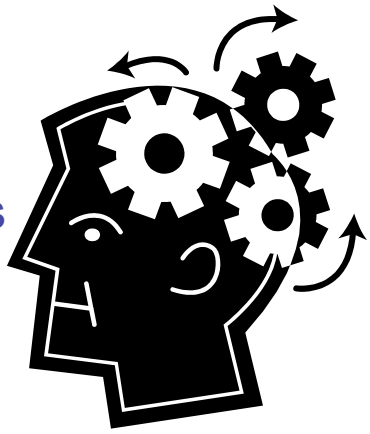
A Comparison of Epistemological Beliefs of African American Engineering Students



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Presentation Outline

- Introduction
- What is epistemology?
- Theoretical Framework
- Research Questions
- Method
- Results
- Discussion
- Questions

Introduction

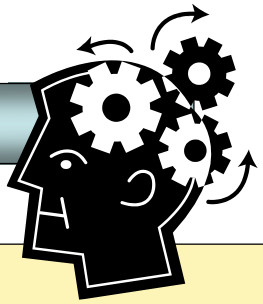
• **U.S. competitive edge in Science, Technology, Engineering,and Math (STEM)**
(Committee on Science, Engineering, and Public Policy, 2007)

•**Engineering Education Reform**
(National Academy of Engineering, 2005)

•**Engineering Epistemologies**
("The Research Agenda", 2006)

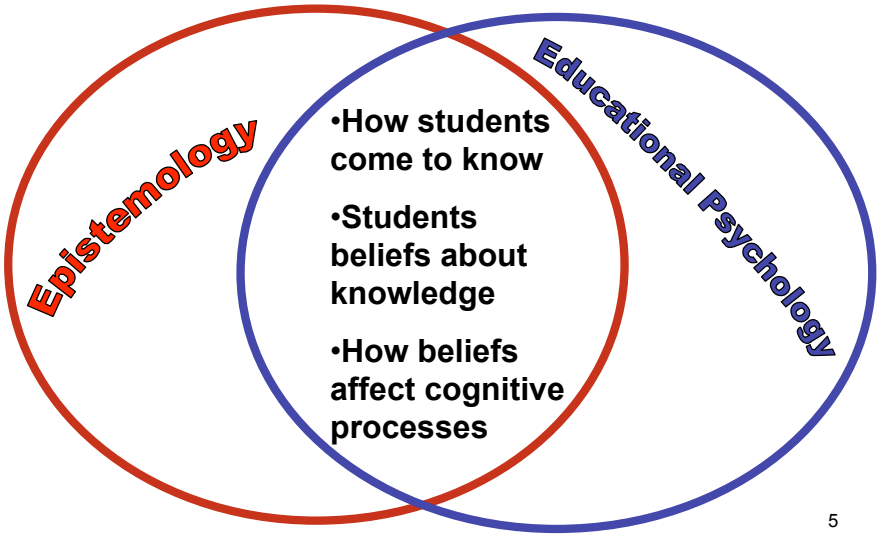
•**Underrepresented minorities for STEM pipeline**
(National Academy of Sciences, 2011).

What is Epistemology?



The branch of philosophy that studies the origin, nature, methods, and limits of human knowledge (Hofer & Pintrich, 1997).

Link between Epistemology & Educational Psychology



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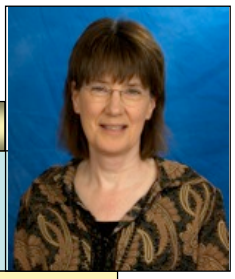
Schommer Framework



Dr. Marlene Schommer-Aikins

- Influenced by Perry's (1970) research.
- Independent dimensions

Dimension	Naïve vs. Sophisticated
–Structure	–Simple vs. Complex
–Certainty	–Absolute vs. Changing
–Control	–Fixed vs. Can Improve
–Speed	–Quick vs. Gradual

Literature Review: Epistemological Beliefs

- **Perry framework is most applied to engineering education.**

(Marra, Palmer & Litzinger, 2000; Pavelich & Moore, 1996; Wise et al., 2004)

- **Schommer framework is most used to compare engineering students to other majors.**

(Schommer, 1993; Trautwein & Ludtke, 2007)

- **Schommer framework is most used to compare educational levels.**

(Jehng, Johnson & Anderson, 1993; Schommer, 1993; Paulsen & Wells, 1998)

Literature Review: Critical to Engineering Education

Impact learning, thinking, and problem-solving.
(Schommer-Aikins, 2004)

- **Certainty** - draw absolute conclusions. (Schommer, 1990)
- **Fixed** - less likely to value school. (Schommer & Walker, 1997)
- **Quickly Acquired** - Poor comprehension. (Schommer, 1990)
- **Simple** - Settle for memorization. (Hofer & Pintrich, 1997)

Literature Review: HBCU and PWI

HBCU = Historically Black College or University

PWI = Predominantly White Institution

Literature Review: HBCU vs. PWI

Fleming (1984)
Trailblazer of HBCU vs. PWI

Four-year study found that African Americans at HBCUs were more likely to show gains in intellectual and social development.

Literature Review: HBCU vs. PWI

HBCUs are more likely than PWIs to:

- have positive interactions between students and faculty;
- admit students who are from a lower SES;
- admit students are less academically prepared for college studies.

