

Diversity in Engineering Education Research: Insights from Three Study Designs

Center for the Advancement
of Engineering Education

Cheryl Allendoerfer

Rebecca Bates

Jaime Hernandez Mijangos

Sharon Jones

Robin Adams

Diversity

- What are the top 2-3 diversity issues on *your* campus?

Studying Diversity in Engineering Education Contexts

- Diversity is a significant concern in engineering education, as evidenced by numerous recent calls to recruit and retain more women and underrepresented minorities into engineering majors and professions.

National Academy of Engineering (2004). The engineer of 2020: Visions of engineering in the new century. Washington, DC: The National Academies Press.

National Academy of Engineering (2005). The engineer of 2020: Adapting engineering education to the new century. Washington, DC: The National Academies Press.

Studying Diversity in Engineering Education Contexts

- Goal: To consider diversity broadly, and in ways that recognize within-group differences as well as individuals' identifications with multiple groups.

Banks, J. (1982). Teaching for social justice, diversity and citizenship in a global world. *Education Forum*, vol. 68(4), pp. 296-305.

Grant, C. and Sleeter, C. (1986). Race, class and gender in education research: An argument for integrative analysis. *Review of Educational Research*, vol. 56(2), pp. 195-211.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, vol. 32(3), pp. 464-491.

Malveaux, J. (2005). Dimensions of diversity. *Diverse: Issues in Higher Education*, vol. 22(19), p. 31.

Studying Diversity in Engineering Education Contexts

- Here we provide three examples of how engineering faculty are studying diversity issues
- Focusing on 3 aspects of the study designs:
 - Conceptualizing and defining diversity
 - Developing a research question
 - Choosing research methods

Three examples: Studies from ISEE 2006

- **ISEE: Institute for Scholarship on Engineering Education**
 - Part of the NSF-funded Center for the Advancement of Engineering Education (CAEE)
 - ISEE 2006: 18 Scholars selected from a competitive national pool
- **Summer 2006:** A week-long intensive workshop at Howard University
 - Scholars designed studies focusing on issues of diversity
- **2006-07 Academic Year:** Implementation of studies
- These 3 studies: Chosen because they represent a variety of ways of conceptualizing and studying diversity

Study #1:
Sharon Jones, Lafayette College

- **Conceptualizing Diversity:** In terms of race and/or ethnicity, focusing on first-year African American and Hispanic American students.
 - Why: National concern, her college's demographics, existing POSSE cohort
- **Research question:** What effect does an intensive, structured mentoring program (Lafayette College's POSSE program) have on the retention of first year engineering students from minority backgrounds?
- **Methods:**
 - Gathering of academic background and academic performance data
 - Semi-structured survey: Combined existing surveys that have previously been used to explore academic and social retention factors

Study #2:
Jaime Hernandez Mijangos, Texas State U.–
San Marcos

- **Conceptualizing Diversity:** In terms of race and/or ethnicity, combined with diverse pathways into engineering: Hispanic students who transfer from 2-yr colleges to a 4-yr university.
 - Why: National concern, located in Texas, large population of Hispanic transfer students
- **Research question:** What are the most meaningful learning/developmental experiences that motivate Hispanic students to transfer from selected Texas community colleges to a 4-year engineering program?
- **Methods:**
 - Large-scale questionnaire: The Community College Experiences Questionnaire
 - Focus groups

Study #3:
Rebecca Bates, Minnesota State U.–Mankato

- **Conceptualizing Diversity:** Differences in learning styles
 - Why: National concern, her university's demographics
- **Research questions:**
 1. What are the relationships between learning styles and clustered major groups, gender, and length of time in college?
 2. What information about learning styles will be most useful (and read by) participants?
- **Methods:**
 - Survey: Incorporating the Felder Learning Style Inventory and demographic questions
 - Focus groups and individual interviews

Conceptualizing & Defining Diversity

1. Race/ethnicity + class standing + participation in a structured mentoring program:

African American and Hispanic American first-year students in the POSSE program

2. Race/ethnicity + diverse student pathways:

Hispanic American students who transfer from 2-year colleges to a 4-year engineering program

3. Diverse learning styles

Conceptualizing & Defining Diversity

- Context is crucial: The types of diversity that are important to examine, as well as what those diversity categories really mean, are context-dependent.

Developing a Research Question

1. What effect does an intensive, structured mentoring program (Lafayette College's POSSE program) have on the retention of first year engineering students from minority backgrounds?
2. What are the most meaningful learning/developmental experiences that motivate Hispanic students to transfer from selected Texas community colleges to a 4-year engineering program?
3. What are the relationships between learning styles and clustered major groups, gender, and length of time in college?
What information about learning styles will be most useful (and read by) participants?

Developing a Research Question

- Moving beyond “what’s going on” to “how” and/or “why” things are the way they are
- Some reasons for this approach:
 - Describing the existing situation (the “what”) is important, but it’s also useful to dig deeper and attempt to understand why things are the way they are, or how the situation affects people in the setting.
 - Leaves room for unexpected discoveries

Choosing Research Methods

1. - Gathering demographic data – control
 - Gathering academic performance data
 - Semi-structured survey
2. - Large-scale questionnaire
 - Focus groups
3. - Survey
 - Focus groups and individual interviews

Choosing Research Methods

- Seeing the landscape and then digging deeper
- Some reasons for this approach:
 - Diversity issues involve people and their experiences
 - Many questions about diversity issues are best answered by methods that let participants explain their experiences in depth

Helpful Hints

- Know your target population
- Become familiar with your institution's IRB, and begin the Human Subjects process early
- Read the relevant body of literature about the diversity issues on which you are focusing

Helpful Hints

- Pilot test interview or survey protocols
- Get buy-in from your department, school, and/or institution

To be continued...

FIE 2007

Special Session: Communities of Practice in
Engineering Education: How Do We Investigate
Diversity and Global Engineering?

Acknowledgement

This material is based on work supported by the National Science Foundation under Grant No. ESI-0227558, which funds the Center for the Advancement of Engineering Education (CAEE). CAEE is a collaboration of five partner universities: Colorado School of Mines, Howard University, Stanford University, University of Minnesota, and University of Washington.

Cheryl Allendoerfer, PhD
CAEE, University of Washington
callendo@u.washington.edu