Building Community Resilience in the K-12 Market

Northeastern

The Center for STEM Education at Northeastern University

NSF Research Experiences for Teachers at Northeastern University

The Research Experience for Teachers Program – RET

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ALERT
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Critical to the success of the K-14 enterprise … Value added for all partners… Students, teachers, university faculty and industry

Critical Components to supporting an Education Program

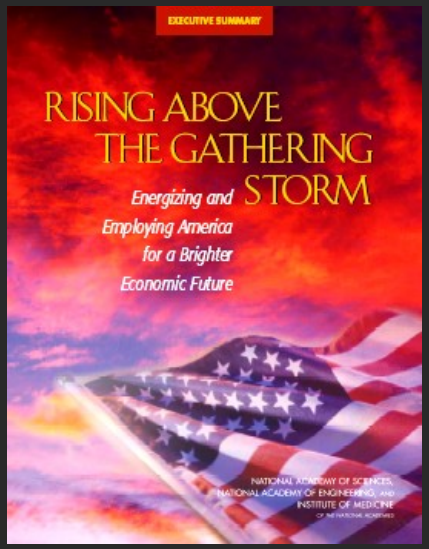
Leadership committed to education outreach

Recognition for faculty and students engaged in education outreach

Strong **partnerships** with teachers, school districts and Community Colleges

"RISING ABOVE THE GATHERING STORM"

What actions should federal policy makers take to enhance the science and technology enterprise so the United States can successfully compete in the global community of the 21st century?



TEN THOUSAND TEACHERS, TEN MILLION MINDS

Increase America's talent pool by vastly improving K-12 mathematics and science education.

Recommendations For Teachers

- **Summer Institutes**
- **Science and mathematics master's programs**
- **AP and pre-AP training**
- **K-12 curriculum materials modeled on world-class standards**

Recommendations for Students

- **Statewide specialty math/science high schools**
- **Inquiry-based learning**
- **Summer internships and research opportunities**

Creating Innovative Solutions - Application to K-14 educational efforts

Dr. Tara O'Toole – Keynote presentation

- **Deep understanding of the problem – operational reality and limitations**
- **Far reaching recognition of the universe of possible solutions**
- **Testing and Evaluation**

Innovation

- **Forming Communities of Practice**
- **Intense interaction between people with different perspectives**
- **Financial and political support**

Building Resiliency in our K-12 classrooms

- **Robustness** – strong curriculum
- **Resourcefulness** – innovative teachers, ability to teach diverse population of students
- **Recovery** – classroom intervention strategies

Why engage teachers in research?

- **Deepen content knowledge** of teachers
- Develop the **leadership and innovation skills** of teachers.
- Expand teacher's knowledge of **STEM pathways** for their students
- Introduce cutting edge **research to the K-14 classroom**
- Improve **student achievement** *
- Provide undergraduate and graduate students the opportunity to strengthen their **presentation skills**
- Build strong **partnerships** between university researchers and K-14 classrooms
- **Institutionalize these changes** so that the partnership's structure and work will be sustained.

*http://cumc.columbia.edu/news/press_releases/101609SilversteinSCIENCE.html

Goals of RET Program at NU

- Implement a comprehensive RET program that includes engineering research and supports professional development.
- Develop curriculum material as an effective professional development strategy and integrate research experiences into classroom instruction.
- Create a comprehensive model for K-14 STEM classroom support that can be replicated by other universities and research centers nationwide.
- Build and support a STEM K-16 community: a dynamic partnership between secondary teachers, undergraduate and graduate STEM students, higher education faculty and private industry.

