UNIVERSITY OF ILLINOIS

AT URBANA-CHAMPAIGN

STEM Intervention Programs at Large, Public, Research Universities: Common Trends and Challenges

Kimberly Walker, M.S
Lorenzo Baber, Ph.D.
William Trent, Ph.D.

illinois.edu

Purpose of the Study

Project STEPUP examines the matriculation, persistence, and degree attainment of full-time, first-time enrolled women, minorities, and low-income undergraduate students in science, technology, engineering, and mathematics (STEM) fields using a mixed methods research design.

Reasons for Investigation

- Social justice – Reducing inequality and improving opportunities

- Workforce preparation and economic competitiveness

- Changing demographics

- Benefits of diversity

- Connection between social stratification, opportunities for social mobility, and higher education

National Trends

- Since 2000, the proportion of Science & Engineering (S & E) degrees increased:
  - 7% to 8% for Black students
  - 6% to 8% for Hispanic students
  - 0.5% to 0.7% for American Indian/Alaska Native students
  - However, the shares of degrees earned by Black and American Indian /Alaska Native students have remained fairly flat (NSF, 2010).

- Underrepresented minorities (i.e., Blacks, Hispanics, and American Indians/Alaska Natives) earned 17% of both S&E and non-S&E bachelor's degrees in 2006, up from 10% in 1989. (NCES 2008).

