

## **Building a Model of Collaboration Between Historically Black and Historically White Universities**

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### **Abstract**

Despite increases over the last two decades in the number of degrees awarded to students from underrepresented groups in science, technology, engineering, and mathematics (STEM) disciplines, enhancing diversity in these disciplines remains a challenge. This article describes a strategic approach to this challenge—the development of a collaborative partnership between two universities: the historically Black Elizabeth City State University and the historically White University of New Hampshire. The partnership, a type of learning organization built on three mutually agreed upon principles, strives to enhance opportunities for underrepresented students to pursue careers in the STEM disciplines. This article further describes six promising practices that framed the partnership, which resulted in the submission of nine proposals to federal agencies and the funding of four grants that led to the implementation, research, learning, and evaluation that followed.

### **Introduction**

Federal efforts to promote participation of underrepresented students in the science, technology, engineering, and mathematics (STEM) disciplines in higher education in the United States have been in effect for several decades. The Science and Engineering Equal Opportunities Act of 1980 aimed to create equal opportunity in the STEM disciplines by promoting the full use of human resources in science and engineering. Federal agency programs such as the National Science Foundation (NSF) Alliances for Broadening Participation in STEM (2009), NSF Opportunities for Enhancing Diversity in the Geosciences (2004b), and the National Aeronautics and Space Administration (NASA) Minority University Research and Education Program (2007), among many others, have helped broaden the diversity of student participation in the STEM disciplines (e.g., see reports from NSF's Committee on Equal Opportunities in Science and Engineering, <http://www.nsf.gov/od/oia/activities/ceose/>). Professional science

organizations, such as the American Geophysical Union (AGU), have also called for broadened opportunities for underrepresented students to conduct research in STEM disciplines, noting that “failure to improve diversity could have important ramifications for the economic, social, and scientific health of our fields” (*American Geophysical Union, 2002*).

However, despite increases over the last two decades in the number of undergraduate and graduate degrees in science and engineering fields awarded to underrepresented students (i.e., African Americans, Hispanic Americans, Native Americans, and Pacific Islanders), significant underrepresentation persists in these disciplines. For example, in 2004 African Americans and Hispanic Americans represented 8.8% and 7.6% of bachelor’s degree recipients in STEM disciplines, respectively (*National Science Board, 2006*); however, this is still 4 to 5 percentage points below their representation in the total U.S. population (African American 12.7%, Hispanic American 12.5% for the year 2000; *U.S. Census Bureau, 2008*). Doctoral degree attainment in these disciplines is of significantly more concern. According to this same NSF report, African Americans and Hispanic Americans represent only 4.8% and 4.5%, respectively, of the 2004 STEM doctoral degree recipients; that is, as the educational level increases, there is a decrease in the educational attainment of racial and ethnic minorities (*National Science Board, 2006*). Further, while a few notable nonprofit and educational organizations (*ACT, 2010; Coleman, Palmer, & Peabody 2004; Educational Testing Service, 2007*) continue to raise serious concerns about the nation’s growing educational disparity, it remains clear that

The U.S. continues to suffer from a longstanding underrepresentation of minorities among science, mathematics, and engineering doctorates. This untapped talent has serious consequences for the nation’s ability to compete in a world economy driven by technological advances, as well as for a large segment of the nation’s citizens who suffer loss of opportunity (*National Science Foundation, 2004a, p. 3*).

In addition, a recent report (*National Science Foundation, 2008*) concludes that although some progress has been made in broadening participation by underrepresented students in STEM disciplines, this progress has been “disappointingly modest.”

The U.S. Census Bureau (*2008*) estimates that by the year 2042, African Americans, Asian Americans, and Hispanic Americans

will compose approximately 50% of the total U.S. population. These estimates further indicate a significant decline and shift in the relative White population from about 70% in 2000 to about 40% in 2100. These demographic shifts, coupled with significant underrepresentation of some groups in the STEM disciplines, are described as two key elements of “America’s Perfect Storm” (*Educational Testing Service, 2007*). Lacking new policies and directions that alter this “perfect storm,” ETS posits that the future competitiveness of the nation is at stake. Further, to respond to what the National Academy of Sciences describes in *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future (2007)* as an urgent need to increase national competitiveness and “ensure that the United States is the premier place in the world for innovation,” it is imperative that all U.S. citizens, particularly those groups currently underrepresented in the STEM disciplines, are encouraged to pursue degrees in the STEM disciplines.

By developing a range of new strategic approaches and opportunities that attract, promote, and expand currently underrepresented student participation in the STEM disciplines, universities can enhance STEM research and scholarship. This article describes one such approach—the development of a model of collaboration between Elizabeth City State University (ECSU), a historically Black university in North Carolina, and the University of New Hampshire (UNH), a historically White university in New Hampshire. We recognize that the ECSU-UNH model is one of a number of approaches that might effectively advance opportunities to enhance the excellence and diversity of students and faculty in the STEM disciplines. What follows includes a description of (a) this partnership model and the respective institutions, (b) federal funding success and student and faculty involvement, (c) partnership principles and promising practices associated with this model, (d) evaluation results of the key federally funded programs, and (e) limitations of this particular partnership model.