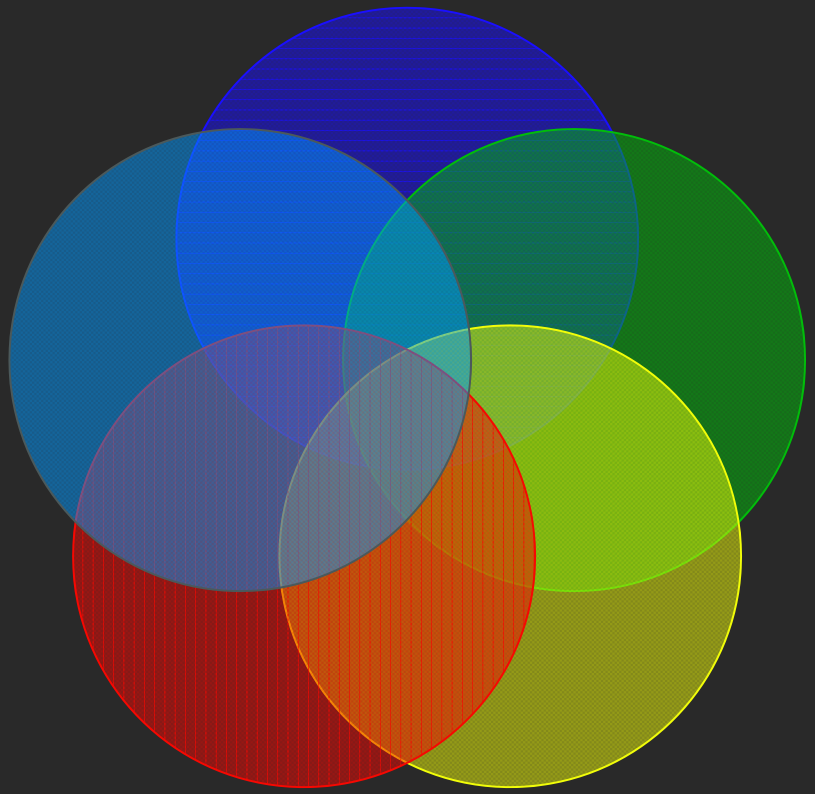
RET-PLUS Northeastern University

- **80 teachers to date** have spent their summers conducting research at Northeastern University.
- Over **7000 students**
- **32** public school districts
- spanning **six** states

Program requirements- blend of authentic research experience with supporting professional development

- Six weeks (35 hours per week) dedicated to research
- 25 hours in supporting professional development prior to and during the summer experience
- Participation in project team meetings, seminars, special training sessions, professional development meetings, field trips, RET group meetings, etc.
- Maintenance of a Laboratory Research Notebook, on-line Reflective Journal, and development of a classroom lesson and research poster

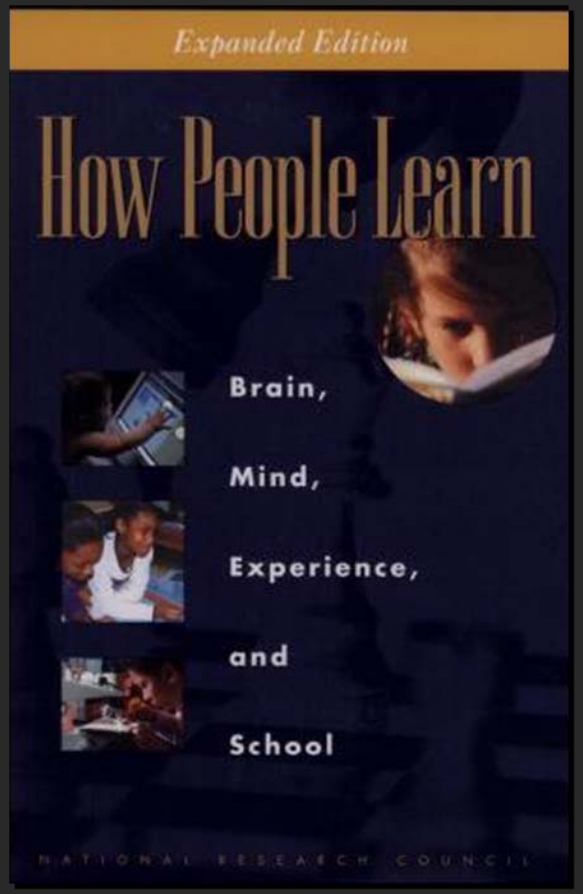
Supporting RET Professional Development



How People Learn

Research-based perspectives which are addressed in *How People Learn (1999)*:

- *Novice vs. Expert Thinking*
- *Learning and Transfer*
- *How Children Learn*
- *Mind and Brain*



How People Learn: Brain, Mind, Experience, and School. **John D. Bransford, Ann L. Brown, and Rodney R. Cocking, editors, (c) 1999**

RET - Back in the Classroom

- *"I now truly understand the importance of higher learning and the incorporation of 'real life' application."*
- *"I now place more focus on inquiry and thus my students are participating in a more question-driven curriculum."*
- *"I try to work engineering into my curriculum more often than I used to"*
- *"Personally, the program has rejuvenated me as a teacher. Although I have only been teaching for five years now, I was at a point where I was feeling bogged down by all the standardized tests and administrative "red tape" so to speak. This program has again made me realize why I love to teach. There is nothing better than being able to educate, evoke understanding, and inspire individuals."*
- *RET rekindled a love of research. Science is about solving problems that no one knows the answer to. I sometimes lose [sight of] that in all of the mess in public education.*

Responses from participants on what impact participation in the RET program had on how and what they taught.

What I took away from my experience in the NU RET program*

1) "Inquiry": promoting a scientific atmosphere for students (similar to the real world) where the answers are yet to be discovered.

2) Lab journaling: for both myself & the students. Use pen. date. time. titles. data. research. etc.

3) Professional collaboration: the "how to's" when it comes to working with colleagues: language, ideas, development, etc.

4) Several new "cool" techniques: plasma machine. hemacytometer. passages. microfluidics & more.

