

# AAREA

An interdisciplinary research team led by Kathryn M. Borman, PhD

Alliance for Applied Research in Education and Anthropology

"Committed to applied research and engaged scholarship in the areas of education and anthropology"

High School, Undergraduate and Graduate STEM Education and STEM Careers

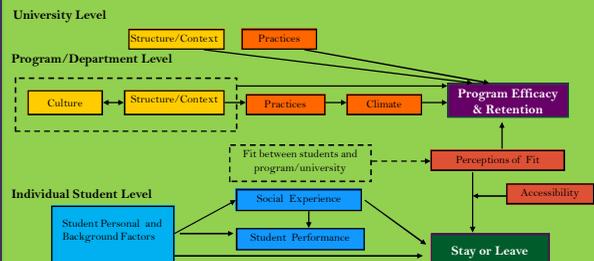
## NSF STEM Talent Expansion Program (STEP II)

### Effects of College Degree Program Culture on Female and Minority Student STEM Participation (2005-09)

**Data:** Surveys and interviews with faculty, deans, staff, current students and former students in Civil and Electrical Engineering at the University of South Florida (Tampa), University of Florida (Gainesville), Florida International University (Miami), and Florida Agricultural & Mechanical University/Florida State University (Tallahassee)

**Purpose:** To examine the effect of culture and climate of engineering and chemistry programs on women and minority students' motivation and ability to complete these STEM degrees.

#### Multi-Level Model of Student Retention



**Methods:** A partially mixed sequential dominant status design was employed whereby quantitative analysis of surveys and university enrollment data was undertaken first and narratives obtained from the thematic analysis of qualitative data illustrate these quantitative findings. The primary survey included 73 items and nine subscales assessing nine dimensions of climate for program efficacy: involvement, faculty support, institutional support, helpfulness, diversity, integration, fit, engagement, and importance. Results from quantitative and qualitative analyses were integrated to inform the understanding of program characteristics associated with successful program efficacy and persistence toward bachelor's degrees.

Complementary qualitative analyses included ethnographies of each institution including classroom observations. The research team used recruitment literature, program curricula and websites to understand how women and minorities are recruited and how programs value their recruitment. The research team conducted participatory workshops and focus groups to delve into issues facing all students, particular women and minority students, and brainstorm about their strategies for success, placing special emphasis on programs geared towards attracting, supporting, and retaining women and minority students.

**Findings:** Professors employed didactic pedagogical methods that clashed with the expectations and learning preferences of many women and minority students. Women and minority students preferred a non-competitive, collaborative environment along with group work and hands-on activities. Adaptation was key to persistence as these students relied heavily on the textbooks and the classmates to understand the material presented in class for themselves. Most women and minority students expressed apprehension at seeking the advice of faculty outside of the classrooms, while white male students generally did not. In contrast, faculty, deans, and staff believed that students did not come into engineering with the mathematics background necessary to succeed and that students did not understand the level of commitment necessary to be an engineer.

**Collaborators:** Florida Department of Education, Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP)

**Program Officer:** Susan Hixson

## NSF Research on Learning and Education (ROLE)

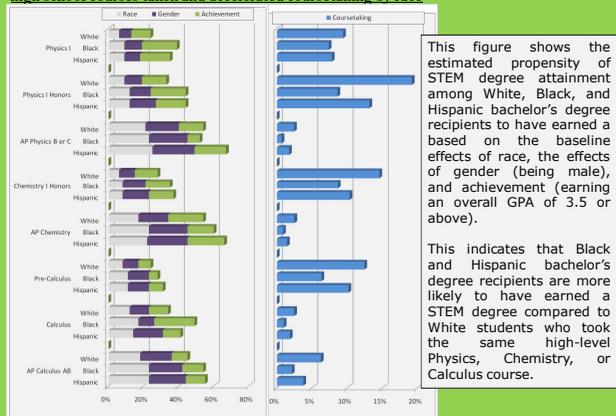
### Understanding Factors that Sustain STEM Career Pathways (2003-08)

**Data:** Data from the Florida Department of Education K-20 Data Warehouse was obtained and analyzed to understand the unique institutional arrangement of Florida's statewide articulation agreement providing students a seamless transition from public high schools to community colleges to public universities. National researchers, state-level administrators, and other government officials have commended Florida for connecting its K-12, workforce, postsecondary, corrections, and other databases into a comprehensive K-20 data system for tracking student progress to support performance-based education funding. Project data includes all 1996-97 Florida public high school graduates (~97,000), all 1996-97 Florida public university graduates (~33,000), and all 2002-03 Florida public university graduates (~40,000).