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## **The Collaborative Partnership**

Elizabeth City State University and the University of New Hampshire have partnered to broaden and extend the pipeline of underrepresented students interested in pursuing careers in STEM disciplines and to support these students in their educational pursuit. The collaboration is based on three partnership principles by which demographically diverse institutions in geographically different regions of the nation collaborate to expand scientific knowledge, enhance educational opportunities, and, over time, ultimately create a more diverse workforce. This article also describes six promising practices that could guide readers interested in establishing similar partnerships.

### **Partnership Profiles**

Elizabeth City State University (ECSU) is a teaching-focused, community-engaged institution in coastal northeastern North Carolina with approximately 260 faculty members in four schools enrolling about 3,300 students. Roughly 80% of ECSU students are African American and about 15% are White. The University of New Hampshire (UNH) is a land-, sea-, and space-grant, community-engaged research institution in New Hampshire's seacoast region with approximately 900 faculty members, and an enrollment of approximately 15,000 students. Roughly 94% of UNH students are White and about 4% are underrepresented minority students. Although considerably different in size, institutional priorities, location, and racial composition of the faculty and student body, the institutions have complementary strengths in Earth system science and remote sensing. ECSU excels in undergraduate education and student mentoring, while UNH excels in research and graduate education.

Since 2002, ECSU and UNH have built the partnership by focusing on mutual benefits when submitting joint grant proposals to federal agencies, interacting with program officers in federal agencies, and engaging students in authentic, hands-on research projects. We focus further in this article on the promising practices that established and framed the collaboration, resulting in the submission of nine proposals and the award of four funded grants by federal agencies that framed subsequent implementation, research, learning, and evaluation.

### **Program Activities and Results**

Our successful collaboration has included the following activities and results.

- Nine collaborative proposals submitted to federal agencies (the National Science Foundation, National Oceanic and Atmospheric Administration, NASA, and Department of Homeland Security; Table 1) between 2004 and 2009, resulting in four grant awards totaling approximately \$5 million and directly involving more than 25 faculty members. These awards resulted in programs that included over 400 students who participated in summer authentic research experiences, summer research immersion experiences, academic year courses, and/or presentations at professional research conferences. Dozens of science and mathematics public school teachers have also participated in summer institutes and academic year collaborations with ECSU and UNH faculty.
- New and ongoing involvement of UNH faculty members at ECSU and new and ongoing ECSU faculty involvement at UNH. This includes two-way student and faculty exchange; new course development and coteaching courses on both campuses; and periodic UNH-ECSU faculty meetings, joint presentations, and positive personal interactions with one another on both campuses.
- Official federal agency recognition of the value of this collaboration as evidenced by (a) NASA hosting a signing ceremony of an official “Memorandum of Understanding” at NASA’s Goddard Space Flight Center that included university leaders, faculty, staff, students, and program officers and officials from federal agencies such as NASA, NSF, and the National Oceanic and Atmospheric Administration (NOAA) in attendance; and (b) the Office of the Director of the National Science Foundation inviting ECSU and UNH to jointly present to 30 federal agency program officers about the ECSU-UNH model to broaden participation in the STEM disciplines (*Williams & Hayden, 2009*).
- The creation of two undergraduate scholarships by UNH for ECSU students to enable them to pursue degrees in the STEM disciplines and experience a set of opportunities at both ECSU and UNH designed to prepare them for graduate education and careers in science.

- The participation of ECSU students in UNH student research and education opportunities such as the UNH Undergraduate Research Conference, UNH Research & Discover Program, and UNH and ECSU participation in undergraduate research summer programs on both campuses.
- Faculty and student joint presentations at the American Geophysical Union international conference meetings (*Hurtt, Einaudi, Moore, Salomonson, & Campbell, 2006; Mitchell, 2006; Wake, Hayden, Williams, Abrams, & Graham, 2005; Williams et al., 2009; Williams, Wake, Hayden, & Hurt, 2007*) and an invitation from NSF to jointly present at the Minority Serving Institution Technical Assistance Conference and at other presentation venues such as NASA and the IEEE International Geoscience and Remote Sensing Society Symposium.
- ECSU hiring in 2011 a recently retired UNH faculty member who has a long-term track record of external funding success, to further connect faculty at ECSU and UNH. This faculty member has had ongoing connections with ECSU faculty, students, and staff over the last eight years.
- The submission in 2011 of a collaborative proposal to NASA's Innovations in Global Climate Change Education program.

