing and Brody School of Medicine.

For nearly a century, East Carolina University has served the people of North Carolina and the nation. From modest beginnings as a teacher training school, ECU has grown to become an emerging, national research university with an enrollment of nearly 22,000. With a mission of teaching, research, and service, East Carolina University is a dynamic institution connecting people and ideas, finding solutions to problems, and seeking to meet the challenges of today and the future.

In 1938, the Science Education Department at ECU achieved the distinction as the first college department in which all members held their doctorate degree. By 1967, East Carolina University was designated a regional university. As an administrative unit within the College of Arts and Sciences, the Department of Science Education actively served the needs of the citizens of eastern North Carolina. Within a few years, faculty had catapulted the Department to an elite status in science education in the Southeast, rivaled only by the Florida State University. To sustain their professional growth, members of the

Department led the movement to establish the North Carolina Science Teachers Association. In January 1991, the Department of Science Education became a member of the College of Education. Since joining forces with faculty in the College of Education, science education faculty have played key roles in bringing current reform initiatives to eastern North Carolina public schools. Today's science education faculty in the Department of Mathematics and Science Education continue the long, proud tradition, which began more than three decades ago, of serving the science education needs of the teachers and public school students of eastern North Carolina through teaching, research, and service.

In order to more easily understand the current and future state of the partnerships developing in Greenville, NC, the following diagram is provided. It will assist the reader through the organizational structure of the project and the volume of acronyms needed to efficiently describe the number of constituent entities affiliated within the entire endeavor.

The Big Picture



The Present: Outreach

Although the Eastern North Carolina Regional Science Center (ENCRSC) does not have a physical setting at this time, many of the goals of the center are being met by faculty in the Department of Mathematics and Science Education and the Center for Science, Mathematics, and Technology Education (CSMTE). There are thirty-three rural school districts in eastern North Carolina which are served by the faculty of the Science Education Program and CSMTE. A rural district is defined as a low wealth district which has over 50% of the student population receiving free or reduced lunches. The majority of these districts have traditionally had agriculture as their main income base. Many of these districts have seen a major decline in farming, with no other type of business to provide new income in the districts. Department faculty members serve these districts as members of education teams that provide professional development and by serving as mentors to district faculty. Among these education teams are those specifically focused on science education. Approximately ten regional counties are participating in two programs offered by the ENCRSC: the North Carolina Infrastructure for Science Education (NC-ISE) program and the North Carolina Partnership for Improving Mathematics and Science (NC-PIMS) grant. Both programs provide professional development and classroom support for teachers in the school systems. University faculty members have conducted professional development workshops in these counties for three years. The workshops are held within each county at local schools. Some counties also provide tuition support for their teachers to take graduate classes in the Science Education Online Master's program to become highly qualified teachers in science. East Carolina University faculty members teach most of the courses offered to elementary and middle school teachers through the program.

Departmental faculty members also visit classrooms to assist or to model teaching science topics using an inquiry science approach. Some work with multiple elementary teachers and in multiple schools each semester. In these classroom lessons, university faculty members teach a portion of a grade level content goal through inquiry science. They continue to work with the teachers in their own classrooms to assist them in planning their own inquiry lessons and activities to use with their students.

Some departmental faculty members also work with local school systems science coordinators to choose and align curriculum and plan professional development workshops to address the needs of the respective teachers. The Science Education Program at East Carolina University has also aligned its courses to focus on science education reform, inquiry instruction, and teacher reflection. This program alignment has assisted many teachers with whom departmental faculty work in their progress toward National Board Certification.

Faculty within the Department of Math and Science Education also provide outreach in the area of astronomy education. This includes taking a Starlab portable planetarium to local schools and presenting information regarding constellations, Moon Phasing, the solar system, and other areas of observational astronomy tied to the North Carolina Standard Course of Study. Over thirty school visits and public presentations have been given on current NASA missions such as the Mars Exploration Rovers and Cassini Mission to Saturn each year for the past two years. Public observing sessions are also conducted four to six times per year, giving children and adults the opportunity to look through a variety of telescopes and experience the beauty and wonders of the night sky. Additional public presentations on special events such as Lunar Eclipses and the Transit of Venus have also been presented by faculty members on an on-going basis. Plans to expand outreach in medical sciences are planned for the near future.

