



## The North Carolina Mathematics and Science Education Network Statewide Institute for Teaching Excellence

*To teach in the ways envisioned by standards reformers, teachers need strong content knowledge and the ability to change their pedagogical repertoire as well as their underlying beliefs and attitudes about it.*

Snow-Renner and Lauer 2005

In September 2005, the North Carolina Mathematics and Science Education Network (NC-MSEN) embarked on an ambitious plan to design and deliver a suite of professional development programs that would be aligned with the findings of contemporary research regarding the teaching and learning of science and mathematics, and that would directly address educational needs in these subject areas in the state of North Carolina. Each of these programs is designated as a Statewide Institute for Teaching Excellence (SITE). They are unified and guided by a set of core understandings of what constitutes best practice in professional development. This paper provides an overview of the SITE initiative including the essential understandings that form its foundations and the schedule for program development and implementation (Table 1).

### **SITE Professional Development Programs Are of Considerable Duration**

All SITE programs are of at least one week duration (30 contact hours). The SITE Science programs for grades K-8 are conducted beginning in summer and continuing in the school year (54 contact hours) and include an additional implementation project. In their synthesis of research on standards-based professional development, Snow-Renner and Lauer (2005) recognize that, "...deep changes in teacher instruction, like those required by reformers, take considerable time" (p. 6). They further state that programs should be extended in time, with time built in for practice, coaching, and follow-ups (p. 9).

### **SITE Programs Are Grounded in the Curriculum That Students Study**

The SITE professional development programs are adult-learner courses that are designed to address specific goals and objectives from the *North Carolina Standard Course of Study* (NC SCOS) for the sciences and mathematics. The NC SCOS goals and objectives that are the foci of the SITE programs have been identified as the most difficult content areas for students and teachers. This is a sound strategy in that it allows time to develop deep understanding in critical areas rather than a cursory treatment of all areas. This approach is responsive to research findings reported by the National Research Council (NRC): "Superficial coverage of all topics in a subject area must be replaced with in-depth coverage of fewer topics that allows key concepts in that discipline to be understood" (Donavan, Bransford, and Pelligrino, eds. 1999, p. 16).

### **SITE Programs Focus on Specific Instructional Strategies**

The SITE programs are informed by recent theories of how people learn. Thus, the instructional strategies employed are those that support the participants as they work to construct their understanding of the subject area concepts. Educators who participate in the SITE programs are introduced to appropriate instructional strategies by experiencing them from the perspective of the learner—pedagogy is not explicitly taught; it is embedded. Appropriate strategies are those that encompass key aspects of knowledge construction such as the drawing out of preconceptions, the exploration of ideas and phenomena through inquiry methods, and the integration of metacognitive skills (Donavan and Bransford, eds. 2005). A longitudinal analysis of data from the evaluation of the Eisenhower Professional Development Program in mathematics and science found that professional development which focuses on such higher order teaching strategies increases teachers' use of them in the classroom. Further, the study indicates that once teachers learn how to make such instructional changes, the changes are long-lasting (Snow-Renner and Lauer 2005).



**SITE Programs Are Designed for Intellectual Engagement and Active Learning**

The NRC Committee on Learning Research and Educational Practice has recognized that many approaches to teaching adults consistently violate principles for optimizing learning; they maintain that the principles of how people learn apply equally to child and adult learning (Donavan, Bransford, and Pelligrino, eds. 1999). Therefore, the SITE programs are designed to engage the adult educators who participate in them through active learning in much the same way that those educators are expected to engage their students. Although lecture plays a role in SITE professional development programs, it is a minor role. Inquiry is at the philosophical core of these programs. This is supported through sound instructional strategies such as the 5E Learning Cycle, which provides the organizing structure for learning in all of the K-8 Science programs. Concept maps are used as a means of organizing content, as well as a formative assessment tool. Participants spend a large amount of time working in small groups to explore subject area concepts through manipulative materials and hands-on methods. The discourse within these groups is frequently rich and is an essential part of the learning that takes place in SITE programs. Participants explain and clarify their understanding during whole-group discussions led by university faculty and master teachers. Individuals reflect on their personal understanding through methods such as science notebooking and the creation of implementation projects. These reflective practices strengthen participants' metacognitive skills and help them understand this essential aspect of the learning process.