**Table 1. Status of Collaborative ECSU-UNH Submitted and Grants Awarded from 2004 to Present**

Date	Agency	Proposal Title	Status
Mar 2004	NSF	Watershed Watch	\$1 Million
July 2004	NSF	NE Alliance for Graduate Education & the Professoriate	\$650,000
Sept 2004	NASA	Next Generation-Remote Sensing Explorers	\$583,000
Oct 2004	NSF	Mentoring Students in Earth Systems Science Research	Not Funded
Apr 2005	DHS	New England Center for Emergency Preparedness	Not Funded
May 2005	NOAA	Priming the Pipeline	Not Funded
Apr 2006	NOAA	Collaborative Marine Research Center	Not Funded
May 2006	NSF	Transforming Earth System Science Education	\$3 Million
Sept 2009	NSF	Establishing a Manufacturing Bridge	Not Funded

*NSF = National Science Foundation; NASA = National Aeronautics and Space Administration; DHS = Department of Homeland Security; NOAA = National Oceanic and Atmospheric Administration*

## **Three Partnership Principles That Undergird the Partnership**

Mattessich, Murray-Close, and Monsey (2001, p.59) define a collaborative partnership as “a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals.” The relationship includes a commitment to mutual benefits and goals, a jointly developed structure and shared responsibility, mutual authority and accountability for success, and sharing resources and rewards. Gray (1989) and Briggs (2001) observe that collaborative partnerships are most successful when all members share and advance a common vision. Accordingly, from these definitions and the literature in this area, ECSU and UNH set three partnership principles that are foundational to all ECSU-UNH collaborative efforts:

1. Agree on a clearly articulated vision so that strategic goals are clear,
2. Share responsibility and authority so that each institution is accountable for success, and
3. Share financial resources based on specific work undertaken.

## **Theoretical Models that Frame the Partnership Principles and Practices**

The three partnership principles were established early in the collaboration. Over time, six promising practices also evolved. To more fully understand these practices, the authors referred to theoretical models described in the business literature, including theories about learning organizations and knowledge-generating companies (Bickel, Millet, & Nelson, 2002; Bruffee, 1993; Garvin, 1993; Leithwood, Jantzi, & Steinbach, 1999; Nonaka & Takeuchi, 1995; Preskill & Torres, 1999; Senge, 1990). Elements of these theoretical models help describe how the ECSU-UNH partnership developed, how it functions, and the nature of its challenges. Two key elements of these theoretical models are learning organizations and transformational leadership.

Teaching and student learning is a core function of universities. Faculty and administrators, however, often do not feel fully integrated into universities as a part of a broader learning community—what Senge (1990) refers to as a “learning organization.” Bickel et al. (2002) suggest that a learning organization is

“committed to inquiry, exhibits fluid information exchange across organizational boundaries (external and internal), possesses knowledge management systems that facilitate collective learning, and demonstrates strategic as well as tactical decision-making based upon what is being learned.” Key features of learning organizations are “culture, structure, practices, and leadership.”

Preskill and Torres (1999) note that high-functioning learning organizations have cultures and practices that welcome inquiry and challenge the status quo. Moreover, learning from mistakes is critical to a learning organization’s advancement.

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*“The learning organization concept can specifically help partnerships realize their promise as a community that generates new knowledge and contributes to innovation.”*

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Collaborative learning and cooperation are central to the culture, as are sharing new information across boundaries, building trust, and being open about challenges and difficulties (Bickel et al., 2002). The ECSU-UNH partnership is a learning organization that functions as a community of scholars with a shared vision and goals. The learning organization concept can specifically help partnerships realize their promise as a community that generates new

knowledge and contributes to innovation.

Transparency, trust, information sharing, and resources are critical to ongoing work, interactions, and forward momentum (Garvin, 2000) of a learning organization. Both faculty commitment and administrative leadership are required. The administrative team should include a leader who is willing, capable, and properly positioned within the institution to advance and transform a learning organization. Nonaka and Takeuchi (1995, p. 127) describe a type of transformational leader—a “middle-up-down-manager” who serves as a “catalyst-communicator-team leader” crossing boundaries between “what is and what should be.” Further, this individual provides leadership and fosters progress through collaboration and respect for all members rather than simply ordering or demanding compliance (Bickel et al., 2002).

### **Implementing the Partnership Principles: Six Promising Practices**

For the ECSU-UNH collaboration, applying the partnership principles has not always been easy. Being in an effective learning



organization, negotiating a common vision and goals, and sharing responsibility, authority and accountability, financial resources, and rewards have been challenging at times. Critically important to the success of the partnership are six promising practices that characterize this learning community. These practices were identified and agreed to by key partners from each campus. The six practices are (1) institutional commitment and faculty engagement; (2) establishing mutual respect and shared time commitment; (3) identifying an engaged leader; (4) engaging critical change agents; (5) initiating difficult dialogues; and (6) preparing for growth and evolution. These practices overlap in many ways; their synergy and integration form the basis of the ECSU-UNH partnership as described below.

