STEM Education in Rural Settings

Nebraska Center for Research on Children, Youth, Families and Schools (CYFS)

Presented at the Nebraska Summit on Math Education

December 14, 2009

Gina M. Kunz | Brad Barker | Gwen Nugent

www.cyfs.unl.edu
Mission & Goal of CYFS Related to Science, Technology, Engineering, and Mathematics (STEM) Education

Advance the conduct of high quality interdisciplinary research to promote *intellectual* development and functioning of individuals across *educational*, familial, and *community* contexts.

Support researchers to examine what works, for whom, and under what conditions across multiple contexts, including *rural*, and across multiple domains, including *STEM* education.
ONGOING PROJECTS THROUGH CYFS RELATED TO STEM EDUCATION IN RURAL SETTINGS
Featured Ongoing STEM Education Projects

UNL Mathematics & Science Professional Development Summer Technology Institute
Collaborative since 2006: Education (CYFS) & Engineering (Nebraska Transportation Center)

National Robotics in 4-H: Workforce Skills for the 21st Century
Collaborative since 2006: 4-H, CYFS, UNL Biological Systems Engineering Department and UNO College of Education
SCIENCE & MATH PROFESSIONAL DEVELOPMENT SUMMER TECHNOLOGY INSTITUTE
Collaborative Effort

Faculty (G. Kunz & G. Nugent) from the *Nebraska Center for Research on Children, Youth, Families & Schools (CYFS)* (UNL College of Education & Human Sciences) and (L. Rillet) the *Nebraska Transportation Center and the Mid-America Transportation Center* (UNL College of Engineering)

Funded, in part, by the *Nebraska Coordinating Commission for Postsecondary Education* and the *U.S. Department of Transportation*

Partners: Nebraska School Districts; Nebraska Department of Education; FutureForce Nebraska
RURAL SCHOOL PARTNERS IN NEBRASKA

- Elba Public Schools
  Middle & High School

- Gretna Public Schools
  Middle School

- Lexington Public Schools
  Middle & High School

- Louisville Public Schools
  High School

- Overton Public Schools
  High School

- Scottsbluff Public Schools
  High School
Goals of Summer Institute: PD in STEM in Rural and Non-Rural Contexts

Provide *resources* for rural and non-rural middle and high school mathematics and science teachers who:

- develop *multi-media materials* using technology as complements to curricula that address mathematics and science state standards
- use *real-life examples* from engineers who approach “problems” we face daily and develop solutions incorporating mathematics and science concepts and principles, often using technology
Purposes of Project

Increase **access** of rural schools, teachers and students to cutting edge content by “real life” scientists and engineers, who bring to life concepts that are often perceived as dull or boring.

Increase **academic achievement** of middle and high school students in math and science.

Increase **awareness** of engineering as a crucial contribution to our lives and as a career option.
### Framework for Teacher Professional Development Processes and Approaches

#### Skill Acquisition
- Content Instruction
- Pedagogical Instruction
- Teacher Collaboration
- Mentoring
- Modeling
- Practice
- Evaluation and Feedback
- Communities of Practice

#### Skill Transfer
- Coaching
- Classroom Implementation

#### Ongoing Supports
- Access to engineering and educational professionals
- Access to peer teachers
HIGH SCHOOL TEACHER SUPPORTING STUDENT LEARNING FOR BRIDGE BUILDING
MIDDLE SCHOOL TEACHER SUPPORTING STUDENT LEARNING FOR FORCE
Teacher-Developed Lesson Plans Using Real Life Examples in the Rural Context

Calculating run off from a feedlot – **Elba**

Traffic patterns of 18 wheel trucks disrupting the school day and generating alternative traffic patterns – **Lexington**

“Using Real-Time Traffic Light Video as an Invitation to Inquiry” – **Lexington/Gretna collaborative**
Benefits to Rural Teachers

Increased **knowledge and skills** in STEM

Opportunity to **develop a professional network** and interact in a meaningful way with fellow teachers, *reducing feelings of isolation*

Increased **access** to university resources and ongoing support from peer teachers

**Access** to a repository of STEM-based lessons
Positive Teacher Impacts

Increases in:

