

AC 2007-2543: A Survey of Teaching Styles and Classroom Techniques to Engage African American Students in the Engineering Classroom

Carlotta Berry, Rose-Hulman

Cordelia Brown, Purdue Univ.

Ingrid St. Omer, Univ. of Kentucky

Stephanie Adams, Univ. of Nebraska-Lincoln

Michael Smith, Nat'l Society of Black Engineers



Purpose

to identify and evaluate the preferred teaching styles and classroom techniques for African American (AA) engineering students



Hypothesis

the implementation of preferred learning styles and classroom techniques for African American (AA) engineering students may increase their retention by engaging them in the classroom and learning process

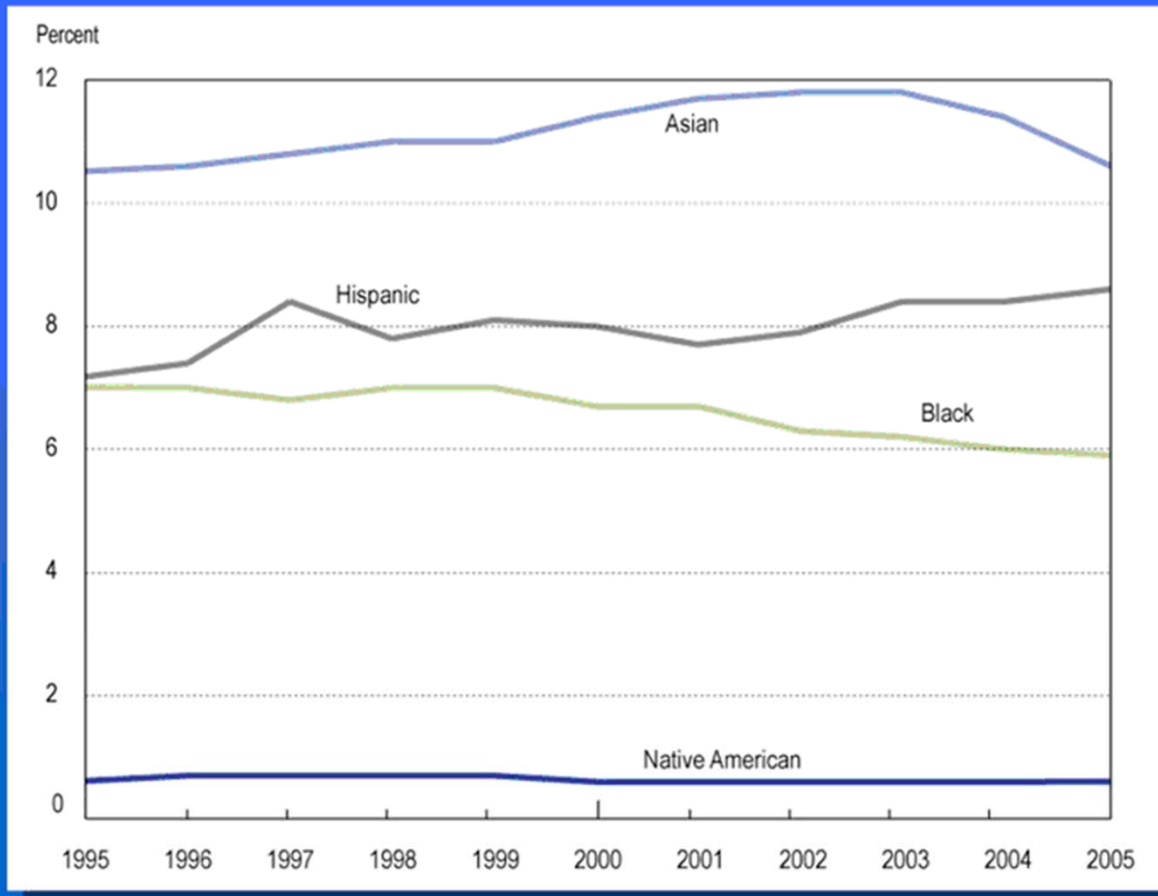


Motivation

- **abundance** of literature on the recruitment and retention of underrepresented populations in STEM fields
- **dearth** of literature on the preferred learning styles and classroom techniques to increase retention of AA engineering students



