

National Science Foundation: Understanding and Improving ELLs' STEM Learning and Instruction

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Two Relevant Performance Goals

- **Prepare and engage a diverse STEM workforce motivated to participate at the frontiers.**

The Foundation promotes inquiry-based instructional practices and ongoing research on the process of learning and the practice of education to improve the nation's capacity to draw in and retain students in STEM fields, including **students from underrepresented groups** and institutions.

- **Enhance research infrastructure and promote data access to support researchers' and educators' capabilities and enable transformation at the frontiers.**

The Foundation aims to develop and maintain infrastructure that enhances researchers' and educators' capabilities and productivity through management that accounts for and demonstrates best practice [by] **partnering with other agencies...to make complementary investments**...and ensuring that diverse students...have access to infrastructure.

Source: NSF Strategic Plan for Fiscal Years 2011—2016



NSF Promotes and Supports High-Quality, Rigorous Research, Including Research on ELLs' STEM Education

Programs

Discovery Research K-12

Innovative Technology Experiences for Students and Teachers
Faculty Early Career Development

Challenges

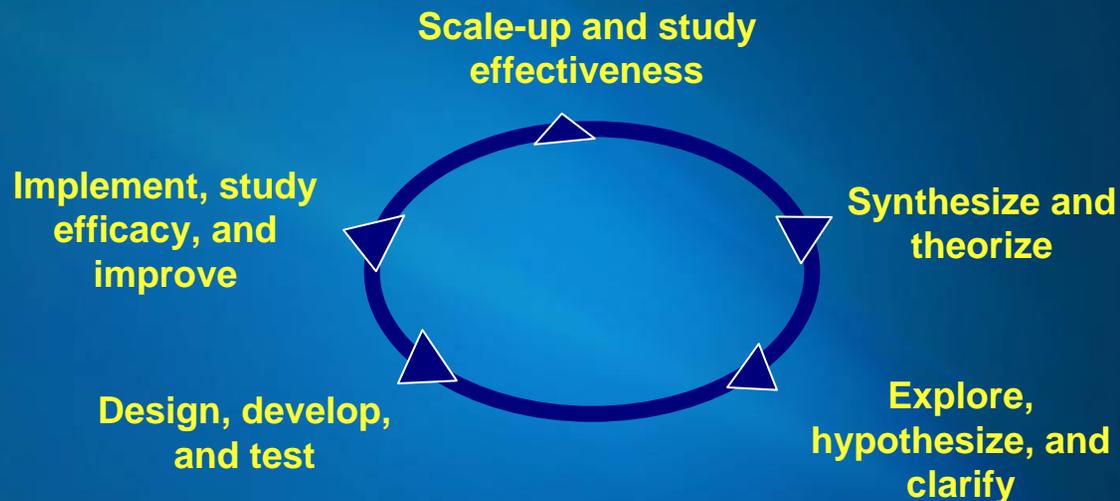
- How can **enhanced assessments** of student knowledge and skills advance pre K-12 teaching and learning?
- How can all students be assured the opportunity to **learn significant STEM content**?
- How can we **enhance the ability of teachers** to provide high-quality STEM education for **all students**?
- How are effective innovations successfully **implemented, scaled, and sustained** in schools and districts in a cost-effective manner?
- How can next-generation, cyber-enabled learning materials radically **transform students' STEM learning** experiences and enhance their abilities and interest in STEM fields?



2011 EHR's Emerging Portfolio on ELLs

32 active awards (~10% of the Discovery Research K-12 portfolio) focused on science and mathematics learning, instruction, assessment, technology, and policy with an average of 2.5 (of 5) years of implementation

Cycle of Research and Development



Major Research Topics

- Student Learning (5)
- Formative Assessment (4)
- Curriculum Development (6)
- Technology-Enhanced Instruction (5)
- Professional Development Models (9)
- Teacher Preparation Model (1)
- Scaling-Up Models (2)



2011 Preliminary Descriptive Portfolio Analysis

- The fields of ELL science and ELL mathematics education are just emerging as researchers from different backgrounds cross domains (i.e., science, math, language acquisition).
- More than half of the projects focus on middle school grades.
- Most projects target Spanish-speaking students.
- Most projects employ mixed-methods approaches and research designs.
- Almost all projects focus on improving students' science or math achievement as the key outcome.
- Most projects gather data from at least two school districts (usually Western states).



The Changing Landscape: Implications for Research

- New standards for K-12 science and mathematics education
- New knowledge from research on learning
 - *Taking science to school* (NRC, 2007)
 - *How students learn* (NRC, 2005)
- New state/federal regulations
 - *Allocating federal funds for state programs* (NRC, 2011)
- Understanding STEM
 - *Successful K-12 STEM education* (NRC, 2011)
 - Potential value of integrated STEM education (in preparation, NRC, 2013)

A View to the Immediate Future

The complexity of the national challenge demands closer inter-agency collaborations for research and development in order to:

- Develop a shared conceptual framework
- Synthesize findings from collective portfolios
- Articulate a common and coherent STEM research agenda
- Define mechanisms to advance knowledge and practice