## **Practice I: Institutional Commitment and Faculty Engagement**

Institutional commitment forms the foundation of the collaboration and was developed differently at each institution. Originally, ECSU and UNH partnered at the faculty-to-faculty level. After responding to invitations from UNH, ECSU science and mathematics faculty recognized that partnering with UNH science, mathematics, and engineering faculty would provide opportunities for collaborative research and education projects. This recognition formed the foundation of the initial ECSU interest and subsequent partnership. Several ECSU faculty members joined or initiated grant proposal writing efforts with UNH faculty. After participating in several face-to-face meetings with a UNH administrative leader, the provost and then dean of ECSU's School of Mathematics, Science, and Technology gave his support to the faculty. The dean also encouraged partnership proposals to further joint-funding efforts. The potential to develop a partnership that sought to enhance student support, develop new curricula, and expand research training was highly consistent with the ECSU mission and attractive to its senior administrators.

In 2002, UNH adopted an academic plan (*University of New Hampshire, 2002*) guided by a renewed sense of the institution's land-grant mission, a growing desire to be an "engaged institution," changing societal demographics, and the national imperative to advance student academic participation in the STEM disciplines. In a newly adopted plan (*University of New Hampshire, 2010*), this commitment is further explicated. Diversity became an institutional priority, exemplified by the hiring in 2005 of the first chief diversity officer. Diversity in the STEM disciplines also was established as an area of emphasis for the newly endowed (2002) Joan and

James Leitzel Center for Mathematics, Science, and Engineering Education. The partnership launched in 2002 between ECSU and UNH was an excellent way to translate UNH's commitment to diversity into reality. The UNH senior vice provost for engagement and academic outreach, working closely with key faculty members and the Leitzel Center, provided administrative leadership for UNH's participation.

Much of the day-to-day effort required for writing collaborative research and education proposals was shouldered by faculty members. The UNH faculty members, typically scientists, mathematicians, and science and mathematics educators, were attracted by the team interactions and the opportunity to partner with ECSU faculty members whose strengths lay in undergraduate education and mentoring. This integrated approach of institutional commitment and transformative leadership (*Leithwood et al., 1999*) with faculty engagement and commitment has proven invaluable, particularly given the hard work required to create, nurture, and sustain the partnership.

## **Practice 2: Mutual Respect, Mutual Benefit**

Partnerships such as the ECSU-UNH partnership take years to develop. Mutual respect and mutual benefit are fundamental to the working interactions, evolve over time, and are key characteristics of a learning organization. The partnership's potential grew because, progressively, the partners identified complementary research and education interests and strengths. For example, ECSU excels in mentoring and promoting undergraduate education and in student research in remote sensing through its Center of Excellence in Remote Sensing Education and Research. The UNH Institute for the Study of Earth, Oceans, and Space leads university efforts in externally funded research in the STEM disciplines. Further, the UNH Leitzel Center developed a strategic focus to create STEM educational partnerships subsequently and became the primary UNH home for the partnership. The initial interest in collaborating was further enhanced by a common vision for STEM education and research, which included a desire to broaden the STEM pipeline for underrepresented students (particularly African American students) by pursuing federally funded opportunities. Preskill and Torres (1999) suggest that successful learning organizations build on the intellectual strengths and potential of members.

Prior to the early proposal-writing stage of the partnership, ECSU and UNH spent 18 months exploring common interests between individual faculty members in each of the institutions. This initial period, which included multiple visits and

face-to-face interactions on both campuses, was critical. The duration and range of discussions allowed lines of communication and mutual understanding to be established before any significant financial resources were at stake, and before there was any need to complete specific grant objectives. This time of building collaborations was essential, and was instrumental to the establishment of the partnership's culture and norms, including the assumptions and beliefs about what was important, the roles and strengths of community members, and the rules by which the community would operate (Garvin, 2000). Without this inceptive investment, the solid foundation upon which the partnership now relies would not have been developed.

### **Practice 3: Identifying an Engaged Leader**

A designated administrator who provides visionary leadership, while also attending to an array of partnership details, is essential to the ECSU-UNH collaboration. In 2002, the UNH senior vice provost for engagement and academic outreach volunteered for this role. She is responsible for the University of New Hampshire's engagement and engaged scholarship mission and provides leadership for a number of faculty development academies, learning communities, and initiatives.

The critical characteristics of an individual described here as the engaged leader are similar to what Nonaka and Takeuchi (1995, p. 127) describe as the "middle-up-down-manager." They note that such an individual is a strategic leader who serves as a "bridge" and "strategic knot" that works effectively across and among top tier (e.g., provost, president, dean) and first tier (e.g., faculty, center directors) individuals. Nonaka and Takeuchi (p. 128) further describe this individual as a "catalyst," "effective communicator," and "team builder" who provides "middle-up-down" leadership while engaging others and asserting quiet authority rather than ordering change. Greenleaf (1996) characterizes servant leadership as having similar qualities, and Block (1993) similarly describes stewardship and focus on serving others. For the ECSU-UNH partnership the designated leader familiarized herself with the strengths and interests of each of the primary faculty collaborators, and worked closely with one key faculty leader on each campus to sustain and spread these leadership qualities.

