



# NSF Core Research and Development in Support of Broadening Participation

2012 Joint Annual Meeting  
*Broadening Participation Research*

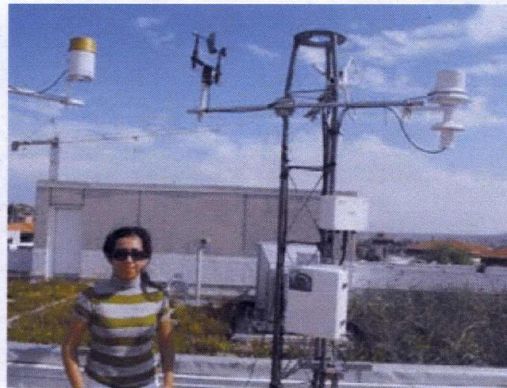
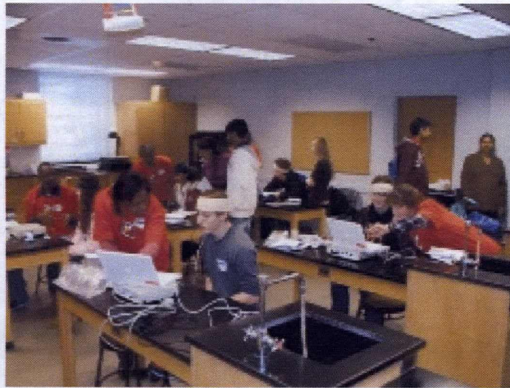
Joan Ferrini-Mundy  
Assistant Director, NSF  
Directorate for Education and Human Resources (EHR)  
June 13, 2012





*The asset of unprecedented  
diversity of learners*

# Broadening participation investments lead to innovation in science.

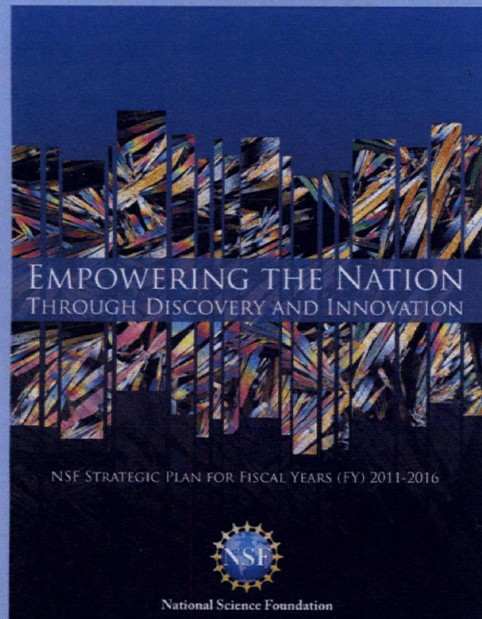


Since 1987, NSF has invested more than \$370 million in 68 Centers of Research Excellence in Science and Technology (CREST) and 31 Historically Black Colleges and Universities Research Infrastructure for Science and Engineering (HBCU-RISE) awards. Results include patents, commercial partnerships, and product development in such key sectors as nanotechnology, environment, and biotechnology.

“The scientific community benefits from diversity. Innovation, creativity, and novel discoveries are accelerated by a diversity of ideas and perspectives. While the scientific method provides a crucible for testing and validating these ideas, a diverse research community with many perspectives affords a rich environment for new theories and hypotheses.”

Schultz, P.W., et al. (2011). Patching the pipeline: Reducing educational disparities in the sciences through minority training programs. *Educational Evaluation and Policy Analysis*, 33 (1).

# Broadening Participation is a Core NSF Value



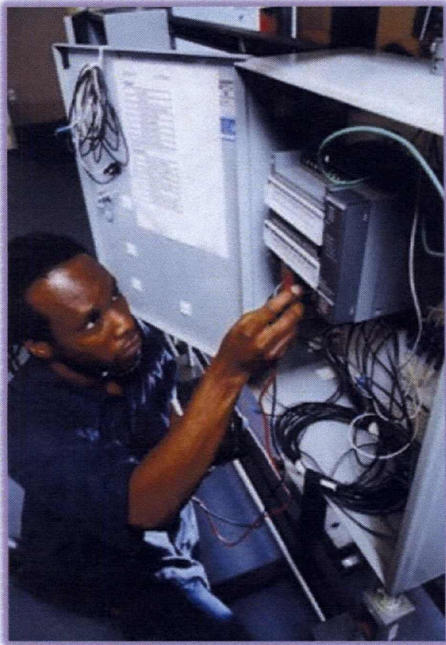
“NSF is broadly inclusive—seeking and including contributions from all sources while reaching out, especially to groups that are underrepresented, serving scientists, engineers, educators, students, and the public across the nation, and exploring opportunities for partnerships, both nationally and internationally.”

# Division of Human Resource Development

“HRD's fundamental mission of broadening participation in STEM is embedded in the greater EHR and NSF goals. A basic premise of all HRD programs is that increasing the successful participation of individuals from historically underrepresented groups in STEM will result in a diverse, highly capable STEM workforce that can lead innovation and sustain U. S. competitiveness in the science and engineering enterprise.”

# Division of Human Resource Development

“Therefore, HRD has an overall goal to increase the successful participation of underrepresented minorities, women and girls, and persons with disabilities in STEM. This is done through the implementation and testing of evidence-based practices, critical review of program results to assess impact, data-driven continuous improvement, and broad dissemination of program findings for wide adoption or scale-up of effective strategies.”