**Purpose:** To track education and career outcomes of Florida high school and college graduates to determine student-, district-, and university-factors that impact persistence in STEM-related coursetaking, degree attainment, and careers.

**Methods:** Quantitative methods explored the longitudinal nature of each dataset by modeling transition points on STEM pathways from 11<sup>th</sup> grade through eight years after college graduation. Transition points include 12<sup>th</sup> grade mathematics coursetaking, lower-level undergraduate STEM core prerequisites coursetaking, STEM bachelor's degree attainment, STEM graduate degree attainment, and entry into the STEM workforce. Multivariate techniques used to model these transitions include logistic regression, ordinary least squares regression, latent class analysis, hierarchical linear modeling, and survival analysis.

#### STEM degree attainment among bachelor's degree recipients by high school courses taken and accelerated coursetaking by race



**Findings:** Both level and content matter in high school coursetaking. The primary finding was that accelerated high school math and science coursetaking and achievement predicted persistence through STEM high school pathways into STEM degree attainment. High school is a primary point for African-American and Hispanic students as well as women to drop off STEM pathways by not continuing to take accelerated science and mathematics courses into their 11<sup>th</sup> and 12<sup>th</sup> grade years. The effect of high school coursetaking remains through students' undergraduate studies to impact STEM degree attainment.

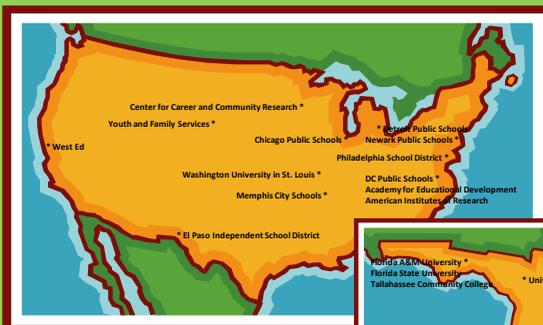
**Collaborators:** Florida Department of Education

**Program Officer:** James Dietz

## Ten Years of National Research on STEM Pathways

AAREA is dedicated to using rigorous quantitative and qualitative methods to conduct applied research on current education, evaluation and policy issues from multiple disciplinary perspectives. The past decade of research and evaluation work has included research and evaluation studies funded by NSF, US DOE, Spencer Foundation and the FL DOE. Each study has built on those preceding it to create a comprehensive understanding of school reform at national, state (FL) and local (Hillsborough County/Tampa) levels and how these reforms influence student success. This poster highlights NSF-funded research and evaluation over the past 10 years.

Collaborators and Project Sites



New Projects: High School Coursetaking and Post-Secondary Outcomes

## NSF Research and Evaluation on Education in

### Science and Engineering (REESE)

#### On-Track for STEM Careers: Access to Rigorous and Relevant STEM Courses in Florida's High Schools (2008-11)

This study builds on the results of our ROLE study by examining how access to rigorous and relevant STEM courses in high school lead to immediate post-secondary interest in STEM degree attainment in Florida postsecondary educational institutions. Almost all Florida high schools offer some form of accelerated science and mathematics courses from 9<sup>th</sup> to 12<sup>th</sup> grade, but it is not yet clear how increased course offerings have addressed lingering disparities. The current project examines who enrolls in accelerated academic programs and if accelerated academic programs increase students' STEM coursetaking in high school and during their first year after high school graduation. This research will provide policymakers at state, district and local levels with important knowledge for improving high school curricular programs to enhance STEM student persistence, particularly for women and other underrepresented groups.

**Collaborators:** Florida Department of Education, Hillsborough County Schools

**Program Officer:** Celeste Pea

### NSF Innovative Technology Experiences for Students and Teachers (ITEST)

#### Expanding Opportunities for Innovative and Technology-Rich STEM Experiences through Florida's High School Career Academies (2008-11)

In 2007-2008, more than half of Florida's school districts (n=36) had career academies with more than 544 programs of study offered in these academies. In 2007, the FL Legislature passed the Career and Professional Education Act (F.S. 1003.491). The law requires districts to develop 5-year plans collaboratively with business and postsecondary partners and establish at least one career and professional academy no later than the beginning of the 2008-2009 school year. This study used Florida high school student records from the Florida Department of Education administrative data and qualitative data from a subsample of schools will be analyzed to determine the course-taking patterns, and career or college enrollment outcomes of students enrolled in STEM-themed career academies.