### **Practice 4: Engaging Critical Change Agents**

In a successful partnership, it is important to identify and engage critical change agents who move the relationship forward. In the ECSU-UNH partnership, the critical change agents are a

highly motivated and dedicated set of faculty members and administrators from both universities. Partnerships, however, also need change agents, both internally and externally, to be successful. The ECSU-UNH partnership has benefited enormously from individuals outside the two universities who provide support and counsel. Dr. Ambrose Jearld from the National Oceanic and Atmospheric Administration; Drs. Anngienetta Johnson, Carl Person, and James Harrington from the National Aeronautics and Space Administration; and Dr. Fae Korsmo, Martha James, and Tracy Gorman from the National Science Foundation all serve as critical ECSU-UNH partnership supporters. These individuals helped elevate and support the partnership by identifying opportunities: for the university partners to jointly present and to meet with program officers at their agencies; for the partners to jointly seek funding by responding to specific requests for proposals; for presentations to other national conferences; and for enhanced connections with their deans, provosts, and presidents by coming to their campuses to discuss and learn about the partnership as it evolved.

### **Practice 5: Initiating Difficult Dialogues**

Even with genuine mutual respect and numerous successes, the ECSU-UNH administrators and faculty members had to initiate difficult dialogues—conversations that they would have preferred to avoid, but were essential to achieving success. Participants in difficult dialogues identify the problem, discuss multiple perspectives, encourage careful listening rather than defensive reaction, foster respect when disagreeing, and commit to reaching a resolution. The desire to advance the partnership, rather than simply win a disagreement, frames the most successful resolutions to difficult dialogues. Few participants enjoy these conversations, and some feel more prepared than others to initiate such discussions. Consequently, when the need arises, the person most prepared given the nature of the concern should lead the discussion, and perhaps practice how best to respectfully and honestly engage in the dialogue before the conversation takes place.

For example, for the ECSU-UNH partnership, a difficult dialogue occurred during the development of a proposal that was submitted to NASA. The primary goal for UNH faculty members was to engage large numbers of underrepresented students in the program, while for the ECSU faculty members the goal was to financially support and closely mentor a small number of students. Having an impact on the greatest number of students versus

providing financial support and close mentoring to a small number of students set the stage for competition for limited grant funds. With a foundation of trust, and what Preskill and Torres (1999) describe as culture and practices that welcome questioning and learning from mistakes, a compromise was reached that ultimately made the grant proposal stronger. Resolution of this difficult dialogue represented a watershed moment, the successful conclusion of which advanced the partnership, and resulted in a proposal that was eventually funded by NASA.

## **Practice 6: Preparing for Growth and Evolution**

Successful partnerships grow and mature over time. They are resilient when membership changes. A key to sustaining this partnership is ongoing reinforcement and strategic review of partnership principles. The ECSU-UNH partnership reinforces best practices in a number of ways. For example, we have learned that our willingness to have difficult dialogues enhances, albeit changes, both the tenor and subsequent practice of discussion when we encounter new difficult situations. Rather than starting over, our prior experiences result in a greater ease with the challenge of such conversations. Further, we have benefited greatly from the inclusion of new critical change agents over time. In the start-up phase of the partnership, the primary external change agents—who were critical supporters—were from two federal agencies, NOAA and NASA. In the last several years, however, the addition of new critical change agents at the National Science Foundation opened new doors of opportunity which led to additional interest and involvement of faculty, students, and administrators at both ECSU and UNH. Finally, because the core of this partnership has always rested on the principle of mutual respect and mutual benefit, the partnership has matured, and recently taken on a new dimension. Recently, and for the first time, a highly respected, recently retired UNH faculty member has been recruited by ECSU to serve in a consultant capacity to work with faculty on grant proposals. We anticipate that she will serve as a critical bridge between our campuses to further bridge the cultures of our respective institutions.

### **The ECSU-UNH Partnership Core Activity**

The core activity of the Elizabeth City State University–University of New Hampshire partnership is developing and implementing collaborative projects to enhance the common research and educational goals and expertise of the partner institutions. Central

to this is the preparation and submission of project proposals to federal agencies, including the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA). Teams with representatives from both institutions codevelop and submit the proposals. Between March 2004 and September 2009, collaborative efforts resulted in the submission of nine proposals to federal agencies (Table 1), four of which were funded (Table 2). Additional information and progress on each of these funded projects is available online at <http://leitzelcenter.unh.edu/programs.html>.