Minority undergraduate engineering students, by race/ethnicity: 1995–2005



SOURCE: *Women, Minorities and Persons With Disabilities in Science and Engineering (December 2006)*



Motivation

- Less than **2 out of 5** minority students who enter engineering will actually graduate with an engineering degree*
- To address retention the overall experience in the engineering classroom must have a baseline **cultural competency** and **sensitivity***

*Chubin, May, Babco "Diversity the Engineering Workforce"
Journal of Engineering Education, Vol. 94, No. 1, 2005.



Method and Analysis

- **Survey** students via the NSBE online membership portal (9/1/06 – 12/31/06)
 - The Likert-style questionnaire contained 10 statements related to teams, projects, quizzes, and active learning activities. Qualitative comments were also requested.
- **Analyze** the data collected for trends
 - looked for positive and negative correlations with respect to chapter, classification, gender, race, major, age
 - significant findings were further analyzed using hypothesis testing



Analysis

- looked for positive and negative correlations with respect to chapter, classification, gender, race, major, age
- significant findings were further analyzed using hypothesis testing



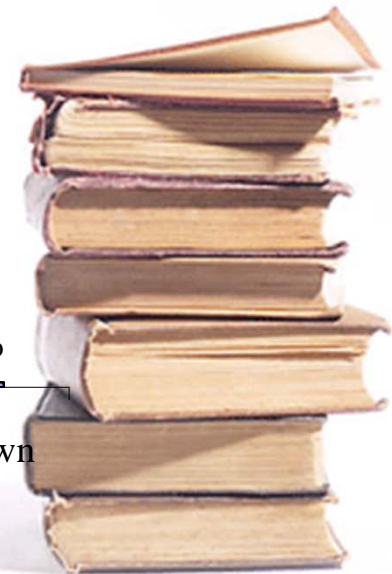
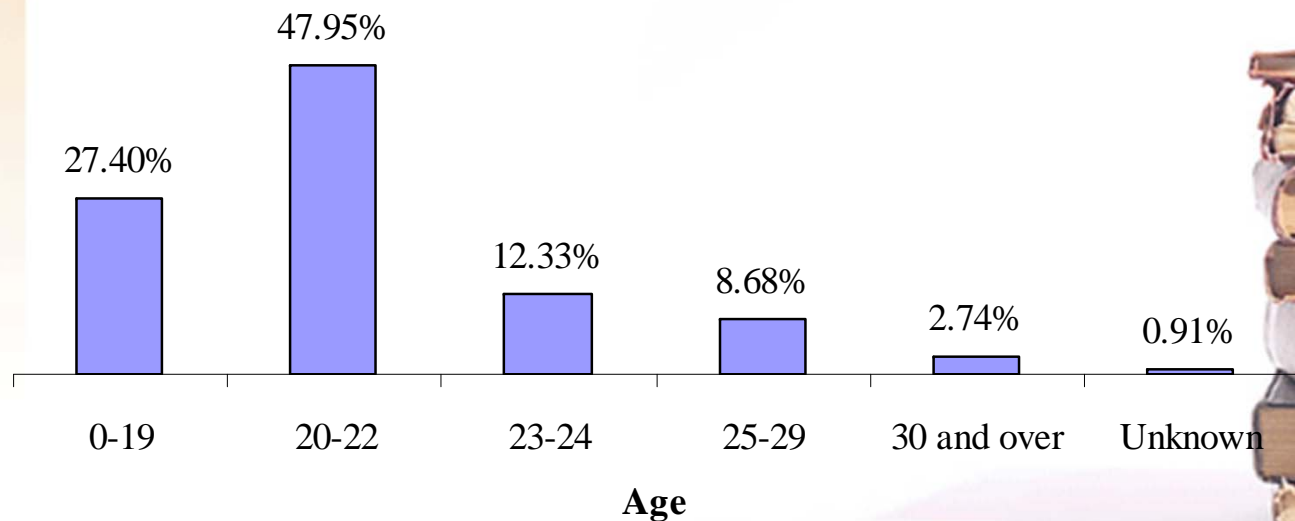
Statistically Significant

