NSF HBCU–UP

BPR in STEM Education: Transferring Research Findings into Education Practice

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Research to Practice in STEM

- Change in STEM teaching practices does not come easily.
- Teaching behavior—like human behavior generally—is influenced by the contexts in which it is situated (Bronfenbrenner, 1979).
- Faculty members’ teaching decisions depend on the interplay of individual beliefs and values, which have been shaped by their previous education and training, and the norms and values of the contexts in which they work.
Research to Practice in STEM

- Contexts include the department, the institution, and external forces beyond the institution (Austin, 2011; Quinn-Patton, 2010; Seymour, 2001; Tobias, 1992).

- R2P = attunement to factors within academic institutions – e.g., “local” barriers, such as institutional leadership, departmental peers, reward systems, students’ attitudes, and, of course, the beliefs and values of the individual faculty members themselves. (Austin, 2011)
The academic department or program has the greatest influence on how faculty members allocate their work time and the decisions they make about teaching (Austin, 1994, 1996).

Improving learning in undergraduate science and engineering courses may depend as much on research into departmental culture, curriculum content, sequencing, and assignment of teachers to courses as it does on research on the impact of various teaching methods (Fairweather, 2008).
Theories of “translational research” apply to STEM Faculty, i.e., application of a finding from the laboratory to the classroom and vice a versa.

Faculty often find one or two techniques that seem to work with their discipline and stay there.

R2P requires a dynamic, robust, iterative, reflective, proactive and collaborative approach to teaching, research and learning.

Translating Research into Practice, Chris Hakala, Ph.D, Quinnipiac University, 2016
Summary of STEM Bachelor’s Degree Completion Trends

- Compared to all other institution types:
  - HBCUs produce a higher percentage of STEM bachelor’s degrees among Blacks.
  - HSIs produce a higher percentage of STEM bachelor’s degrees among Hispanics.
  - The percentage of AI/AN graduates in STEM has increased steadily over time at TCUs.
Blacks and Hispanic STEM graduates of HBCUs and HSIs, respectively, earn most bachelor’s degrees in biological sciences.

AI/AN STEM graduates of TCUs earn most degrees in agricultural sciences and computer sciences.
Across all institution types, HBCUs award the highest percentage of STEM bachelor’s degrees to Blacks.

Percent of STEM Bachelor's Degrees Awarded to Blacks, by Institution Type, 2009

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>Percent of All Degrees Awarded</th>
<th>STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-MSI</td>
<td>90%</td>
<td>10%</td>
</tr>
<tr>
<td>HBCU</td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>PBI</td>
<td>92%</td>
<td>8%</td>
</tr>
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<td>92%</td>
<td>8%</td>
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</tbody>
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US STEM Crisis

STEM fields are growing in United States
STEM fields are growing in The Nation
Between 2014 and 2024 STEM jobs will grow 16%
Non-STEM jobs will grow 11%

MORE than 50% of White and Asian American students intending to major in STEM fields actually complete a degree in these fields.

LESS than 50% of African American and Hispanic students intending to major in STEM actually complete a degree in these fields.
Forty-eight percent of bachelor's degree students who entered STEM fields between 2003 and 2009 had switched to non-STEM majors or dropped out by 2009.
Seven Essential Components for STEM Success

- Pre-college initiatives
- Student support
- Undergraduate research
- Faculty development
- Curriculum development
- Physical infrastructure development
- STEM graduate school and employment initiatives
Common Features of Comprehensive Programs

- Faculty professional development
- Interdisciplinary approach
- Shared leadership and responsibility for change
- Curriculum reform
- Undergraduate research
- Recruitment and transition activities
- Academic and social support
- Mentoring
Gaps in the Existing Research Base

- Program implementation
  - Most studies lacked detailed information about the implementation

- Examination of individual program components
  - Evaluations often lacked an assessment of how specific program components impacted outcomes
Integration of Research and Education – Challenge

- Faculty Enhancement and Increased Awareness and Implementation of Promising Practices that have Impact on Student Learning

- What is your niche in BPR?

- What is your strength, your asset in BP?