*Urgent challenges*



Table 3-25  
**Racial/ethnic distribution of individuals in S&E occupations, S&E degree holders, college graduates, and U.S. residents: 2008**  
 (Percent)

Race/ethnicity	S&E occupations	S&E degree holders	College degree holders	Total U.S. residential population
<b>S&amp;E occupations</b>				
Asian	16.9	11.2	8.5	4.7
American Indian/Alaska Native	0.3	0.4	0.3	0.7
Black	3.9	5.5	7.2	11.7
Hispanic	4.9	5.6	6.2	13.9
White	71.8	75.2	76.5	67.6
Native Hawaiian/Other Pacific Islander	0.4	0.4	0.1	0.1
Two or more races	1.7	1.7	1.1	1.2

SOURCES: Census Bureau, American Community Survey (2008); National Science Foundation, National Center for Science and Engineering Statistics, Scientists and Engineers Statistical Data System (SESTAT) (2008), <http://sestat.nsf.gov>.

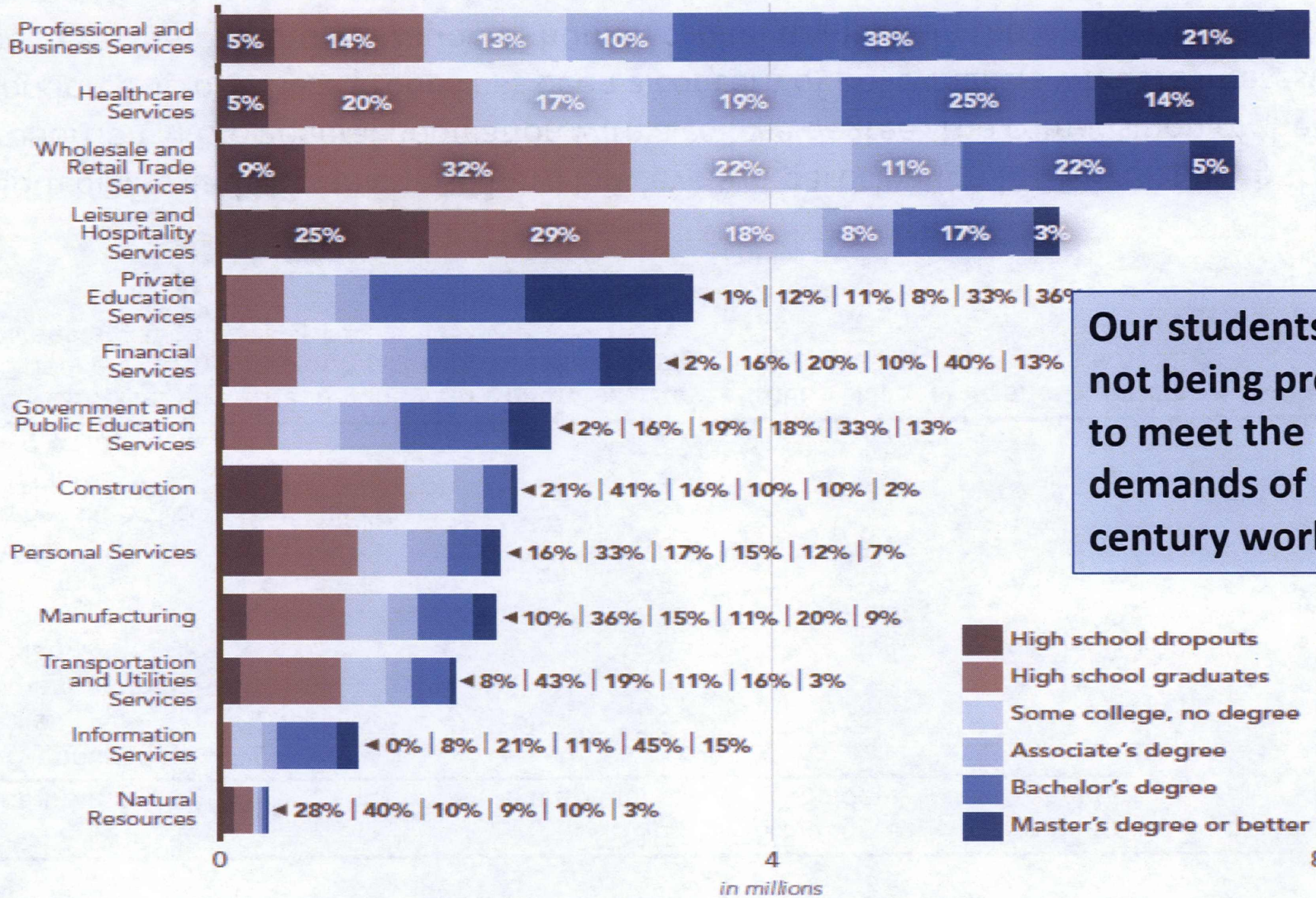
*Science and Engineering Indicators 2012*

“Both blacks and Hispanics also have low levels of participation in S&E relative to their proportion in the general population with a college degree. The composition of the S&E workforce across these groups has been a concern of policymakers who are interested in the development and utilization of human capital to maintain the United States' global competitiveness in science and engineering.”

