Leveraging Student Research Experiences to Bridge the Gap for Underrepresented Minorities in STEM Careers

Irene O. Aninye, Ph.D.
RCP Senior Program Associate
American Association for the Advancement of Science

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Session Overview

- Introductions
- Review of National Data on Underrepresented Minority (URM) participation and persistence in STEM
- AAAS Research Competitiveness Program STEM Program Assessment Findings
- SWOT Assessment
- Discuss tools and approaches to engage URMs in STEM undergraduate research
Racial/Ethnic Distribution of S&E Degree Recipients, 2012
(U.S. Citizens and Permanent Residents)

- US Population (age 18-24)
- Associate's degrees
- Bachelor's degrees
- Master's degrees
- Doctoral degrees
- S&E Workers

- Black/AA
- Hispanic
- American Indian/AN
- Asian/PI
- White
- Unknown

National Science Board, STEM Education Data and Trends, 2014
Factors that Effect URM Persistence in STEM

**Challenges**
- Negative stereotypes and experiences
- Cultural and academic isolation
- Disparities in academic preparation

**Interventions**
- Social support and community building
- Academic services
Factors that Effect URM Persistence in STEM

Challenges

- Negative stereotypes and experiences
- Cultural and academic isolation
- Disparities in academic preparation

Interventions

- Financial support
- Social support and community building
- Academic services

Undergrad Research Experiences
Benefits of Undergraduate Research (UGR) Experiences

- Builds confidence in research and professional skills
- Increases preparation for and commitment to pursue graduate program in STEM
- Clarifies future career pathways in STEM

**ALL** Student participation in UGR  
*NSSE, 2017*

**STEM** Student participation in UGR  
*Russell, 2006*

Black student participation in UGR compared to White students (Delta-P)  
*Figueroa, 2013*

16.27%
URM students who participated in UGR experiences were **17.4% more likely** to persist in STEM than those who did not. *(Chang et al., 2014)*

![Bar chart showing the effect of research participation on STEM graduate/professional school enrollment.](chart.png)

*Effect of Research Participation on STEM Graduate/Professional School Enrollment*

- **Structured Program**
- **Research with Faculty**
- **Any Research**

*Hurtado, 2014*
Bridging the STEM Gap for URM\text{s} through UGR

Racial/Ethnic Distribution of S\&E Degree Recipients, 2012

Effect of Research Participation on STEM Graduate/Professional School Enrollment

- Delta P
- Structured Program
- Research with Faculty
- Any Research

- All Students
- URM Students

- Black/AA
- Hispanic
- American Indian/AN
- Asian/PI
- White
- Unknown

National Data & Trends
AAAS Research Competitiveness Program

- Provides support to individual researchers, academic institutions, funding agencies, and governments in four program areas:
  - Peer Review of Research Proposals
  - STEM Program Assessments
  - Innovation and Entrepreneurship programs
  - Capacity-building and Competitiveness short courses
AAAS STEM Program Assessments

- 250+ strategic assessments (> $1 billion in programs)
  - Independent, external assessment to institutions and awardees
  - Large-scale multi-institutional initiatives
    - Established Program to Stimulate Competitive Research (EPSCoR – NSF, NASA, DoE)
    - IDeA Network for Biomedical Research Excellence (NIH INBRE)
  - Expert panel provides scientific and administrative assessment and guidance
    - Research infrastructure
    - Program design and leadership development
    - Student training and research
- Summary report of panel’s findings and recommendations

RCP Assessment Portfolio

- NSF EPSCoR, 46%
- NIH INBRE, 33%
- Other, 20%
AAAS STEM Program Assessments: A Retrospective Analysis

- RCP assessments from 2010 to 2017
  - Reports on programs assessed at least 3 times over 5 years
  - 15 reports, including 48 institutions

**No. of Institutions Represented in AAAS Study**

- Research-intensive
- Primarily Undergraduate
- Minority Serving Institutions
- Tribal Colleges
- Community Colleges
- Healthcare Centers/Hospitals
- Other (e.g., National Labs, NFP)
Retrospective Analysis: Approaches to Engage URMs in UGR

Areas of Focus

- Students/Training
- Faculty/Mentoring
- Outreach
- Leadership
- Communication
- Research/Program Cores
- Funding
- M&E
- Sustainability

- Broadening Access and Participation
- Addressing Student Preparedness
- Developing Mentors
- Institutionalizing Support for UGR
Approaches to Broaden Access and Participation

- Offer challenging projects that students can take ownership of
- Ensure research opportunity is accessible to students (travel and lodging), summer and academic year UGR
- Engage students after the summer program; utilize alumni networks
- Highlight non-PhD career options in STEM

