Northwestern University’s (NU) Center for STEM Education in collaboration with the Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems, the Center for High Rate Nanomanufacturing (both at NU and UMass Lowell) and the Colleges of Engineering and Arts & Sciences, has built an RET program (RET-PLUS) that supports STEM change agents throughout partner schools. NU RET site participants are recruited from local K-12 school districts and partnering community colleges. Additional RET participants supported through various supplemants are also included in the RET-PLUS program. The participants and mentor faculty engage in collaborative inquiry through shared research experiences, strengthening the content knowledge of teachers, building understanding and professional respect, and providing opportunities for leadership and professional development for all members of the RET team.

Project Goals and Objectives

- Implement a comprehensive RET program for participants that includes engineering research and supporting professional development.
- Develop curriculum material as an effective professional development strategy and integrate research experiences into classroom instruction.
- Create a comprehensive model for K-16 STEM classroom instruction that can be replicated by other Universities and Engineering Research Centers nationwide.
- Build and support a K-16 STEM community: a dynamic partnership between RET participants, undergraduate and graduate STEM students, higher education faculty, and private industry.

Educational Goals and Learning Outcomes

Project Overview

The Greater Boston area has a wealth of universities and high technology industries. Unfortunately, it also is a region in which less than half of the students are judged to be proficient in examinations based on state standards. Even after ten years of reform, a stubborn gap persists between the scores of white and minority students. Urban children have many more under-prepared teachers, take less demanding classes, are less engaged in school, and fail in far greater numbers than their suburban counterparts. This achievement gap presents serious challenges to Massachusetts and the nation.

The Center for STEM Education in collaboration with the Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS) and the Center for High Rate Nanomanufacturing (CHN), leads the coordination of an RET site and multiple RET supplements to build and support science change agents throughout our partner schools.

The RET PLUS project provides continued support to develop leadership skills of all participants, to foster professional networking, and to hone presentation skills. All participants are encouraged and supported to share their experiences, products, and lessons learned within the region and beyond. By engaging mathematicians, scientists, engineers and educators in collaborative inquiry, we are significantly changing institutional cultures, to produce both more scientifically and technologically literate citizens, and to inspire and empower more urban students to pursue careers in STEM or STEM teaching.

Approach/Methods

Participant Recruitment, Application, and Selection

Recruitment – Applications are distributed electronically to teachers, principals, and STEM leaders throughout MA beginning in early January. A program announcement is also faxed to partnering schools/school districts (those who have signed a letter of commitment to the program). It is also sent to former participants who may be encouraged to apply again or share with colleagues.

Application – Each applicant completes a two-page application, submits a current resume, a letter of reference, and a letter from their principal committing them to 3 days of leave during the year for professional development at the NSTA Conference.

Selection – Participants are selected based upon their application responses and their interests available to labs. The number of participants may very depending upon availability of supplemental funds but usually ranges between 12 and 20.

Lab Recruitment and Selection

Laboratories are recruited beginning in January. Mentor requests are sent to partnering Research Centers, as well as new STEM faculty identified by Department Heads or current faculty mentors. Interested labs complete research assignment forms (an abstract of the project) and final lab selection is based upon the interest of the current year’s participants. Assignments and labs selected may change from year to year.

Program Model

Participants spend six weeks on campus, a bulk of that time in their respective labs. The lab activities are supplemented with lesson development discussions/practice, professional development, and optional field trips and research seminars coordinated in conjunction with the Gordon CenSSIS RET program and the Center for STEM Education’s Young Scholars Program (high school students). Tables 2 and 3 represent the results of a recent survey of participants from the 2008 RET program. Participants are required to create a lesson plan and research poster for the final presentations.

Outcomes and Broader Impact

One of the final products of this program which tends to have a broad impact is the final lab reports and papers that are created from these experiences. NU RET alumni have also assisted with Professional Development at new RET sites and often return to deliver professional development to new cohorts in the RET-PLUS program. NU’s RET program also seeks to raise awareness for the RET program nationwide, to build collaboration across funded programs, and to share lessons developed for classroom implementation.

Back in the Classroom

Lesson Development is one of the critical products created by RET-PLUS participants. Lessons serve as a way for the teachers to revitalize their curriculum and bridge the gap between real-world science and science in the classroom. Lessons at the end of the program are just a beginning for the teachers and often lead into complete units.

The Greatest Success stories and units have enhanced STEM classrooms across the state and many teachers have been asked to replicate these lessons for summer programs. They also serve as an ever-expanding resource for teachers across the city, districts, states and beyond. In the end, the hope is that the teachers who participate feel that they have improved their teaching based upon these experiences and that their classrooms have been enhanced.

Table 1 – 2008 labs, disciplines, affiliations, and participants

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<thead>
<tr>
<th>Lab Site</th>
<th>Discipline</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Boston High School</td>
<td>Physics</td>
<td>CHN</td>
</tr>
<tr>
<td>Cambridge Rindge and Latin School</td>
<td>Chemistry</td>
<td>CenSSIS</td>
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<tr>
<td>Medford High School</td>
<td>Biology</td>
<td>NU RET</td>
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This material is based upon work supported by the National Science Foundation under Grant No. 0742924.