FIGURE 4.6

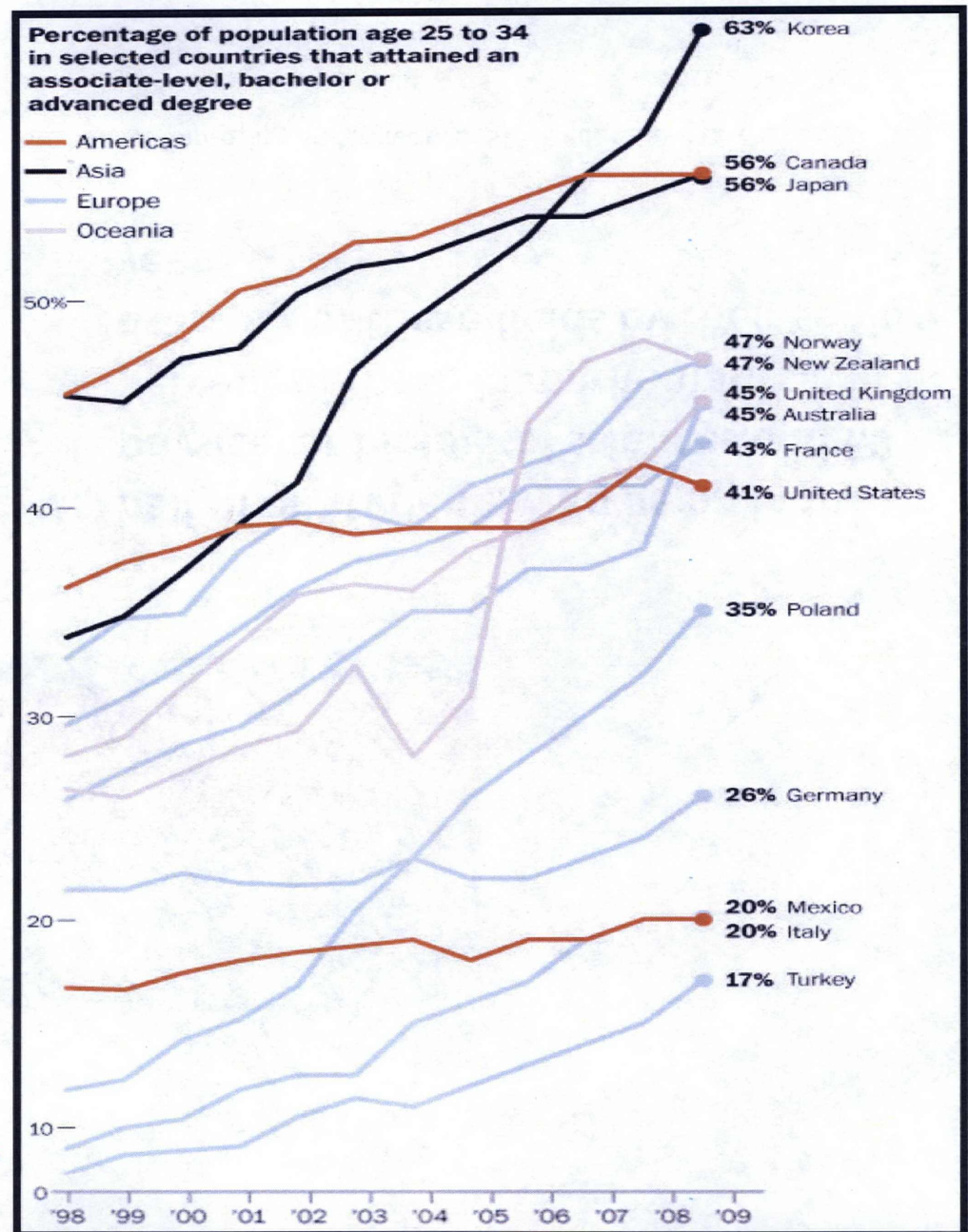
Total job openings and educational demand by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018