**Table 2. Brief Description of Each of the Four Funded Collaborative ECSU-UNH Education and Research Grants**

1. Watershed Watch: Monitoring the Merrimack and Pasquotank Drainage Basins as a STEM Undergraduate Recruitment and Retention Tool
<ul style="list-style-type: none"> <li>• URL: <a href="http://leitzelcenter.unh.edu/watershedwatch">http://leitzelcenter.unh.edu/watershedwatch</a></li> <li>• Goal: to increase STEM recruitment rates at UNH and ECSU by engaging students in authentic, hands-on research of societal-relevant scientific problems.</li> <li>• Undergraduates learn STEM disciplines via use of geospatial technologies in an integrated, multidisciplinary study of the terrestrial, aquatic, and social components of watersheds.</li> <li>• Key components: (a) an intensive, technology-rich summer research institute held for rising freshmen and (b) a one-semester course in which student research teams design and implement a research or educational outreach project.</li> </ul>
2. Inspiring the Next Generation of Earth Explorers Through Remote Sensing Studies: Remote Sensing Explorers
<ul style="list-style-type: none"> <li>• Designed to create and disseminate new curricula in Earth system science and remote sensing across multiple HBCUs via summer workshops for faculty.</li> <li>• ECSU faculty to provide models of successful student research mentoring; UNH faculty to plan, develop, and deliver the summer curriculum.</li> <li>• Originally designed to directly impact more than 1,700 students at 15 HBCUs. Unfortunately, budget reductions at NASA resulted in suspension of the last two years of this three-year grant award.</li> </ul>
3. Northeast Alliance for Graduate Education and the Professoriate
<ul style="list-style-type: none"> <li>• URL: <a href="http://www.neagep.org/">http://www.neagep.org/</a></li> <li>• Goal: to increase diversity in STEM doctoral programs via graduate student recruitment, retention, and mentoring.</li> <li>• Established recruiting program for prospective underrepresented students nationally with a particular focus on several of ECSU's partner institutions.</li> <li>• UNH faculty have learned from ECSU faculty who have expertise and proven success in mentoring African American students.</li> </ul>
4. UNH GEO-Teach: Transforming Earth System Science Education
<ul style="list-style-type: none"> <li>• URL: <a href="http://leitzelcenter.unh.edu/geo-teach">http://leitzelcenter.unh.edu/geo-teach</a></li> <li>• Partnership among UNH, ECSU, Dillard University, and Pennsylvania State University.</li> <li>• Project addresses the need for highly qualified teachers in the geosciences via transformation of geoscience education at the middle and high school levels by mentoring and networking pre-service teachers with in-service teachers and authentic Earth system science research.</li> <li>• Earth science graduate and undergraduate students participate in summer enrichment institutes with teachers and continue to build relationships with the teachers during subsequent academic years.</li> </ul>

## Evaluation of the Partnership Core Activity

To ensure ongoing programmatic success and continued commitment to the partnership vision, each funded grant proposal undergoes rigorous evaluation. Project teams commit approximately 10% of the proposal budgets to these evaluations, hiring professional external evaluators to ensure timely, targeted evaluation results and reports. External evaluators have been drawn from private companies specializing in program evaluation and assessment (RMC Research Corporation, Portsmouth, NH; Research and Learning Innovations at WestEd, Woburn, MA). The evaluation process begins with the proposal development process (needs assessment) and proceeds through program implementation (formative) until the program's end (summative).

Evaluation of three of the four grant-funded projects has occurred through a variety of methods, including pre- and post-test surveys, phone interviews, focus groups, site visits, and formal assessment instruments (Table 3).

**Table 3. Methods Used to Evaluate Projects Funded by Federal Agencies**

Project	Evaluation Method					
	Single survey	Pre/post surveys	Phone interviews	Focus groups	Site visits	Validated assessment instrument
Watershed Watch		X	X	X	X	
NEAGEP	X		TBC	TBC		
TESSE		X	X	X	X	X

*TBC: To be conducted*

In order to understand how the partnership functions, evaluators have also participated in advisory board meetings and conference calls, and conducted phone interviews with faculty and staff in key programmatic roles. The evaluators have also communicated findings regularly to the project leadership, helped to prioritize program challenges, and offered guidance to reach specific grant program goals.

The ECSU-UNH partnership and grant programs have benefited from the ongoing external evaluations. For example, evaluation feedback has led to (a) frequent and consistent partnership-wide communication through monthly conference calls during planning stages, (b) awareness of the need to explicitly define

and identify roles and responsibilities among faculty and staff, (c) understanding of qualities needed in faculty to effectively mentor undergraduate students, and (d) alternative mechanisms to successfully recruit students into programs.

Evaluation feedback has also directly affected student participants. Through surveys and interviews with students the evaluator (a) ranked the incentives important to students for their participation in summer programs (for example, ranked highest to

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lowest: meeting other student researchers, receiving college credits, conducting field research, receiving a modest stipend, receiving free tuition, designing a study to answer questions, being mentored by faculty, receiving free room and board), (b) recommended curriculum adjustments to further reduce lecture teaching and provide more time for student research projects, (c) ascertained that freshmen require skill-building with computer tools, and (d) determined

that more than two-thirds of students benefited from specific journaling exercises. Thus, through the external evaluation process, the grant project leadership learned which practices were effective and should be kept, which needed to be adjusted, and which could be discarded. As a result of the evaluation, the overall partnership has improved, at least in part because of the intentional observations, methods, and skillful interpretations of its external evaluators.