- All of the questions were found to be statistically significant at a level of 5% with respect to at least one of the respondent factors
- All of the responses were ranked from 0 to 5 (not sure, strongly disagree to strongly agree)



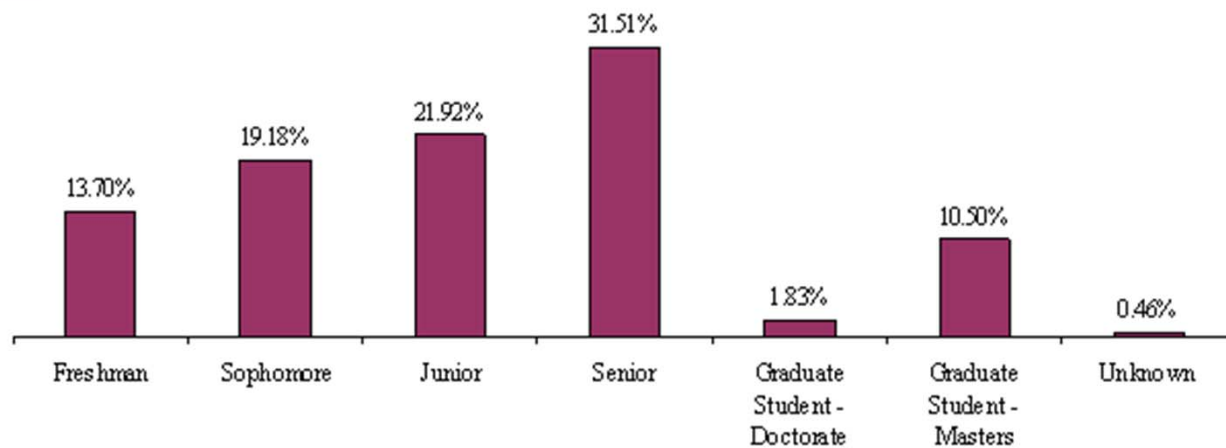
Quantitative Results

- 219 responses representing 111 schools
- 111 males, 107 females
- 79.4% African American



Quantitative Results, cont.

- majority of the students were STEM majors
- Electrical and Computer Engineering and Mechanical Engineering



Quantitative Results, cont.

- 111 responding schools
- 11 members at large
- 34 respondents from HBCUs
- 4 respondents from HSIs
- 9 respondents from Africa



Quantitative Results, cont.

Statement	Mean (stdev)	Findings
<i>"I like a lecture that relates the topics introduced to real world applications"</i>	4.42 (0.87)	<i>Strongest preference overall Master's and Doctorate students rated it the highest (p=0.00)</i>
<i>"I like forming my own learning teams in class opposed to the professor placing me on a team"</i>	2.89 (1.58)	<i>Weakest preference overall</i>
<i>"I expect my professors to know my name and use it to interact with me personally in class or during office hours"</i>	3.52 (1.18)	<i>highest response for HBCU students (p = 0.003)</i>

Quantitative Results, cont.

Statement	Mean (stdev)	Findings
<i>"I like in-class activities where I work in teams with my peers"</i>	3.59 (1.23)	<i>lowest response for women although insignificant at a level of 5%</i>
<i>"I like to work in teams on semester-long projects"</i>	2.92 (1.38)	Men rated it higher ($p = 0.022$) Students with a higher classification rated it higher ($p = 0.020$)
<i>"I like interactive teachers who call on me during class or ask me to work a problem on the board"</i>	3.03 (1.33)	Men rated it higher ($p = 0.024$)
<i>"I learn better when my professor gives quizzes, exams and homework frequently to evaluate my understanding"</i>	3.36 (1.27)	<i>no significant findings</i>

Quantitative Results, cont.