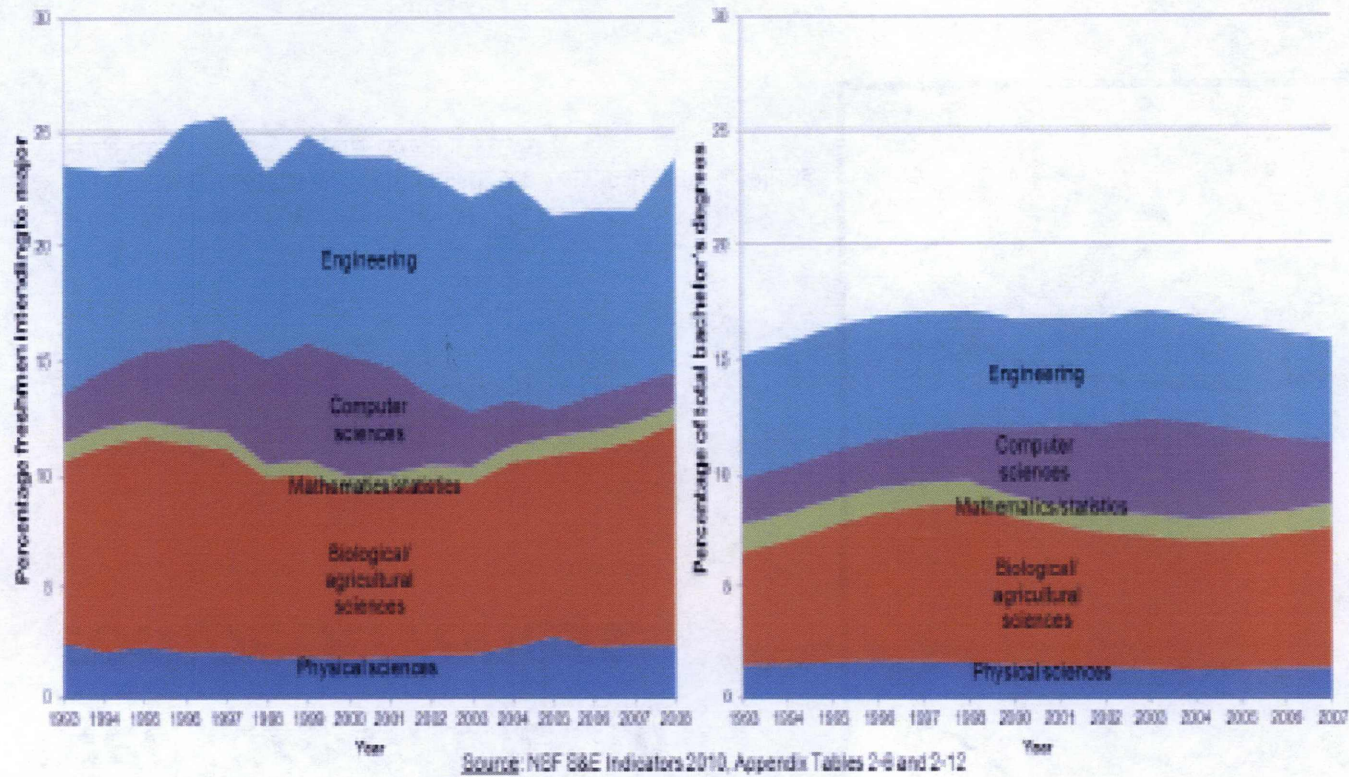


**Our students are not being prepared to meet the demands of a 21<sup>st</sup> – century workforce.**

***The US trails much of the developed world in college attainment among young adults, a key measure of global competitiveness.***



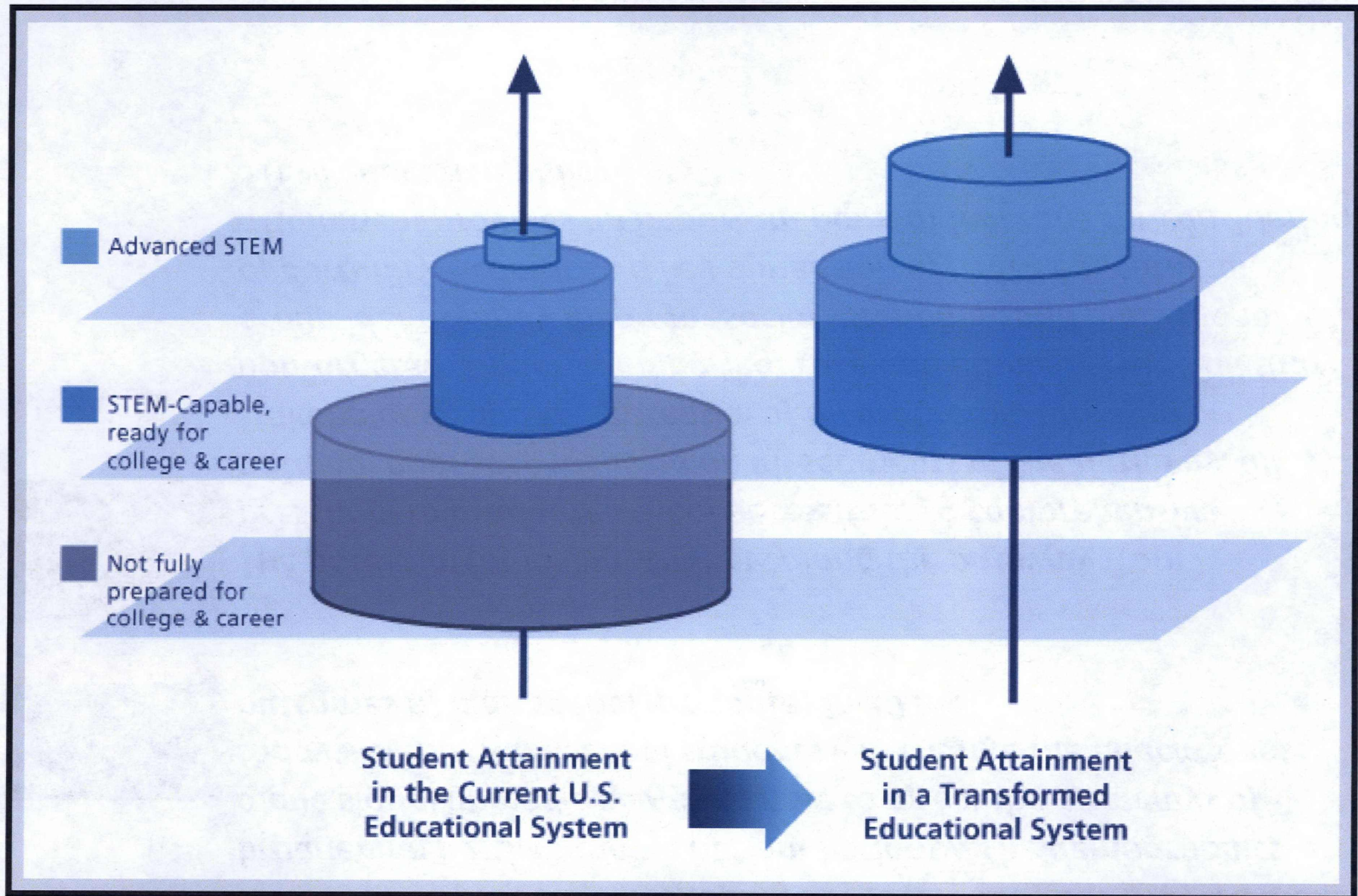
Source: OECD. Washington Post, September 12, 2011:  
[http://www.washingtonpost.com/local/education/playing-catch-up-in-college-completion/2011/09/12/gIQAegt6NK\\_graphic.html](http://www.washingtonpost.com/local/education/playing-catch-up-in-college-completion/2011/09/12/gIQAegt6NK_graphic.html)



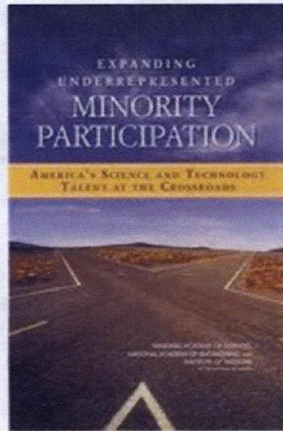
**Figure 3**

**half of all students who begin in the physical or biological sciences and 60 percent of those in mathematics will drop out of these fields by their senior year**

American Association of Universities. (September 15, 2011). 5-Year Initiative for Improving Undergraduate STEM Education: Discussion Draft.