The Center for Science, Mathematics, and Technology Education (CSMTE) has long been an integral part of mathematics and science education at East Carolina University. Through collaborations with university departments, business and industry, and schools, the CSMTE translates the findings of educational research into practices that benefit students and teachers. The CSMTE began operations in 1984 as part of the North Carolina Math and Science Education Network. The NC-MSEN consists of eleven centers located at four-year universities around the state and at the North Carolina School of Math and Science. These centers provide either outreach programs to in-service teachers, pre-college programs for students, and research and development opportunities in mathematics and science education.

At ECU, the CSMTE provides professional development to mathematics and science teachers in 29 districts in eastern North Carolina. The mission of the CSMTE, as charged by the UNC General Assembly in 1984, is to increase the pool of students who graduate from North Carolina high schools prepared to pursue careers requiring mathematics and science by improving the quality of science and mathematics education through professional development programs and the recruitment and retention of teachers. Although not having a pre-college program, the CSMTE also works closely with the Summer Ventures in Math and Science Program, Legislature School, Science Olympiad, and the Regional Science and Math Fairs. Only a small portion of the CSMTE budget is appropriated through state funds. The majority of the operating budget is via external grants.

The types of programs offered through the CSMTE reflect the needs of our constituent school systems, many of which have limited resources. Recent programs have included field studies in science, courses for the preparation of teachers who are teaching the new fourth year mathematics course, programs in the use of educational technology, AP institutes, renewal and retention initiatives,

and distance education courses in oceanography and K-12 school mathematics and science content. The CSMTE maintains an equipment base of laptop computers, digital cameras, etc. for loans to area school systems. The CSMTE also assists classroom teachers who are either seeking National Board Certification or who need assistance with classroom activities regarding math, science, or technology applications. To assist these teachers the CSMTE provides videotaping, equipment loans, portfolio development assistance, and classroom visitations. Each year the CSMTE has a direct impact on several hundred teachers in eastern North Carolina through professional development, equipment loans, and professional assistance.

Professional development for teachers is important for several reasons. One is that teachers are life-long learners, not only for certification requirements, but more importantly for expanding their own knowledge. Teachers in relationships with university faculty and the CSMTE are kept up to date with pedagogy, content, and research. The old saying that "anyone can teach" and "teachers are born to teach" has come under attack through research studies showing that teacher knowledge of subject matter, student learning and development, and teaching methods are essential for creating effective teachers (Darling-Hammond, 1998). A report by the National Commission on Teaching and America's Future (NCTAF, 1996) reiterates this observation. It reported a critical finding which stated that teacher expertise is one of the most important factors in student learning. "Teachers who know a lot about teaching and learning, and who work in environments that allow them to know students well are the critical elements of successful learning" (Darling-Hammond, 1998).

Due to the increase in gasoline prices, the growing infrastructure of high-speed Internet access, and the time demands on rural classroom teachers, the CSMTE is working to provide quality professional development utilizing distance resources such as the Internet and video conferencing technologies. The CSMTE also hopes to increase the number of refresher courses in higher-level mathematics and science it offers, courses such as Calculus, Statistics, Physics, and so on. This is in direct response to constituent requests. Technology education is also a prevalent need among the districts served by the CSMTE. Preparing teachers to prepare students to use technological tools in math and science applications is a particularly pressing professional development need.

In order to conduct these professional development programs and to provide equipment and services for teachers, funding is derived from public external grant agencies such as the Department of Education and the National Science Foundation and through private foundation donations. Securing this external funding to provide the resources needed to meet the needs of constituent teachers and schools is the responsibility of the CSMTE faculty in conjunction with the Department of Mathematics and Science Education at ECU.