The overall SITE Program comes in part as a response to needs for North Carolina's public schools as identified by the State Board of Education (SBE). The SBE is committed to ensuring that every public school student will graduate from high school, globally competitive for work and postsecondary education and prepared for life in the 21st Century. This will require extensive professional development delivered in a systemic and comprehensive manner. The call for sound professional development includes the areas of mathematics (including research-based mathematics strategies, mathematics content for elementary teachers) and science (including inquiry-based science instruction, science content for elementary teachers). The SBE asked for specific support in Biology and all mathematics courses (specifically, teaching higher mathematics to all students). The SITE Program also responds to *The UNC Tomorrow Commission's* recommendations which indicate that "UNC should improve the quantity, quality, and geographic distribution of public school teachers" [4.3.1] and "should help address the shortage of science and math teachers, especially in rural areas" [4.3.2]. The NC-MSEN professional development centers work with the Network's Central Office in the development and delivery of these and future institute programs in order to help meet these needs.

The North Carolina Mathematics and Science Education Network (NC-MSEN), a comprehensive statewide program of The University of North Carolina Center for School Leadership Development (UNC CSLD), was established by the NC General Assembly in 1984 with the mission to strengthen the quality and increase the size of the teaching base in mathematics and science education. The NC-MSEN consists of a Central Coordinating Unit at UNC CSLD in Chapel Hill; a research and evaluation center at North Carolina State University; and ten professional development centers located at Appalachian State University, East Carolina University, Fayetteville State University, North Carolina A&T State University and University of North Carolina at Greensboro (a consortium), The North Carolina School of Science and Mathematics, University of North Carolina at Chapel Hill, University of North Carolina at Charlotte, University of North Carolina Wilmington, Western Carolina University, and Winston-Salem State University. These professional development centers: (1) are geographically located so that teachers statewide will not have to travel great distances to receive high quality mathematics and science professional development, and (2) have direct access to university faculty and resources, which permit richer teacher professional development opportunities.

**Table 1. SITE Program Development and Implementation Plan**

<b>Program</b>	<b>Contact Hours</b>	<b>Curriculum Development (Draft Completion)</b>	<b>Pilot and Formative Assessment</b>	<b>Program Revisions and Evaluation (Completion Date)</b>	<b>Full Implementation and Evaluation</b>
<b>SITE: K-2 Science</b>	54	April 2008	Summer and School Year 2008-09	June 2009	Summer 2009
<b>SITE: 3-5 Science</b>	54	April 2006	Summer and School Year 2006-07	Revisions Ongoing Evaluation by June 2009	Summer 2009
<b>SITE: 6-8 Science</b>	54	June 2007	Summer and School year 2007-08	Revisions Ongoing Evaluation by June 2009	Summer 2009
<b>SITE: Biology</b>	30	April 2007	Summer 2007	Revisions Ongoing Evaluation by June 2009	Summer 2009
<b>SITE: Geometry</b>	30	June 2007	Summer and School year 2007-08	Revisions Ongoing Evaluation by June 2009	Summer 2009
<b>SITE: CARSAM (Content Area Reading in Science And Mathematics)</b>	30	April 2007	Summer 2007	Revisions by June 2008; Evaluation by June 2009	Summer 2009
<b>SITE: AFM (Advanced Functions and Modeling)</b>	30	April 2003	Summer 2003	Revisions ongoing; Initial evaluation by August 2009	Summer 2009
<b>SITE: Algebra</b>	30	Planning Stage	Planning Stage	N/A	Summer 2010
<b>SITE: Chemistry</b>	30	Planning Stage	Planning Stage	N/A	Summer 2010

**References Cited**

Donavan, S. M., Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press.

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Snow-Renner, R. and Lauer, P. A. (2005). *MCREL Insights: Professional Development Analysis*. Denver, CO: Mid-continent Research for Education and Learning.