Carnegie Corporation of New York. (2009). *Visualizing Change*. Retrieved from <http://opportunityequation.org/report/visualizing-change>.



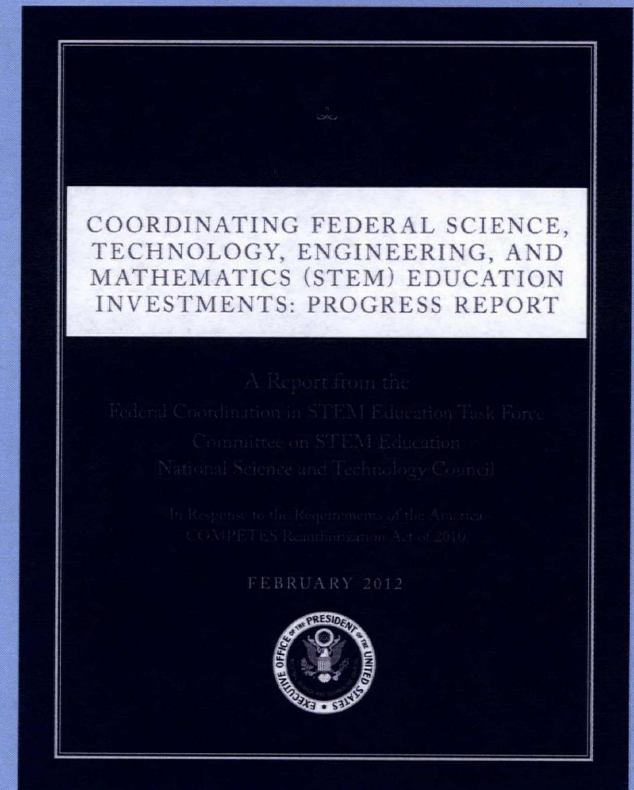
pp. 143-144

***The problem is urgent and will continue to be for the foreseeable future. To be proactive in shaping our future requires that we make broadening participation a national priority. The demographics alone signal immediacy. Acting now to affect the pathways of today's elementary school students will change the educational outcomes of high school graduates in 2020 .***

***The potential for losing students along the pathway from preschool to graduate school necessitates a comprehensive national approach focusing on all segments of the pathway, all stakeholders, and the potential of all programs, targeted or nontargeted. Understanding that race and ethnicity—and all that group identity may mean for social, economic, and educational opportunity—comprise a key dimension of STEM educational attainment provides an important point of leverage for considering STEM education policy .***

# NSTC Committee on STEM Education 5-Year Strategic Plan Priority Areas

- Effective K-12 STEM Teacher Education
- Engagement in STEM
- Undergraduate STEM education
- Serving groups traditionally underrepresented in STEM fields



# Some Key Leverage Points for Broadening Participation

- Community colleges
- K-12 learning opportunities
- Readiness for college mathematics
- Retention of STEM undergraduates
- Broadening participation research



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"A larger percentage of students from some minority groups, notably Hispanics and American Indians, attend community colleges than White, African-American, and Asian students. In effect, community colleges have become an educational pipeline for under-represented minorities entering the higher education system . . . 20 percent of engineering degree holders began their academic careers starting in and earning at least 10 credits at community colleges. 40 percent of the recipients of engineering bachelor's and master's degrees in 1999 and 2000 attended community colleges at some time." (*Enhancing the Community College Pathway to Engineering Careers*, 2005)