(Allen, 1992; Cokley, 2000; Kim & Conrad, 2002; Lent et al., 2005; Perna et al., 2009; Southern Education Foundation, 2005)

HBCUs granted 20.6% of engineering bachelors awarded to African Americans in 2009.
(National Center for Science and Engineering Statistics, 2009)

Literature Review: African American Engineering Students

- **Students at HBCUs were more likely to have higher self-efficacy than peers at PWIs.** (Lent, Sheu, Schmidt, Brenner, Wilkins, Brown, Gloster, Schmidt, Lyons, & Treistman, 2005)
- **Students were more likely to have interests in engineering activities and interests pursuing engineering as a career.** (Lent et al., 2005)
- **Students found peers and faculty to be supportive.** (Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, & Gary, 2009)
- **Students surrounded by peers (perception), felt more connected to engineering community and were more likely to persist.** (Good et al., 2001-2002).

Gap in Literature

No quantitative studies to examine and compare epistemological beliefs of African American engineering students attending HBCUs vs. PWIs.

Research Questions

1. Do epistemological belief dimensions (certainty, structure, control, and speed) significantly differ for African American students attending a Historically Black University (HBCU) from those attending Predominantly White Institutions (PWI)?

2. Which variables (high school GPA, gender, educational level) best predict epistemological beliefs for African American engineering students attending HBCUs and PWIs?

Method

- **Participants**
- **Materials**
  - Schommer Epistemological Questionnaire (SEQ) (Schommer,1998)
  - Background Information Form (Barker, 1998)
- **Procedure**
- **Analysis**
  - Inter-item reliability analysis
  - T-tests
  - Hierarchical multiple regression

Results - Background Information

Gender
421 males; 91 females

Educational Level	
Freshman	130
Sophomore	98
Junior	104
Senior	150
Master	29
Doctoral	5

Ethnicity	
African American	**146**
Alaskan/Pacific	2
Asian American	26
Euro American	278
Hispanic	11
Multi-ethnic	11
Native American	2
Other	35

Note: African Americans at HBCU (N= 90) and PWI (N = 56)

Results - Reliability

Reliability - 3 Factor Structure

- **Fixed:** α = .72
- **Simple:** α = .61
- **Quick:** α = .64
- **Certain:** α = .46

Schommer (1993) found α = .63 to .85

Results - Question 1

No differences between African Americans at HBCUs vs. PWIs.

Belief Dimension	*Mean*	*SD*	*t-ratio*	*p (two-tailed)*
Fixed				
PWI	2.43	.51	.41	**.68**
HBCU	2.40	.48		
Simple				
PWI	3.04	.37	-.21	**.84**
HBCU	3.06	.37		
Quick Learning				
PWI	2.35	.49	-.026	**.98**
HBCU	2.35	.50		

Results - Question 2 (a)

Significant predictors of beliefs for African American engineering students (gender, high school GPA, educational level)?

- **HBCU** students.
  - **Simple Knowledge**:
  - 14.7 % total variance explained, $F(2, 83) = 4.18$, $p < .05$.
  - **Underclassmen** more likely to have beliefs that knowledge is simple than **Upperclassmen.**

Results - Question 2 (b)

Significant predictors of beliefs for African American engineering students (gender, high school GPA, educational level)?

- **PWI** students.
  - **Fixed Ability**:
  - 23.2 % total variance explained, $F(2, 46) = 5.64$, $p < .01$.
  - **Graduate students** more likely to have beliefs that knowledge is fixed than **Underclassmen.**
  - **Above average HS GPA** more likely to have beliefs that knowledge is fixed than **Average HS GPA**.

Results - Question 2 (c)

Significant predictors of beliefs for African American engineering students (gender, high school GPA, educational level)?

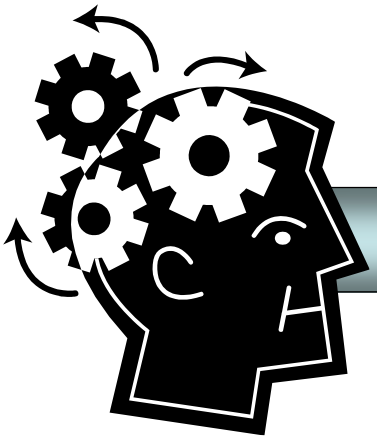
- **PWI** students.
  - **Quick Learning**:
  - 34.6 % total variance explained, $F(2, 46) = 4.86$, $p < .001$.
  - **Graduate students** more likely to have beliefs that knowledge is quickly acquired than **Underclassmen.**
  - **Above average HS GPA** more likely to have beliefs that knowledge is quickly acquired than **Average HS GPA**.
  - **Average HS GPA** more likely to have beliefs that knowledge is quickly acquired than **Below average HS GPA**.

Summary

- Exploratory study.
- **No significant differences** in epistemological beliefs between HBCU and PWI students.
- **Educational level** was a predictor for beliefs about simple knowledge (HBCU), fixed ability, and quick learning.
- **HS GPA** was a predictor for beliefs about fixed ability and quick learning.

Limitations & Future Research

- Generalizability ⇨ Needs replication
- Cross-sectional ⇨ Longitudinal
- Self-reported ⇨ Official records



Questions?