STEM: Working with African American Students from a Culturally Relevant Pedagogy

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These are all our children. We will profit by, or pay for, whatever they become.

James Baldwin
What are some stereotypes of African American students who want to pursue STEM?
Importance of Representation

The STEM field lacks the racial, ethnic and gender diversity required to address the dire technological and scientific needs of the United States.
In 2012, the Bureau of Labor Statistics has forecasted that employment in STEM occupations will grow about 70 percent faster than any employment in other occupations; by 2014, employers expect to hire 2.5 million new STEM workers.
Why are the STEM majors/subjects important for African American students?
STEM Statistics

Attrition rates--from a STEM major and from college itself--are greater for African Americans than they are for the average college student.

Science and Engineering Indicators 2008
African Americans made up 11.4% of freshman in 2005.

*Science and Engineering Indicators 2008*
STEM Statistics Cont.

4 years later, African Americans received just 9.0% of bachelor’s degrees in 2009.

• Of that 9.0%, only 10.8% of African American graduated with a bachelors degree in STEM 2009.
STEM Statistics Cont.

This means: less than 1% of graduates were African American **AND** graduated with a STEM bachelors degree.
In comparison, white students made up 62.9% of incoming freshmen in 2005 and received 64.3% of the STEM bachelor’s granted in 2009 (http://www.nsf.gov/statistics/wmpd/pdf/tab5-3.pdf).
• African Americans represented 2.6% of graduate enrollment in STEM fields in 2010, compared with 30.2% for whites.
• African Americans earned just 3.8% of all STEM doctorate degrees granted in 2010, compared with 69.4% for whites.

How Do We Develop Strategies/Techniques to Increase STEM Access to African American Students?
Strategies/Techniques to Increase STEM

1. Attribution Theory (Mindset)
2. Cultural Relevant Pedagogy
3. Critical Thinking
4. Hip Hop Connection
Attribution Theory

“I am the greatest...
I said that even before I knew I was”
Attribution theory is concerned with how individuals interpret events and how this relates to their thinking and behavior.
Attribution Theory Cont.

1) Internal attribution, the inference that a person is behaving in a certain way because of something about the person, such as attitude, character or personality.

2) External attribution, the inference that a person is behaving a certain way because of something about the situation he or she is in.
Overcoming Barriers

• Establishing High Expectations

• Institutional, Faculty, and Staff Commitment

• Advising

• Out-of-Class Environment
Our Study

"If the only tool you have is a hammer, you tend to see every problem as a nail."

--Abraham Maslow
Demographics

<table>
<thead>
<tr>
<th>Total Participants: 17</th>
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<tbody>
<tr>
<td><strong>Ethnicity</strong></td>
</tr>
<tr>
<td>African-American</td>
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<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Males-65%</td>
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<tr>
<td>Females-35%</td>
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<tr>
<td><strong>Age Range</strong></td>
</tr>
<tr>
<td>18-20: 53%</td>
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<tr>
<td>21-23: 41%</td>
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<tr>
<td>24+: 6%</td>
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<table>
<thead>
<tr>
<th>Academics</th>
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<tbody>
<tr>
<td><strong>Class Standing</strong></td>
</tr>
<tr>
<td>Freshmen: 24%</td>
</tr>
<tr>
<td>Sophomore: 24%</td>
</tr>
<tr>
<td>Junior: 35%</td>
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<tr>
<td>Senior: 18%</td>
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<tr>
<td><strong>GPA</strong></td>
</tr>
<tr>
<td>4.0: 6%</td>
</tr>
<tr>
<td>3.6-3.9: 6%</td>
</tr>
<tr>
<td>3.1-3.59: 17.6%</td>
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<tr>
<td>2.6-3.0: <strong>47.1%</strong></td>
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<tr>
<td>2.1-2.59: 23.5%</td>
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<table>
<thead>
<tr>
<th>STEM Majors</th>
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<tbody>
<tr>
<td>• Biology</td>
</tr>
<tr>
<td>• Chemistry</td>
</tr>
<tr>
<td>• Civil Engineering</td>
</tr>
<tr>
<td>• Computer Engineering</td>
</tr>
<tr>
<td>• Mechanical Engineering</td>
</tr>
<tr>
<td>• Mathematics</td>
</tr>
</tbody>
</table>
Demographics Cont.