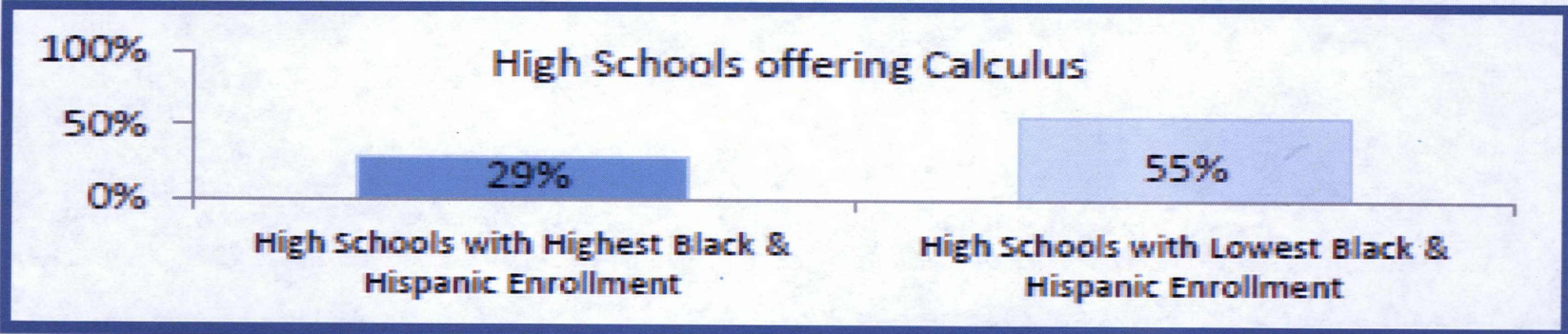
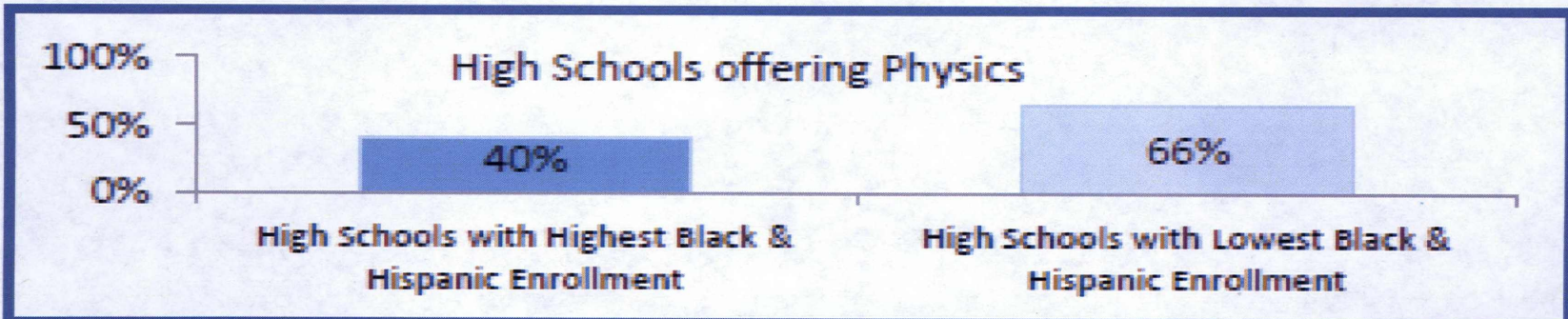
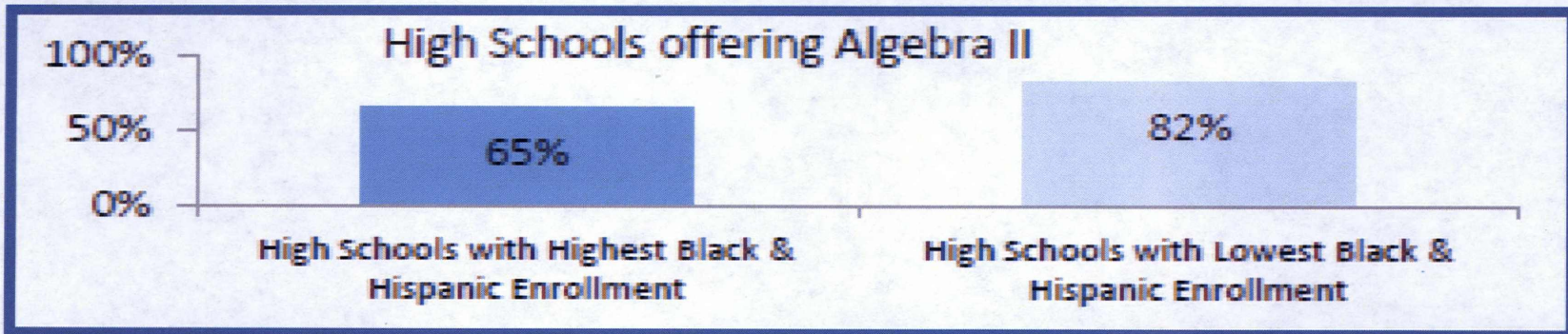


Community college students constitute the following percentages of undergraduates (fall 2008):<sup>2</sup>

All U.S. undergraduates . . . . .	44%
First-time freshmen . . . . .	43%
Native American . . . . .	55%
Asian/Pacific Islander . . . . .	45%
Black . . . . .	44%
Hispanic . . . . .	52%

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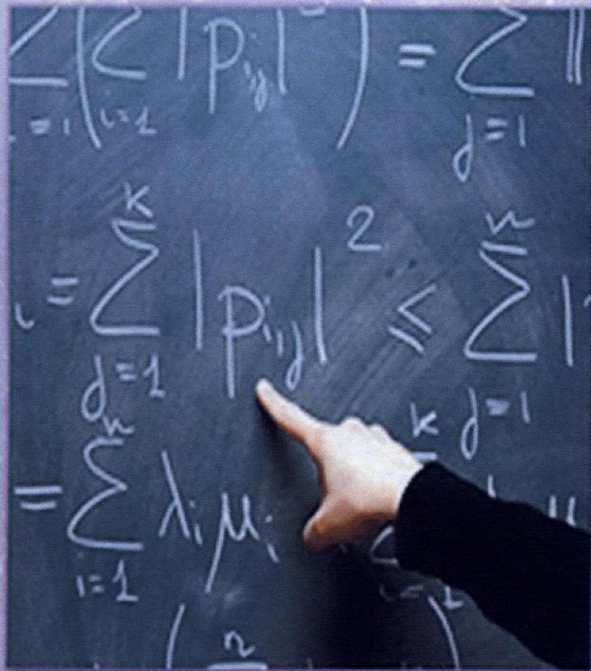
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# K-16 Mathematics Education Initiative



Moving successful education programs from  
early research to widespread use



National Science Foundation  
WHERE DISCOVERIES BEGIN

[torium.edu](http://torium.edu) (right) NSF 12-080

Dear Colleague Letter - Request for ideas about a  
Mathematics Education Initiative JULY 1

# Some Key Leverage Points for Broadening Participation

- Community colleges
- K-12 learning opportunities
- Readiness for college mathematics
- **Retention of STEM undergraduates**
- Broadening participation research



Better teaching methods are needed by university faculty to make courses more inspiring, provide more help to students facing mathematical challenges, and to create an atmosphere of a community of STEM learners. Traditional teaching methods have trained many STEM professionals, including most of the current STEM workforce. But a large and growing body of research indicates that STEM education can be substantially improved through a diversification of teaching methods. These data show that evidencebased teaching methods are more effective in reaching all students—especially the “underrepresented majority”—the women and members of minority groups who now constitute approximately 70% of college students while being underrepresented among students who receive undergraduate STEM degrees (approximately 45%). This underrepresented majority is a large potential source of STEM professionals.