- **Community-based participatory research and service learning opportunities**
  - Potential public health or clinical research focus
  - Partnered with community organizations, clinics, centers
  - Engaged and serviced students’ local or home community
Approaches to Address Student Preparedness

- Expose students to sophisticated equipment/methodology
- Utilize small group discussions and working groups

**Intensive boot camp orientation (1-2 weeks) at the beginning of the summer**

- Provided training in basic lab techniques, research ethics, and field methods
- Offered specialty training and certifications (e.g., cultural competency, CPR, phlebotomy)
- Assessed knowledge acquisition with pre- and post-testing
Approaches to Develop Mentors

- Require mentor training/orientation
- Incorporate teaching and mentoring opportunities for post-docs and graduate students

**Active matching process to place students with a faculty mentor**

- Promoted direct faculty engagement with student during program
- Exposed students to a diverse pool of mentors

Strong faculty-student relationships is a strong predictor of choosing STEM graduate study *(Hurtado, 2014)*
Approaches to Institutionalize Support for UGR

- Enable course credit for UGR throughout the year
- Provide gap funds when grant cycle is misaligned to internship schedule
- Incentivize and recognize faculty for participation in UGR
- Sponsor internal competition for students to continue summer research during the academic year (awards <$10,000)

**Multi-program symposia and seminars**

- Allowed students to communicate science and exposed them to the larger scientific community
- Maximized individual program resources
- Incentivized the institutions to provide additional support to event
- Attracted attention of the surrounding non-STEM community
References and Resources


- National Science Board’s STEM Education Data: https://www.nsf.gov/nsb/sei/edTool/

- National Survey of Student Engagement: http://nsse.indiana.edu/
<table>
<thead>
<tr>
<th><strong>Internal Origin</strong> (attributes of the organization)</th>
<th><strong>Helpful</strong> to achieving the objective</th>
<th><strong>Harmful</strong> to achieving the objective</th>
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<td><strong>STRENGTHS</strong> - internal, positive attributes of your group/program/institution. These are things that are within your control.</td>
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<td>• Successful processes implemented</td>
<td><strong>WEAKNESSES</strong> - negative factors that detract from your strengths. These are things that you might need to improve on to be more effective.</td>
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<td>• Assets of your team/environment (e.g., network, staff, equipment, funding, skills, reputation)</td>
<td>• Things needed to be more competitive</td>
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<td>• Competitive advantages</td>
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<td>• Gaps in team, program, or institution</td>
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<td><strong>EXTERNAL ORIGIN</strong> (attributes of the environment)</td>
<td><strong>OPPORTUNITIES</strong> - external factors in your environment that are likely to contribute to your success, but have not been incorporated or utilized.</td>
<td><strong>THREATS</strong> - external factors that you have no control over. Consider identifying contingency plans for dealing them if they occur.</td>
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<td>• Trends in research attractive to students</td>
<td>• Sustainability of supplies, funds, and resources</td>
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<td>• Upcoming events to promote-grow program</td>
<td>• Maintaining pace with advances in technology</td>
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<td>• Policy and funding developments</td>
<td>• Research, funding, or career trends that challenge your goals</td>
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<td>• Reputation</td>
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Discussion

• Broadening access and URM participation in UGR
• Addressing student preparedness
• Engagement of faculty and program alumni
• Institutionalizing support
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<th>WEAKNESSES</th>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
</tr>
</thead>
</table>
| Internal, positive attributes of your group/program/institution. These are things that are within your control.  
- What processes have shown success implementing your goals?  
- What assets do you have in your team/environment (e.g., staff, network, skills, reputation, equipment, technology, funding, facilities)?  
- What competitive advantages does your group/program/institution have? | Negative factors that detract from your strengths. These are things that you might need to improve on to be more effective.  
- What things would make your group/program/institution more competitive?  
- What processes need improvement?  
- Are there tangible assets that you need (e.g., money, equipment)?  
- Are there gaps on your team or within your program/institution?  
- Is your location ideal for your success? | External factors in your environment that are likely to contribute to your success, but have yet not been utilized/maximized.  
- What trends in your research area will attract student participation?  
- What coming events could you utilize to promote/grow your program?  
- Are there upcoming policy or funding changes that might impact your program positively?  
- Do students, colleagues, or external entities think highly of you? | External factors that you have no control over. Consider identifying contingency plans for dealing them if they occur.  
- Which other groups draw from your current pool of resources (e.g., facilities, funds, audience)?  
- What supplies/funds will be available long term to support your needs?  
- How might technology advances change how you do your work?  
- Are there research/funding trends that could become a threat to your goals? |