.content knowledge of various topics within engineering

.confidence in teaching mathematics and science

.more sophisticated use of technology in their classrooms
Planned Expansion of Delivery Mechanisms


Summer 2009: technology-based distance broadcast at two sites (Omaha - PKI and UNL - Lincoln)

Summer 2010: technology-based broadcast to multiple sites, including on-site rural locations
NATIONAL ROBOTICS IN 4-H: WORKFORCE SKILLS FOR THE 21ST CENTURY
PURPOSES OF THE PROJECT

Prepare youth aged 11 to 15 for the 21st century STEM workforce by providing a hands-on, “minds-on” national program focused on the use of robotics and GPS/GIS technologies.

Utilize the informal learning environments of 4-H clubs and afterschool programs to support STEM learning and to increase youth’s interest in STEM careers.
PROFESSIONAL DEVELOPMENT GOALS

Increase computer competence and general understanding of IT and computer-based technologies

Effectively communicate the basic structure inherent in mobile robots and their potential for STEM learning

Increase competence in computer programming

Develop skills in collecting geospatial data to create local geographic information systems (GIS) maps

Communicate procedures for trainers to further their skills using on-line modules and utilizing the on-line learning community
PAST TRAINING SESSIONS

Antelope County, NE
Gretna, NE
Orange City, IA
Green Bay, WI
Maui, HI

4-H Summer Staff
Gretna, NE

Extension Staff
Antelope County, NE

Iowa State Extension
Orange City, IA

University of HI Extension
Maui, HI

University of Wisconsin Extension
Green Bay, WI
INFORMAL EDUCATOR IMPACTS

Overall increase in confidence to facilitate STEM-based programs

Increase in confidence in the use of robotics and GPS/GIS tools to teach STEM concepts
Confidence using robotics and GPS/GIS is a barrier for volunteers to do activities with youth.

Positive impact on confidence can be made through hands-on, one-day workshops.
Confidence is contagious:

Once volunteers get youth started with robotics, GPS, and GIS, the youth get excited.

If the youth are engaged, adults see their learning and become more motivated themselves to continue the activity.
NATIONAL SCALING PLANS

Continue to develop training materials for face-to-face and self-paced learning.

Recruit regional trainers responsible for separate U.S. regions.

Trained educators and volunteers will run Robotics camps and clubs.
CYFS STEM Education Projects Provide Foundation for Planned STEM Education Research in the Rural Context
National Center for Research on Rural Education (R²Ed)

Housed in the Nebraska Center for Research on Children, Youth, Families and Schools (CYFS)

Directed by Dr. Susan Sheridan with

Co-Directors: Drs. Todd Glover, Gwen Nugent, Gina Kunz, and Jim Bovaird

Funded by the U.S. Department of Education’s Institute of Education Sciences (IES)
Local Partners to Support R2Ed Efforts

Buros Center for Testing
Center for Science, Mathematics and Computer Education
Central Nebraska Support Service Program
Gallup Research Center/Survey Research and Methodology Program; Bureau of Sociological Research
Great Plains Institute

Nebraska Council of School Administrators
Nebraska Department of Education
Nebraska Rural Community Schools Association
Office of Qualitative and Mixed Methods Research
University of Nebraska Rural Initiative
UNL Cooperative Extension
Goals and Activities of R²Ed Related to STEM Education in the Rural Context

**Improve** rural students’ acquisition of science knowledge and skills

**Identify and validate** a practically-relevant, research-based framework for teacher PD, including mechanisms of delivery (e.g., technology-based distance delivery) in the rural context

**Identify** effective school, teacher, and family supports needed to support the learning of rural students, with a particular focus on science instruction
Planned Research Studies

Identification of Current Professional Development Practices in Math and Science for Elementary Teachers in Rural and Non-Rural Contexts

Intervention Study for Guided Science Inquiry Instruction in the Rural Context
Contact Information

Drs. Susan Sheridan, Gwen Nugent & Gina Kunz
Nebraska Center for Research on Children, Youth, Families & Schools (CYFS)
gkunz2@unl.edu | gnugent@unl.edu | (402) 472-2448

Dr. Brad Barker
Nebraska 4H
bbarker2@unl.edu

www.cyfs.unl.edu