The Meyerhoff Scholarship Program, which celebrated its 20th year in 2008, is considered a successful intervention program for increasing the number of underrepresented minorities who earn Ph.D.s or M.D./Ph.D.s and pursue research careers in science, technology, engineering, and mathematics (STEM). This article examines the relationship between participation in one specific component of the Meyerhoff Scholarship Program—on-campus, academic year research—and the pursuit of a STEM Ph.D. by 13 cohorts of program participants. ..

Carter, F.D., Mandell, M., & Maton, K. (2009). The Influence of On-Campus, Academic Year Undergraduate Research on STEM Ph.D. Outcomes: Evidence From the Meyerhoff Scholarship Program. *Educational Evaluation and Policy Analysis*. 31 (4), 441-462

...The results indicate that participation in on-campus, academic year research is associated with a substantial increase in the probability of pursuing a STEM Ph.D. They further suggest that the structure and intensity of the on-campus, academic year research experience matter.”

Carter, F.D., Mandell, M., & Maton, K. (2009). The Influence of On-Campus, Academic Year Undergraduate Research on STEM Ph.D. Outcomes: Evidence From the Meyerhoff Scholarship Program. *Educational Evaluation and Policy Analysis*, 31(4) 441-462

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# BROADENING PARTICIPATION RESEARCH IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) EDUCATION PROJECTS

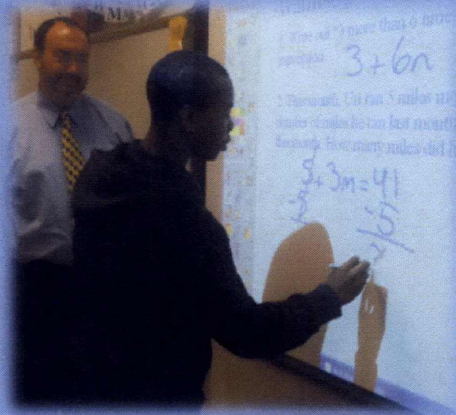
- The Broadening Participation Research in STEM Education (BPR) track exists across HRD programs
- The goal of this track across programs in the Division of Human Resource Development is to enhance our understanding of the underlying issues affecting the differential participation and success rates of students from underrepresented groups in STEM.
- Proposals should be designed to create and study new models and innovations in STEM teaching and learning to enhance the understanding of the underlying issues affecting the differential participation and success rates of students from underrepresented minority groups; add to the research knowledge; and inform STEM education practices and interventions.