**Hours on campus (academic)**
- 0-10: 30%
- 11-20: 30%
- 21+: 40%

**Hours Studying**
- 0-10: 41%
- 11-20: 41%
- 21+: 18%

**Out-of-classroom Activities**
- Peer Mentorships: 33%
- Internships: 33%
- Research: 11%
- Professional Associations: 22%
- STEM-related Employment: 22%
Discussion of Key Findings

1. Early Exposure (K-12 pipeline)
2. Confidence/Self-efficacy
3. Peer Culture
4. Faculty/Teacher Interactions
5. Institutional Support
Early Exposure

“In high school, I had a good set of math teachers and they did so well, and I wanted to be just like them”

Motivation for Pursuing STEM
Family Members: 55%
STEM Event: 27%
Mentor: 18%
Peers: 18%
Teacher: 27%

K-12 STEM Preparation
AP Courses: 64%
Gate: 14%
MESA: 7%
Other Prep: 7%
Self-Efficacy

“My personal drive has lead me to where I am today in my major as an mechanical engineer”

Preparedness for major
- Prepared: 20%
- Somewhat Prepared: 60%
- Not Prepared: 20%

Confidence in Major
- Very confident: 13%
- Confident: 47%
- Somewhat Confident: 33%
- Not Confident: 7%
Peer Culture

“I have built strong relationships with my classmates, which helped me tremendously as an engineering major, we make sure to support each other”

Factors Facilitating Success
Peer Mentorships: 33%
Peer Study groups: 83%
Peer Support: 58%
Student Organizations
"Connecting with professors early in this major is so important. I have been able to build relationships with them and learn about internships because of it."

Factors Facilitating Success
Faculty: 16%

Faculty Interactions
None: 27%
Major Advising: 67%
Mentorship: 13%
Office Hours: 40%
Research Opportunities: 27%
Institutional Support

“As a student I have received tutoring for difficult major classes, and was able to understand the concepts better”

Support
Services/Programs
First Generation Support Programs: 54%
STEM based programs: 13%
Tutoring: 73%
Implications for Practice

1. Earlier exposure within K-12 system
   • Coursework
   • STEM program/events
   • STEM community collaboration
2. Cultivating a positive peer culture
3. Promotion of STEM-related research
Accessing culturally relevant pedagogy?
What is culturally relevant pedagogy?

Culturally relevant pedagogy uses "the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning more relevant to and effective [for students]...." (Gay 2001).
Culturally Relevant Pedagogy

It has three components:

1. “Students must experience academic success”
2. “Students must develop and/or maintain cultural competence”
3. “Students must develop a critical consciousness through which they challenge the status quo of the current social order”.
STEM: Influential Individuals

Star Trek
STEM: Influential Individuals

Mae C. Jemison
STEM: Influential Individuals

The Light Bulb
Best Practices

Students at two San Bernardino, California, high schools got the chance to apply mathematics to investigating crime scenes. They learned about the geometry of blood spatter, and, given actual crime scene photos, applied this knowledge to the types of problems that actual investigators have to address, including cause of death and angle of impact.

Best Practices Cont.

African American males from various high schools in Los Angeles wanted to know whether there were more African American males in prison than in college.
What is Critical Thinking?
Critical Thinking

Critical thinkers: distinguish between fact and opinion; ask questions; make detailed observations; uncover assumptions and define their terms; and make assertions based on sound logic and solid evidence.
Hip Hop/Rap
Hip-Hop/Rap

- Have an Open Mind
- Messages within Cultural
- Thought Provoking
Newton’s Three Laws of Motion

Law 1: Inertia
Recap

• Understand your cultural competence to teach

• Validate Students

• Critical Thinking

• Hip Hop Connection
Thank You

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