Overview of Presentation

- The Role of NSF in STEM Education
- Drivers Shaping the Future
- EHR’s Systematic Approach to Evaluation
- Examples of EHR Program Evaluations
- AGEP and the Broader Context
The Role of NSF in STEM Education

- To promote a diverse and well-prepared workforce of STEM professionals and educators.
- To develop the ideas and tools that lead to innovation in STEM education through research and evaluation.
- To disseminate findings to the S&E community.
- To promote a public understanding of science.
Drivers Shaping the Future

External Drivers

Global Competition
- Economic
- Education
- Workforce

American Competitiveness Initiative (ACI)
Drivers Shaping the Future
Internal Drivers

- NSF’s Mission
- *NSB 2020 Vision for the NSF*
- EHR’s Mission: To achieve excellence in U.S. science and engineering education at all levels and in all settings, and to ensure the development of a diverse and well-prepared workforce of scientists, engineers, mathematicians, technicians, and educators; and a well-informed citizenry.
NSF’s Strategic Plan for FY 2006 to FY 2011

Strategic Outcome Goals

Discovery
Learning
Research Infrastructure
Stewardship

Broadening Participation
EHR’s Systematic Approach to Evaluation

- Multi-method approach that includes quantitative and qualitative analyses.
- An evaluation continuum driven by the program development cycle.
- Multiple purposes including strategic planning, program improvement, and accountability to advance STEM knowledge.
**DISCOVERY:** Does the study advance the field of evaluation? Does it create formative knowledge for program improvement?

**PROGRAM GOAL/LOGIC:** Does the study fully capture the variety of program successes and challenges?

**EMPIRICAL RIGOR:** Are study methods and hypothesis testing appropriate and sufficiently rigorous to meet study aims?

**EVALUATION STANDARDS:** In its design, implementation and reporting, does the study adhere to appropriate standards of utility, feasibility, propriety, and accuracy?
Evaluation Timeline

Capacity Building of Evaluation

Year 1 Year 3 Year 5 Years 6-7 Years 8-10

Annual Reports
Merit Review
COV

Program Monitoring Studies
Project Level Evaluation
Formative Assessment
GPR A

Evaluative Research
PART

Summative Evaluation
Portfolio Review
Sustainability Studies
Longitudinal Studies
Long-Term Impact
<table>
<thead>
<tr>
<th>Examples of EHR Program Evaluations</th>
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<tbody>
<tr>
<td><em>Math and Science Partnership (MSP) Program</em></td>
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<tr>
<td><em>Advanced Technological Education (ATE) Program</em></td>
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<tr>
<td><em>Louis Stokes Alliances for Minority Participation (LSAMP) Program</em></td>
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<tr>
<td><em>Integrative Graduate Education and Research Traineeship (IGERT) Program</em></td>
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A major research and development effort that supports innovative partnerships to improve K-12 student achievement in mathematics and science.

An emphasis on K-12 and higher education partnerships.

Funded activities:
- 36 funded Partnership projects
- 12 funded MSP Teacher Institutes
- 35+ Research, Evaluation & Technical Assistance (RETA) awards
In a first *analysis of student data*, elementary, middle and high school students showed significant improvements in *mathematics* proficiency test scores during the 2002-2003 and 2003-2004 school years. During the same period, MSP elementary school students showed significant gains (p<.05) in *science* proficiency.
Math and Science Partnership (MSP) Program: Impacts

_Growth in the number of participating IHEs_  
- 150 IHEs participate in MSP  
  - 37% doctoral-granting  
  - 26% master's colleges/universities  
  - 20% baccalaureate-granting  
  - 13% associate-granting institutions

_Greater commitment and interest among IHEs_  
- 2003-2004, 27% of Partnerships reported low levels of commitment or interest among IHE partners  
- 2004-2005, that level dropped to 10%
ATE Program Synopsis

- Education of technicians for the high-technology fields that drive our nation's economy.
- Partnerships between academic institutions and employers to improve S&E education at the undergraduate and secondary school levels.
- ATE portfolio: National and Regional Centers, Resources Centers, model projects, and applied research studies.
ATE Program Reach

- **Students:** FY 2005, >65,000 students took one or more courses directly impacted by the ATE program with 47,400 of them at 2-year institutions.

- **Instructional:** 28,000 faculty and teachers involved in professional development workshops.

- **Partnerships:** 7,800 business and industry partnerships with 2,200 educational institutions.