### **Limitations and Opportunities for Future Research**

Although we have specifically evaluated individual grant-funded programs and have identified measures of success to guide these programs, we have not systematically evaluated the ECSU-UNH partnership model. Our initial focus was on building and nurturing the ECSU-UNH partnership by collaboratively writing proposals, implementing the grants that were funded, and becoming acquainted with the strengths of faculty on each campus. A limitation of this study is that we did not initially develop an overall evaluation of the partnership model, but rather focused more specifically on evaluating the grant-funded programs.



We suggest to future researchers and other universities that seek to adopt the ECSU-UNH model a well-planned and executed evaluation of the partnership. Such a plan would focus longitudinally on agreed-upon goals for the partnership, systematic evaluation of progress toward these goals, and modification of the partnership goals over time as the partnership matures. Such a systematic evaluation of the partnership would have provided additional data beyond that previously described to guide others and assist our analysis of what works to help further sustain the partnership.

## **Conclusion**

Elizabeth City State University and the University of New Hampshire maintain a strategic partnership to collaborate on externally funded research and education programs and projects to expand scientific knowledge, enhance educational opportunities, and broaden participation in the STEM disciplines. The ECSU-UNH experience can serve as a model for other diverse institutions in geographically different regions of the country who seek to develop these kinds of partnerships. To date, ECSU-UNH's partnership success relies on the enthusiastic commitment of faculty and students engaged in learning and discovery; the ongoing, tangible support of administrative leaders at both institutions; and project funding from federal agencies.

The partnership is a learning organization with a cross-institutional community of scholars who jointly established partnership principles as defined by six promising practices. These practices overlap in many ways; their synergy and integration support a complex working partnership.

To date, the ECSU-UNH partnership has secured more than \$5 million in federal agency grant awards and has involved more than 25 faculty members, more than 400 students, and dozens of public school science teachers. As a relatively new learning organization, the partnership has had a positive effect on ECSU and UNH faculty and has served as a catalyst for new UNH faculty interest in recruiting STEM graduate students from underrepresented groups. The partnership also has enhanced and elevated recruitment efforts by the UNH Graduate School by catalyzing new, more diverse institutional connections. To improve the partnership, formative and summative evaluations of specific programs have occurred over time to help guide these programs. Additional plans are under way to strengthen the partnership as it continues to evolve over time.

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## References

- ACT. (2010). *Solutions for success in an evolving global market: ACT annual report September 1, 2009–August 31, 2010*. Retrieved from <http://www.act.org/aboutact/pdf/AnnualReport10.pdf>
- American Geophysical Union. (2002). *AGU diversity strategic plan*. Retrieved from [http://www.agu.org/education/diversity\\_programs/plan.shtml](http://www.agu.org/education/diversity_programs/plan.shtml)
- Bickel, W., Millett, R., & Nelson, C. (2002). *Challenges to the role of evaluation in supporting organizational learning in foundations*. Retrieved from <http://www.foundationnews.org/webextra/learningweb.htm>
- Block, P. (1993). *Stewardship: Choosing service over Self-Interest*. San Francisco, CA: Berrett-Koehler.
- Briggs, X. (2001). *The will and the way: Local partnerships, political strategy, and the well-being of America's children*. Paper presented at sixth meeting of the Urban Seminar Series on "Building Coalitions to Bring about Change," Harvard University, Cambridge, MA. Retrieved from [http://www.ksg.harvard.edu/urbanpoverty/urbsemdec2001\\_agenda.html](http://www.ksg.harvard.edu/urbanpoverty/urbsemdec2001_agenda.html)
- Bruffee, K. A. (1993). *Collaborative learning: Higher education, interdependence, and the authority of knowledge*. Baltimore, MD: Johns Hopkins University Press.
- Coleman, A., & Palmer, S. & Peabody, N. (2004). *Diversity in higher education: A strategic planning and policy manual regarding federal law in admissions, financial aid, and outreach*. The College Board. Retrieved from [http://www.collegeboard.com/prod\\_downloads/highered/ad\\_diversity\\_manual\\_2\\_ed.pdf](http://www.collegeboard.com/prod_downloads/highered/ad_diversity_manual_2_ed.pdf)
- Educational Testing Service. (2007). *America's perfect storm: Three forces changing our nation's future*. Retrieved from <http://www.ets.org/stormreport>
- Garvin, D. (1993). Building a learning organization. *Harvard Business Review*, 71, 78–91.
- Garvin, D. (2000). *Learning in action: A guide to putting the learning organization to work*. Cambridge, MA: Harvard Business School Press.
- Gray, B. (1989). *Collaborating: Finding common ground for multi-party problems*. San Francisco, CA: Jossey-Bass.
- Greenleaf, R. (1996). *On becoming a servant leader*. San Francisco, CA: Jossey-Bass.
- Hurt, G. C., Einaudi, F., Moore, B., Salomonson, V., & Campbell, J. (2006). Research & discover: A pipeline of the next generation of Earth system scientists. *Eos, Transactions, American Geophysical Union*, 87(Fall Meeting Suppl.). (Abstract ED34A-07)