Statement	Mean (stdev)	Findings
<i>"I like a class that includes more than straight lecture for 50 minutes"</i>	3.67 (1.51)	<i>Women ranked this statement higher (p=0.046) Students at public institutions ranked this statement higher (p = 0.015)</i>
<i>"I learn material better when I join a study group to review material after class"</i>	3.39 (1.40)	<i>Juniors rated it higher than other classifications (p = 0.040)</i>
<i>"I enjoy a class that includes a multimedia presentation such as PowerPoint, videos or internet"</i>	3.37 (1.53)	<i>Ranked higher for men (p=0.043) and International students (p=0.002)</i>

Strongest and Weakest preference

- *"I like a lecture that relates the topics introduced to real world applications"*
 - mean = 4.42
 - standard deviation = 0.87
- *"I like forming my own learning teams in class opposed to the professor placing me on a team"*
 - mean = 2.89
 - standard deviation = 1.57



Question 1

"I expect my professors to know my name and use it to interact with me personally in class or during office hours"

- highest response for HBCU students ($p = 0.003$)
- mean = 4.26



Question 2

"I like in-class activities where I work in teams with my peers"

- lowest response for women (mean = 3.59)
- insignificant at a level of 5% ($p = 0.085$)



Question 3

"I like to work in teams on semester-long projects"

- Men rated it higher ($p = 0.022$)
- Students with a higher classification rated it higher ($p = 0.020$)



Question 4

"I like interactive teachers who call on me during class or ask me to work a problem on the board"

- Men rated it higher
 - $p = 0.024$
 - mean = 3.03



Question 5

"I like forming my own learning teams in class opposed to the professor placing me in a team."

- Students under 20 and over 22 ranked their preference to this statement higher



Question 6

"I like a class that includes more than straight lecture for 50 minutes"

- Women ranked this statement higher ($p=0.046$)
- Students at public institutions ranked this statement higher ($p = 0.015$)



Question 7

"I like a lecture that relates the topics introduced to real world applications"

- Students at Doctoral/Research and Research/Very High institutions rated this statement highest ($p = 0.064$)
- Master's and doctorate students rated this question higher ($p = 0.000$)



Question 8

"I learn material better when I join a study group to review material after class"

- Students at extra large institutions rate it highest ($p=0.091$)
- Juniors rated it higher than other classifications ($p = 0.040$)



Question 9

"I learn better when my professor gives quizzes, exams and homework frequently to evaluate my understanding"

- Students at master's medium and small institutions ranked this statement the highest
- mean = 3.36
- $p = 0.081$



Question 10

"I enjoy a class that includes a multimedia presentation such as PowerPoint, videos or internet"

- Ranked highest for men ($p=0.043$)
- International students ranked the statement higher ($p=0.002$)



Qualitative Responses

- *most prevalent responses were concerning professor qualities*
 - *enthusiasm*
 - *interested in subject and student*
 - *considerate of other courses*
 - *organized*
 - *provides timely feedback*
 - *provides detailed worked out examples and solutions*
 - *respectful to students when asking or answering questions*



Qualitative Responses, cont.

*“When a professor recognizes a student outside of class and takes interest in the other courses the student is taking (this) shows that they are interested in the student’s education.
...”*



Qualitative Responses, cont.

- *“ . . . I enjoy lectures that include going on an excursion and seminars with people more experienced in the field: down here in Nigeria, we r [sic] only taught theoretically and most of the time we know little or nothing practically about the equipment. . . .”*
- *“ I feel it is best for a professor to teach the material in a different way than the book shows it. Most of my professors don't really go to in depth on certain topics and very detailed in others depending on what the book covers. I like it when the professor instead of repeating a book, tries to teach his/her class the same subject but in a different manner”.*



Selected Qualitative Response

“Effective instruction starts with an instructor who is a life-long learner and a facilitator, comprehensive curriculum/resources, and adequate instructional time. Frequent formative and summative assessment, along with performance assessment (portfolios) is key. When instruction incorporates real life examples, peer collaboration, use of technology and the opportunity to reflect upon learning ... that's a great course!”



Conclusions and Future Work

- Students feel strongly that professors should relate topics to real world applications
- There were major disparities in gender preferences that contradicted published literature
- Students at HBCUs expect more interpersonal communication
- Expand the participation and survey, perhaps involve SWE, AISES, and SHPE students as well



Questions