**Collaborators:** Florida Department of Education, Hillsborough County Schools

**Program Officer:** Larry Suter

Contact AAREA at <http://anthropology.usf.edu/aarea/>

K-12 Education

## NSF Directorate of Education & Human Resources (EHR)

### Assessing the Impact of the NSF's Urban Systemic Initiative (1999-2001)

**Findings:** In addition to the critically important role of school culture in positively affecting student outcomes on a variety of standardized tests, this study of Chicago, Miami, Memphis, and El Paso elementary schools also yielded a number of significant findings on the linkages between professional development and classroom practices and between classroom practices and achievement in mathematics. Teachers who reported participating in the following professional development activities had significant relations with identified instructional practices with effect in parentheses:

- *In-depth study of mathematics content* – collecting data or information (.48); having students maintain and reflect on a portfolio (.39); using performance tasks (.43); and using sensors or probes (.40).
  - *Activities emphasizing multiple strategies for student assessment* – using performance tasks (.45); using hands-on measurement activities (.43); analyzing data to infer or draw conclusions (.39); and work in schools where they have many opportunities to learn new things (.43).
  - *Participating in a teacher network or study group* – presenting new information using manipulatives (.43).
  - *Participating in a formal portfolio activity* – using small groups to write a mathematics report (.50); using small groups to work on demonstrations or presentations (.40).
- Teachers who reported that their professional development emphasized the following activities had significant correlations to student mathematics test score gains in their schools over the four-year period of the USI reforms: State or national content standards in mathematics (.35), Implementation of new curriculum or instructional (.46), Use of educational technology (.29), Professional development that provided in-depth study of mathematics content or methods of teaching (.30).

**Collaborators:** Council of Chief State School Officers, Technical Advisory Network

**Program Officer:** Bernice Anderson

Elementary Education

## NSF Research on Gender in Science and Engineering (GSE)

### Teaching SMART® (2004-07)

This study implemented *Teaching SMART®*, a science professional development program for 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grade teachers in one Hillsborough County elementary school. Approximately 20 elementary teachers and their students participated in the three-year implementation of the program. Findings indicate that the program had a positive influence on teacher and student attitudes toward science. In particular, third grade students indicated more positive views about science than their fourth and fifth grade peers. Participating teachers expressed overall satisfaction with the program and a desire to continue using it in their future teaching.



**Collaborators:** Hillsborough County Schools

**Program Officer:** James Dietz

K-12 Education

## NSF Directorate of Education & Human Resources (EHR)

### Evaluation of Center for Inquiry in Science Teaching and Learning (2005-09)

**Purpose:** This study evaluates the effectiveness of the CISTL program of activities in providing research opportunities in science education and learning, rebuilding and diversifying the human resource base for STEM education, increasing the number of K-12 STEM educators with the knowledge to implement standards-based science instruction, and creating synergy between research and practice through research-based practice, and translating these results into practical suggestions for science educators.

**Methods:** CISTL employed qualitative methods were used to analyze the data collected for this evaluation study. The semi-structured and focus group interviews were transcribed and coded by three members of the AAREA evaluation team (there was 75 percent coding agreement) using themes that emerged from the evaluation questions, preliminary review of transcripts, and reviewing documentation such as the annual reports and meeting minutes. The interview transcripts were entered into QSR N6 (formerly known as Nu\*DIST) for analysis. The field notes of observations, scopes of work, quarterly progress reports, curriculum materials, email communication and meeting minutes collected by the AAREA evaluation team were analyzed to identify themes that could further elucidate the evaluation questions.

**Findings:** Recommendations include the need to: 1) continue funding for the C.A.D.R.E. Model Program, 2) publicize the St. Louis Regional Database Project, 3) provide support for ISIs and partners pursuing grant opportunities, 4) ensure that scholarly publications in progress are published in appropriate journals, and 5) dissemination of professional development curriculum units.

**Collaborator:** Washington University at St. Louis

**Program Officer:** Mike Haney