- Leithwood, K., Jantzi, D., & Steinbach, R. (1999). Transformational leadership as a place to begin. In K. Leithwood, D. Jantzi, & R. Steinbach (Eds.), *Changing leadership for changing times*. (pp. 21-42). Buckingham, Great Britain: Open University Press.
- Mattessich, P. W., Murray-Close, M., & Monsey, B. R. (2001). *Collaboration: What makes it work, a review of research literature on factors influencing successful collaboration* (2nd ed.). St. Paul, MN: Amherst H. Wilder Foundation.
- Mitchell, J. (2006). Using active and passive microwave records for detecting firm characteristics in Greenland: A new indication of melt. *Eos, Transactions, American Geophysical Union*, 87(Fall Meeting Suppl.). (Abstract GC51A-0444)
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York, NY: Oxford University Press.
- National Aeronautics and Space Administration. (2007). *Minority University Research and Education Program*. Retrieved from [http://www.nasa.gov/audience/foreducators/postsecondary/features/F\\_MUREP.html](http://www.nasa.gov/audience/foreducators/postsecondary/features/F_MUREP.html)
- National Academy of Sciences. (2007). *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, DC: National Academy Press.
- National Science Board. (2006). *Science and engineering indicators 2006*. Retrieved from <http://www.nsf.gov/statistics/seind06/>
- National Science Foundation. (2004a). *Alliances for graduate education and the professoriate* (Publication No. 04-575). Arlington, VA: Author. Retrieved from <http://www.nsf.gov/pubs/2004/nsf04575/nsf04575.pdf>
- National Science Foundation. (2004b). *Opportunities for enhancing diversity in the geosciences* (Publication No. 04-590). Arlington, VA: Author. Retrieved from <http://www.nsf.gov/pubs/2004/nsf04590/nsf04590.pdf>
- National Science Foundation. (2009). *Alliances for broadening participation in STEM* (Publication No. 10-522). Arlington, VA: Author.
- National Science Foundation, Committee on Equal Opportunities in Science and Engineering. (2008). *2007-2008 biennial report to Congress*. Retrieved from [http://www.nsf.gov/od/oia/activities/ceose/reports/2008CEOSE\\_BiennialReport.pdf](http://www.nsf.gov/od/oia/activities/ceose/reports/2008CEOSE_BiennialReport.pdf)
- Preskill, H., & Torres, R. (1999). *Evaluative inquiry for learning in organizations*. Thousand Oaks, CA: Sage.
- Science and Engineering Equal Opportunities Act of 1980, 42 U.S.C. § 1885 (1980). Retrieved from <http://thomas.loc.gov/cgi-bin/bdquery/z?d096:S.568>
- Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. New York, NY: Doubleday.
- University of New Hampshire. (2002). *Academic plan for the future of the University of New Hampshire*. Retrieved from <http://www.unh.edu/academic-affairs/pdf/academicplan.pdf>
- University of New Hampshire. (2010). *The University of New Hampshire in 2020: Breaking silos, transforming lives, reimagining UNH*. Retrieved from <http://www.unh.edu/strategicplanning/>
- U.S. Census Bureau. (2008). *Population projections*. Retrieved from <http://www.census.gov/population/www/projections/2008projections.html>

- Wake, C. P., Hayden, L. B., Williams, J., Abrams, E., & Graham, K. (2005). Building a model of research and education collaboration between minority and majority universities. *Eos, Transactions, American Geophysical Union*, 86(Fall Meeting Suppl.). (Abstract ED23B-05)
- Williams, J. E., & Hayden, L. B. (2009). Leadership lessons in science, technology, engineering and mathematics partnerships. Presentation to program officers of the National Science Foundation. Office of the Director, National Science Foundation.
- Williams, J. E., Hayden, L. B., Wake, C. P., Varner, R., Graham, K., Rock, B., Hale, S., Hurtt, G., Porter, W., Blackmon, R., Bryce, J., Branch, B., & Johnson, J. (2009). Partnership opportunities in Earth system science education between historically Black and historically White institutions: Elizabeth City State University and the University of New Hampshire. *Eos, Transactions, American Geophysical Union*, 90(Fall Meeting Suppl.). (Abstract ED52A-04)
- Williams, J. E., Wake, C. P., Hayden, L. B., & Hurtt, G. (2007). Building a model of collaboration between historically Black and historically White universities. *Eos, Transactions, American Geophysical Union*, 88(Fall Meeting Suppl.). (Abstract ED31B-05)

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