- **Courses:** Within these 690 programs, nearly 2,000 courses were developed or improved.
Current Evaluation of the ATE Program

- Program-level formative evaluation by Western Michigan University
- Program-level analysis of annual and final reports by SRI International
- Project-level evaluation capacity building workshop
Louis Stokes Alliances for Minority Participation (LSAMP) Program

The LSAMP program supports sustained and comprehensive approaches to broadening participation at the baccalaureate level. These approaches facilitate the production of students who are well prepared in STEM and motivated to pursue graduate education.
A multi-year evaluation study conducted by The Urban Institute. Surveyed LSAMP participants who graduated between 1992 and 1997. 60% response rate. Survey data compared with national data on STEM graduates collected as part of the NSRCG.
FIGURE 6. Graduate Coursework, Degrees Pursued, and Degrees Complete

LSAMP Participants

<table>
<thead>
<tr>
<th>STEM</th>
<th>Graduates</th>
<th>Took Further Coursework</th>
<th>Pursued Grad Degrees</th>
<th>Completed Grad Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>1,426</td>
<td>1,122</td>
<td>937</td>
<td>635</td>
</tr>
<tr>
<td>58%</td>
<td></td>
<td>79%</td>
<td>66%</td>
<td>45%</td>
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<tr>
<td>39%</td>
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<tr>
<td>25%</td>
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National Underrepresented Minority

<table>
<thead>
<tr>
<th>STEM</th>
<th>Graduates</th>
<th>Took Further Coursework</th>
<th>Pursued Grad Degrees</th>
<th>Completed Grad Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>36,234</td>
<td>22,501</td>
<td>16,529</td>
<td>7,139</td>
</tr>
<tr>
<td>43%</td>
<td></td>
<td>62%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9%</td>
<td>20%</td>
<td></td>
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National White and Asian

<table>
<thead>
<tr>
<th>STEM</th>
<th>Graduates</th>
<th>Took Further Coursework</th>
<th>Pursued Grad Degrees</th>
<th>Completed Grad Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>272,964</td>
<td>169,145</td>
<td>120,273</td>
<td>48,315</td>
</tr>
<tr>
<td>54%</td>
<td></td>
<td>62%</td>
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<td></td>
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<tr>
<td>22%</td>
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<td></td>
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</tr>
<tr>
<td>9%</td>
<td>18%</td>
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</table>

Sources: UI LSAMP Graduate Survey and NSF NSRCG Longitudinal File.
*National comparison group statistic is not significantly different from LSAMP.
IGERT has been developed to meet the challenges of educating U.S. Ph.D. scientists and engineers in collaborative, interdisciplinary research in emerging areas across the NSF with technical, professional and personal skills; catalyzing a cultural change in graduate education; facilitating diversity in graduate student participation and preparation; and developing a diverse, globally engaged science and engineering workforce.
IGERT N ranges from 303-306. Non-IGERT N ranges from 559-566. Range is due to missing responses.

Significance denoted as: *** (p < .0001)
IGERT: Interdisciplinary Experiences

- Working on joint research projects with individuals outside of home discipline: 90*** (IGERT) vs. 78*** (Non-IGERT)
- Co-authored proposals with individuals outside home discipline: 86*** (IGERT) vs. 64*** (Non-IGERT)
- Co-authored research articles/books with individuals outside home discipline: 76*** (IGERT) vs. 60*** (Non-IGERT)
- Published research findings in journal outside home discipline: 63*** (IGERT) vs. 48*** (Non-IGERT)
- Presented research findings at a conference outside home discipline: 60*** (IGERT) vs. 44*** (Non-IGERT)
- Team taught courses with faculty members outside home department: 42*** (IGERT) vs. 28*** (Non-IGERT)

Note: IGERT N ranges from 344-346. Non-IGERT N ranges from 551-555. Range is due to missing responses. Significance denoted as: * (p<.01) ** (p<.001) *** (p<.0001)
AGEP

SBE
Social, Behavioral and Economic Sciences
SBE-AGEP Participating Institutions

- City University of New York (CUNY)
- Howard University
- Michigan State University
- Northwestern University
- Ohio State University
- Pennsylvania State University
- Temple University
- Texas A&M University
- Stanford University
- University of California at Berkeley
- University of California at Los Angeles
- University of California at Santa Barbara
- University of Chicago
- University of Florida
- University of Illinois at Urbana-Champaign
- University of Maryland at College Park
- University of Miami
- University of Michigan
- University of North Carolina at Chapel Hill
- University of Southern California
- University of Wisconsin
- University of Texas at Austin
- Wayne State University
The EHR Portfolio

• To prepare the next generation of STEM professionals
• To develop a robust research community that can conduct rigorous research and evaluation that will support excellence in STEM education
• To increase the technological, scientific and quantitative literacy of all Americans
• To broaden participation and close achievement gaps in all STEM fields
AGEP and the Broader Context

AGEP

GSE
LSAMP
CREST
HBCU-UP
RDE
TCUP
Examples of How Evaluation Informs EHR Programming

**Program Redirection**

- **MGE** → **AGEP**
  - Alliances for Graduate Education and the Professoriate

**Program Realignment or Consolidation**

- **ILI + CCD+ UFE** → **CCLI**
  - Course, Curriculum, and Laboratory Improvement

**Program Enhancement**

- **PGE/PWG** → **GSE**
  - Research on Gender in Science and Engineering

**Program Refinement**

- **IGERT**
QUESTIONS

- What are the educational/research outcomes for the participating institutions?
- What is the impact of the program on its participants (e.g. students, faculty and administrators)?
- How has AGEP increased the knowledge base regarding broadening participation in STEM?