The Near Future: Outreach

The Eastern North Carolina Regional Science Center (ENCRSC) is envisioned as a dynamic, state-of-the-art, teaching and research center that will serve residents and visitors in Eastern North Carolina. This facility is a separate entity governed by a board that represents the region and includes medical doctors, faculty at ECU and Pitt Community College, business leaders and community leaders. The Science Center is seen to be a key component of overall cultural, educational, and economic development in Greenville and is to enrich the community and the larger region through a variety of on-site and outreach programs. The total size of the planned Science Center will be 60,000 square feet, including 40,000 square feet of program space. The total cost for the project is estimated at \$45 million. If all goes as planned, groundbreaking will take place in early 2007 and the facility will open in early 2009.

Due to the educational diversity in eastern North Carolina, the Science Center will offer a unique mixture of pure science and popular themes. The area has a large underserved population commingled with college educated residents. Developing interactive presentations around popular themes such as sports, science, crime scene investigations, meteorology, and space in the Science Center will be essential in conveying a simultaneous sense of fun, entertainment, and education. The overarching theme will be on medicine and the biosciences given the presence of large health care and pharmaceutical companies in the region and the careers they provide, but the Science Center will also focus on the interrelationship of all sciences. The current plan is to open with a theme "From the Big Bang to Life."

A number of components will make the ENCRSC a unique attraction and educational tool for Eastern North Carolina. These components include: 1) A Planetarium/Visualization Dome, 2) Challenger Learning Center, 3) Temporary and Permanent Exhibits, 4) Weather Station, 5) East Carolina University's Center for Science, Mathematics, and Technology Education, and 6) Gift shop and Cafeteria Areas.

The Planetarium/Visualization Dome is expected to be a focal point in the new Science Center. It will be a multi-media theater dedicated to science and entertainment programming. The current plan envisions a 60' diameter dome with a maximum of 160 seats. The facility will be used to teach astronomy to students from kindergarten through university level. Additionally, the facility will provide for programming in the biological sciences, 3-D modeling for university and medical school research, and entertainment programming. These require that advanced supercomputing visualization systems be integrated into the planetarium theater.

A Challenger Learning Center is another important component in the Science Center. Challenger Learning Centers are state-of-the-art, innovative educational

simulators. They consist of a Space Station (complete with communications, medical, life, and computer science equipment), Mission Control (patterned after NASA's Johnson Space Center mission control area), and a transporter room (for transporting students from Earth to the Space Station). Programs at the Challenger Learning Centers emphasize educational content in science, cooperative learning, problem-solving, and decision-making skills. These centers often become a focal point for teachers looking to improve their teaching in the areas of science, math, and technology, and are shown to improve student scores in a variety of science areas.

A 5000-foot permanent exhibit area and a 10,000-foot temporary exhibit area will house a variety of exhibits. The permanent area will focus on medicine and life sciences and include a crime scene investigations interactive exhibit, as well as a small exhibit on the history of tobacco and related health issues in North Carolina. The permanent exhibit will be linked to the Pitt County Memorial Hospital and some of the pharmaceutical manufacturers in the region. The temporary exhibit space will be designed to accommodate large traveling exhibits and will be built to Smithsonian Exhibit Standards. Exhibits will change in this area twice each year and will cover a wide spectrum of sciences.

The Science Center has also been approached by one of the regional television stations with plans to place their broadcast weather station inside the Science Center and produce live weather broadcasts from the Science Center. They also would conduct a number of activities with students and the general public who visit the facility.

The aforementioned Center for Science, Mathematics, and Technology Education will incorporate two high tech science classrooms, a biology/medicine classroom and a chemistry/physics classroom. These classrooms will be used for teacher professional development and for a variety of student classes in K-16 education.

Ground breaking for the new facilities is set for early 2007 with opening tentatively set for 2009 to coincide with the International Astronomical Union's *Year of Astronomy*.