# EHR Moving Forward: FY 2013 Request

Research & Development

Leadership & Capacity

Expeditions & Collaborations

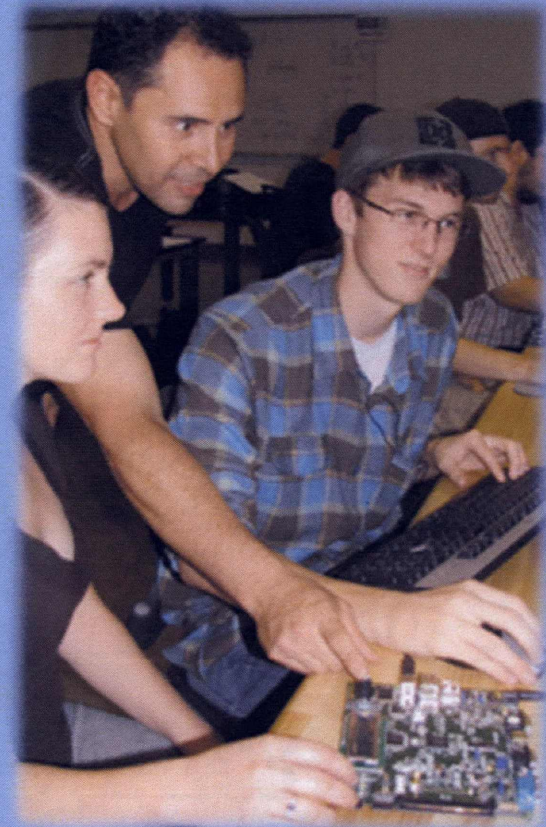


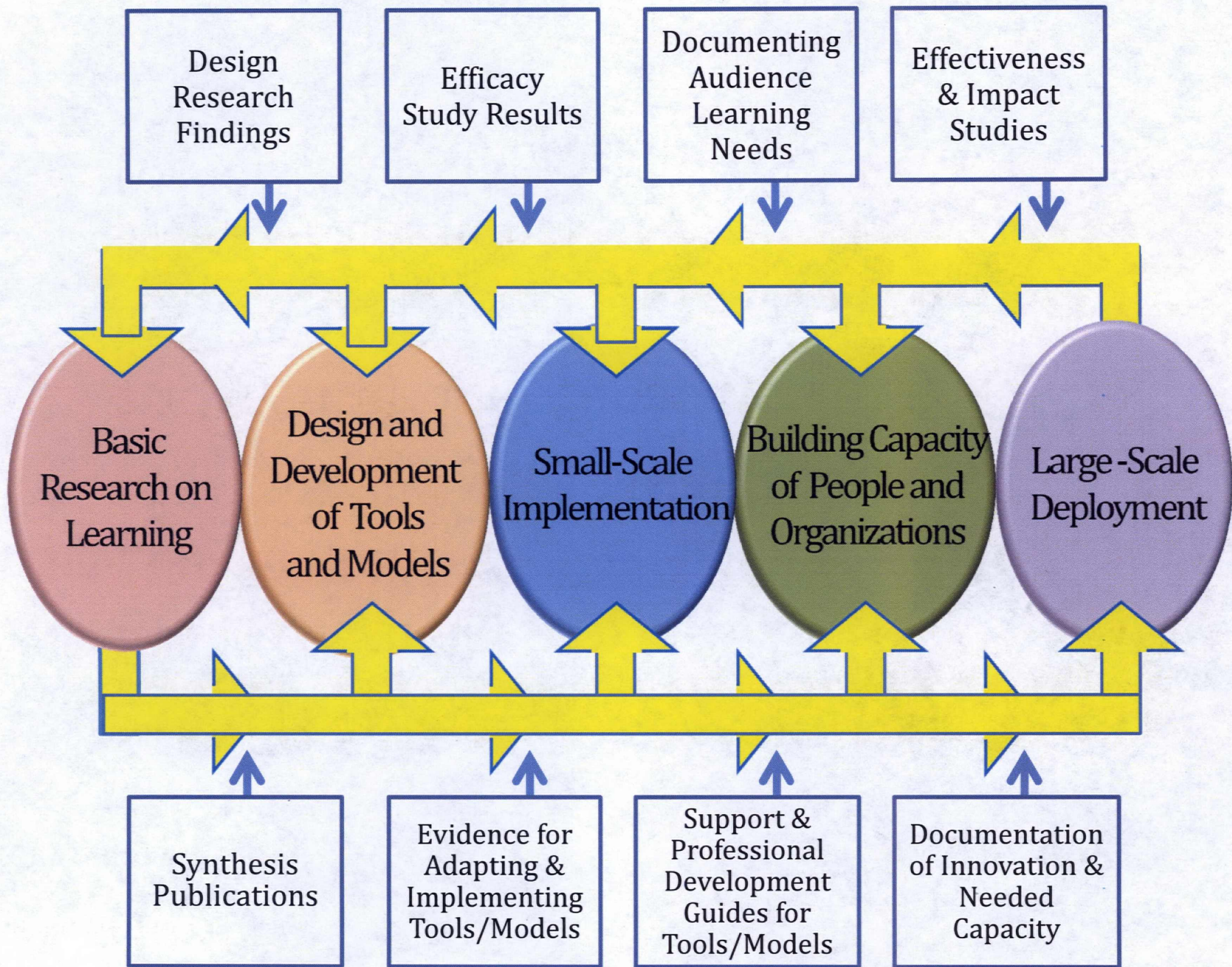


## Research & Development

## Core Launch

- ✓ STEM Learning
- ✓ STEM Learning Environments
- ✓ Broadening Participation and Institutional Capacity in STEM
- ✓ STEM Professional Workforce Preparation





- Similar to other NSF directorates, the EHR R&D Core will
  - build areas of investment for the long term;
  - allow for a knowledge base to systematically accumulate; and
  - provide a core base of knowledge that will be a resource for other investments, perhaps shorter term to address an ephemeral problem needing more immediate resolution.
- The core launch area *broadening participation and institutional capacity* will seek to
  - understand the models and interventions supported thus far and how they answer critical questions about recruitment, retention, mentoring, career development of individuals from groups underrepresented in STEM fields; and
  - build a more comprehensive base of knowledge about broadening participation, a base that can not only inform our future work, but be shared with other organizations and institutions.

# *Dear Colleague Letter for SBP*

NSF 12-037

## **Dear Colleague Letter - Stimulating Research Related to the Science of Broadening Participation**

**DATE: January 24, 2012**

National Science Foundation

Directorate for Social, Behavioral and  
Economic Sciences

JAM 2012



## ***The Science of Broadening Participation (SBP)***

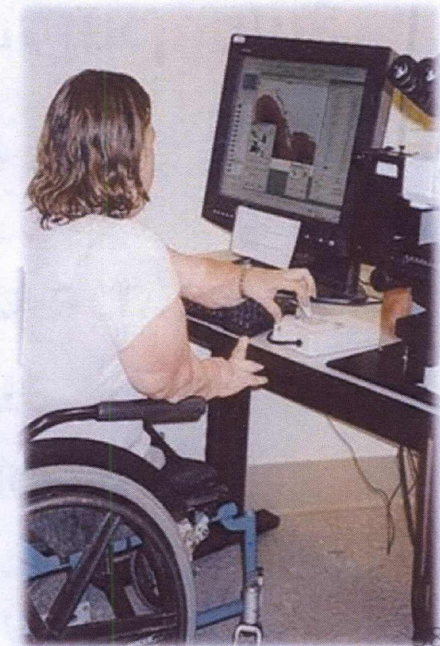
- **Empirical demonstration that focuses on access, inclusion and retention by documenting the inequitable distribution of educational and economic opportunities.**
- **Cuts across all levels of analysis of behavior including the individual, group and societal.**
- **Provides an impetus for collaboration between SBE scientists and those in the natural and physical sciences engaged BP efforts.**
- **Tells us what works and what doesn't work to reduce differences in rates of participation in STEM.**

# Building on Value...



Research on Gender in S&E supports investigations in gender-based factors that impact learning and choice in STEM education and the workforce.

Research in Disabilities Education supports investigations in the underlying issues affecting the differential learning, participation, retention and graduation rates of postsecondary students with disabilities in STEM.



## Building the Core R&D Area of Broadening Participation:

- Who are the important stakeholder communities?
- How can we best engage/advance communication with each stakeholder community?
- What can each stakeholder community contribute to this core agenda?

# One NSF