5) A deeper understanding: of what a life in *research* "truly" is: repetition, grants, sacrifice, reward, learning from failures, aseptic techniques, honesty, integrity...

6) Interdisciplinary connections: Knowledge is not static! Science depends on the numbers from math, as well as language, culture, history, etc.

7) Fun!: There are plenty of opportunities to make light of serious situations; a stop to smell the roses message- what's the use of all this science & technology if we don't know how to enjoy it :o)

8) Working with students (high school and college): It was an excellent preview of what my career would be like if I ever graduate from middle school education.

9) Lesson plans: This aspect of my teaching evolves daily & has been accelerated by this experience with some extremely valuable tools e.g. *backwards design & putting the "life" in life science.*

*Jason Souza, Middle School Science Teacher, Newton Public Schools, Newton, MA

Perspectives of a Community College Faculty*

- **Supporting professional development** - community college faculty are not required to have any formal education classes prior to entering the classroom
- Increased emphasis on providing more **"inquiry-based"** experiences for my students
- **Increased respect** for middle and high school teachers
- Better understanding of my **students' prior experiences**

*John Savage, Middlesex Community College

Impact on Students

- *The impact on my students is through me and how I determine how to teach my content. I now place more focus on inquiry and thus my students are participating in a more question-driven curriculum.*

- *I have a couple students this year for a second time (they did not pass the course the preceding year). They have brought to my attention that they have noticed I am "not teaching the same." I think that students are benefiting from my constant willingness to change and improve what and how I teach.*

- *I have a broadened awareness of STEM fields resulting in a better sense of required skill sets my students will need for post secondary education. This awareness helps guide my classroom planning and instruction. RET materials money has provided for instrumentation and materials my students would not otherwise have access to. These materials greatly enhance instruction and student understanding.*

Where can I get more information?

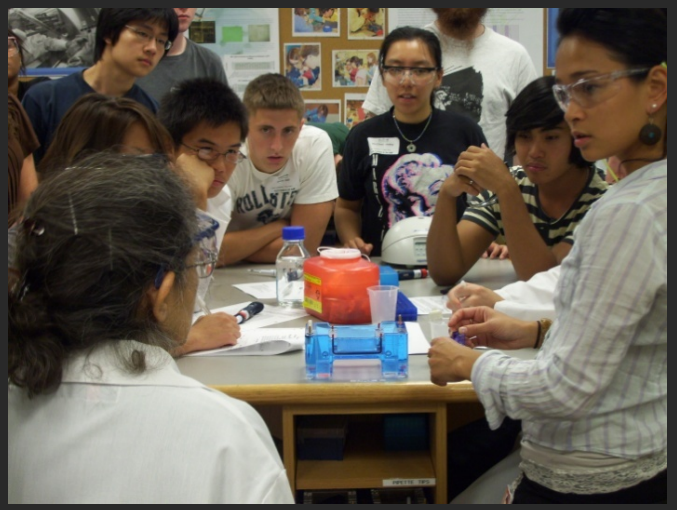
- For data that illustrates the impact of RET on student achievement
  - http://cumc.columbia.edu/news/press_releases/101609SilversteinSCIENCE.html
  - www.ScienceTeacherProgram.org
  - http://www.nsf.gov/news/news_videos.jsp?cntn_id=115775&media_id=65781&org=NSF

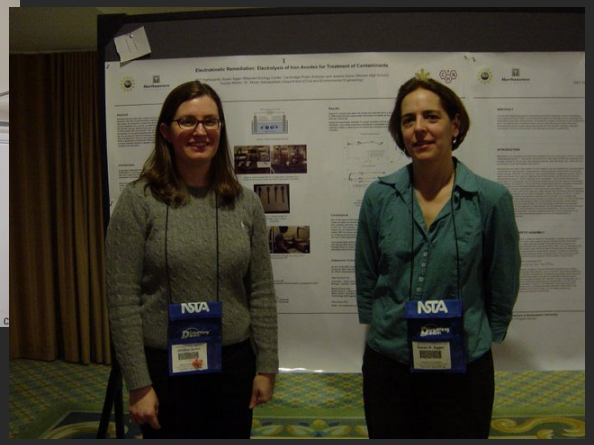
- For a list of RET experiences
  http://www.retnetwork.org/

- For books/research used
  - http://sites.google.com/site/rettoolkit/

- For lesson plan samples
- www.ScienceTeacherProgram.org
- http://sites.google.com/site/retneulessons/

ALERT Leverages Over 15 Years of NEU Experience and Innovation in K-12 Education





Centers of Excellence

- Enrich STEM curriculum by providing research opportunities for teachers and students
- Provide career awareness to the K-14 community
- Leverage their partnerships with K-14 community to expand community resilience through information, collaboration and increased preparedness