The Future: Outreach

As with most human endeavors, inertia is only overcome by a critical mass of resources, personnel, building space and vision. This critical mass is now congealing at East Carolina University into a dynamic structure supporting current and future enhancement of science and mathematics education in North Carolina. Now, the momentum cannot be abated and more entities continually seek to collaborate with the ENCRSC. This includes greater collaboration among various university departments in the sciences and education.

Collaborative relationships with K-12 schools in the region have been developed and continue to grow. Weekly, individual schools and school systems contact the ENCRSC through its existing components seeking science experiences

for their students and professional development for their teachers. These requests continue to increase and outreach by the ENCRSC continues to evolve.

It is envisioned that these collaborative relationships will continue to grow under the unifying theme of ever increasing outreach to the K-12 school systems in the region. As success breeds more success, the outreach of the constituent university parties to the regional K-12 schools draws more student and teacher visitation of the ENCRSC, which in turn leads to more success for the Center and then to more student success. As each new component of the entire ENCRSC comes to fruition, different avenues of service to the K-12 community respectively evolve.

With the infrastructure in place, the Science Center with its integrated planetarium and visualization dome, Challenger Learning Center, weather station, Center for Science, Mathematics, and Technology Education and gift shop and cafeteria areas, is well positioned to meet the needs of K-12 students and teacher through much of the state of North Carolina and a significant portion of the Eastern Seaboard. For the next few decades, students will have access to high quality science and mathematics exhibits, experiences, curricular materials, and instruction. Transcending static displays, the ENCRSC will provide rich experiential learning to ignite interest in, and verve for, science and mathematics. This interest will have multidimensional effects. First, students who demonstrate an interest in these curricular areas tend to perform better on standardized assessment on those topics. We envision this will affect both end of course and completion of grade testing and national standardized test results. This can open the door for more students to attend college and further their education. Second, broadening student awareness of science and mathematics and feeding students' interests in science and mathematics may demonstrate to many students that the study of science and mathematics is worthwhile for all, not just a chosen few. Finally, we envisioned that, from involvement with the ENCRSC, a greater number of K-12 students will choose to become professional scientists, mathematicians, educators or medical professionals and become employed in high tech occupations which are rapidly developing in the region.

Regional K-12 teachers will also find support through the ENCRSC. Professional development provided through the Center for Science, Mathematics, and Technology Education in conjunction with curricular resources and instructional experiences available through the ENCRSC will provide teachers with materials and experiences that they can share with their students both in class and in the ENCRSC. This will support teacher preparation to address topics that are more complex and aid their students to grow in academic proficiency in science, mathematics and technology.

The future of the ENCRSC cannot be foretold. Too many additional entities and collaborations will evolve and be forged in the future to fully predict how the ENCRSC

program will unfold. Suffice it to say that the solidity of the current and predictable infrastructure of the ENCRSC bodes well for the future of the program.

Conclusion: Cautious Invitation

The current success of the ENCRSC project also leads its participants to be able to offer advice to other institutions who may propose a similar undertaking. While we at ECU perceive the national need in the K-12 schools for additional centers which support student success in the sciences and encourage other institutions to follow our model, our encouragement is tempered by the realization that our success is built upon an infrastructure which is supported by the entire university structure and its school of medicine, local businesses, Pitt County Memorial Hospital, and private donors. From the Chancellor and deans to faculty and staff, university wide support for the ENCRSC is recognized and translates to ideas freely flowing throughout the chain of

authority. Only when this structure is in place can universities succeed with such large scale endeavors. This is evidenced by the amount of time that has been invested in the development of the ENCRSC. The vision for the center began over twenty years ago, but it has taken that amount of time to develop partnerships with other entities such as the university, local businesses and the hospital to bring in a larger population which could support the financial campaigns that must go into the building of such a center. These other entities not only supply the needed financial support, but will also provide a specialized pool of personnel to provide educational support to the museum and to the people of the surrounding rural districts. With the opening of the Eastern North Carolina Regional Science Center, additional support for the next generation of scientifically minded citizens of eastern North Carolina will be more readily available for all of the citizens of these rural districts.

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