Graduate STEM Fellows in K-12 Education: Translating Complex Science for Many Audiences

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NSF Division of Graduate Education
Graduate STEM Fellows in K-12 Education

GK-12
NSF’s GK-12 Program

• Provides funding for graduate students in science, technology, engineering, and mathematics (STEM) disciplines to bring their leading research practice and findings into K-12 learning settings.

• Why?
  – to acquire skills that will broadly prepare them for professional and scientific careers
  – in addition to being competent researchers, STEM graduate students must be able to communicate science and research to a variety of audiences.

How do participants benefit?

**Graduate Students**
Communication, Leadership, Team Building

**K-12 Education**
Enhanced Teaching and Learning, Inspire Students with Role Models

**Higher Education**
Transform Graduate Programs
299 Projects at >180 Universities Funded Since 1999

But how do we do this?

Challenges:

• Broad disciplines of fellows’ work
• Different and complex dissertation topics
  (how to distill for different audiences?)
• Curriculum constraints
• Range of teacher experience, grade-levels taught
• Roles may be initially unclear
• Unfamiliar with one another’s scope of practice
Diverse projects with common goals

- First fellow cohort 2010
- Theme: Changing land use patterns and their socioeconomic, biological and health-related effects
- Partner with 3 schools
- 3rd-12th grade

- First fellow cohort 2010
- Theme: STEM dimensions of bioenergy sustainability
- Partner with 13 school districts
- K-12th grade

Are we meeting our goals?
Summary of 1st year findings –
For fellows, teachers, K-12 students

UNC Greensboro’s
GK-12 Program

Transforming Minds in a Transitioning Community
UNC Greensboro’s GK-12—
Transforming Minds in a Transitioning Community

• Focus on historical and changing land use patterns and their socioeconomic, biological and health-related effects in High Point area
• Graduate research is translated to students and teachers by addressing neighborhood and regional environmental problems through critical thinking skills

UNC Greensboro Project Stats

• 9 Resident Scientists from 3 departments (Biology, Biochem/Chem, Geography)
• 9 Partner Teachers
• 3rd-12th grade
• 3 Schools on Greenway in High Point, NC
Teams investigate biological, chemical, physical, health-related, and socioeconomic effects of changing land use patterns in the region, taking advantage of the Greenway that runs between their schools.

Topics include: soil erosion, behavior of streams, and ecological consequences of stream pollution.
Major Project Activities

• Summer Science Institute
  – just fellows for 2 weeks: focus on translating your science, skills for classroom work
  – Partner teachers join for 3 days: address how research might be integrated into classroom
• Fellows meet with leadership team 2x/month
• Workshops with teachers 2x/semester
• Fellows spend 15 hours/week on project activities including time in the classroom

W.K. Kellogg Biological Station’s
GK-12 Program

STEM Dimensions of Bioenergy Sustainability
MSU Project Stats

• 10 Fellows/year
• 10 Partner Teachers in Elementary, Middle, and High School classrooms
• 13 rural school districts in SW Michigan
• 80+ Teachers
• STEM dimensions of bioenergy sustainability

Major Project Activities

• Collaborative Schoolyard Research Network
• Week-long Summer Science Institute –
  – “grad student for a day”, inquiry based lessons at intersection of fellows’ research, project theme, and MI standards
• 4 School-year workshops
  – expand teacher content knowledge and field skills, fellow-led
• Weekly Professional Development Course
  – help fellows place their research in broader societal and global contexts, science education research
• Fellows spend 15 hours/week on project activities (10 in classrooms)
From our Proposal—

We will create a collaborative research network of schoolyard science research sites which will:

• serve as arenas for inquiry science activities,
• mimic aspects of KBS and fellows’ thesis research,
• address MI Science standards
• allow K-12 classes to develop their own research initiatives,
• facilitate cross-district research collaboration

Project Theme: STEM Dimensions of Bioenergy Sustainability
Summer 2010:
Fellows introduced Teachers to native prairie and switch grass plots treatments

GK-12 Fellow Nikhil and teacher John Edgerton check out a native prairie plot at the GLBRC.

Summer 2010:
Brainstormed with teachers to develop experimental design and questions/hypotheses to address in our research network

KBS K-12 Partnership teacher Sandy Erwin observes a switch grass plot at the GLBRC.
Can we grow our fuel and our flowers and butterflies too?

Basic experimental block:
(modeled after the GLBRC)

Our global hypothesis:
There are tradeoffs that will force compromises, but by understanding the basic ecological and social processes at play we can get good bioenergy production while sustaining biodiversity and ecosystem services at socially acceptable levels.

Fall 2010: Planted the Plots!
This map indicates the locations of our GK-12 BEST schoolyard research plots in SW Michigan.

300+ Plots in 13 Districts!

2010 School-year: designed and tested research protocols and teaching materials with students and teachers

Fall 2011: Official start to data collection!
External Evaluators Assess Project Success

Common questions include:

- In what ways have GK-12 Fellows been affected by participation in the program?
- In what ways have participating teachers been affected?
- Have their students benefited?

Tools:
1. Pre- and Post-program surveys and interviews
2. Questionnaires at workshops and Summer Science Institute
3. Observation of Fellow presentations at workshops and in classroom
4. Student surveys in classrooms

Fellows report:
increased ability to share science subject matter knowledge with partner teachers

(Rate your ability to do the following on a 5 point scale)

p=0.011*
Fellows report: increased ability to introduce inquiry activities addressing state and national science standards

Fellows report: increased ability to put their own research in broad societal and global contexts

*Significance level: p<0.05
Fellow comments agree

How has this experience benefited your graduate career?

“I like the fact that it was mandatory for us to explain our research to our students...I feel that having this knowledge will make me a better instructor.”

“It allowed me to use my research as a teaching implement which then provided me with continued interest in my work.”

How has this experience helped you to better communicate science?

“I had to convey ideas, concepts etc. in a way that I had never considered before because I had to think of others’ perspectives, prior knowledge, and needs.”

Enhanced Teaching and Learning in K-12 Settings

On a scale from 1 to 5 (1 lowest) teachers rated the following:

Working with a resident scientist (RS) increased my ability to collaborate with someone knowledgeable about the subject I teach. Mean=4.43

Working with a resident scientist promoted self-reflection about the subject I teach. Mean = 4.43

Also noted: Working with a resident scientist increased my students’ interest in science.
Teachers Report: Impacts on Students

In what way(s) do you think students benefit from fellows’ presence?

*Adds up to >100% because respondents gave >1 answer.

Contact Us

- [http://www.uncg.edu/bio/gk12/](http://www.uncg.edu/bio/gk12/)
- [http://kbsgk12project.kbs.msu.edu](http://kbsgk12project.kbs.msu.edu)

MSU GK-12 Fellow Alycia Lackey is here to answer questions

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“With these kids, if you don't talk in their language, they stop you in your tracks, I'm helping them to see that just because I'm a scientist doesn't mean I'm just babbling off big words. I try to give them different ways to approach science.”

-Kristen Perez (UNC GK-12 Fellow)