- The percentage of the population ages 25–29 with bachelor's or higher degrees was 20% for Blacks, 12% for Hispanics, and 36% for whites in 2007, up from 12%, 9%, and 25%, respectively, in 1987 (NCES 2008).
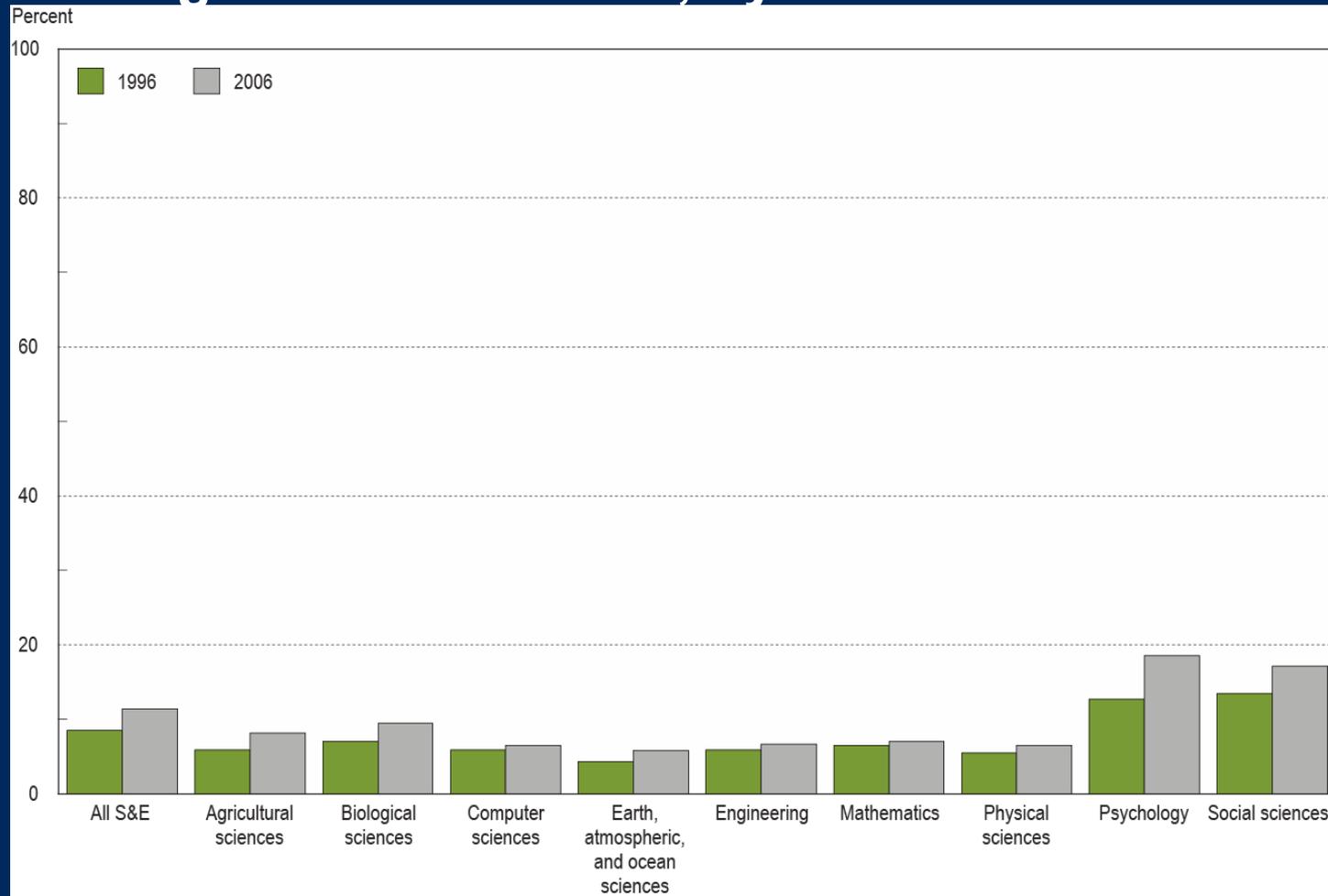
National Trend: Minority share of S&E and non-S&E bachelor's degrees: 1995–2008
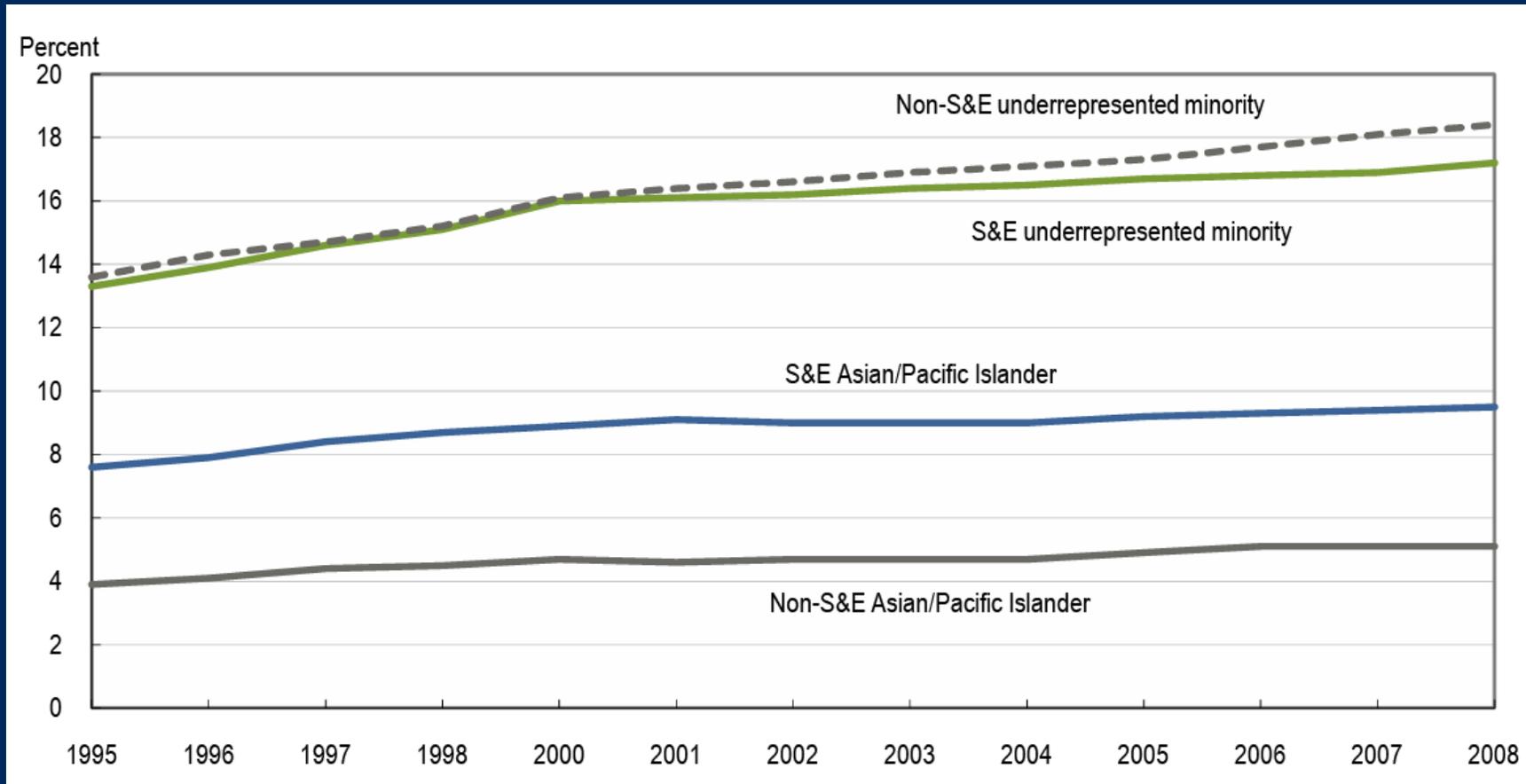
National Trend: Underrepresented minority share of S&E graduate students, by field: 1996 and 2006

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Graduate Students and Postdoctorates in Science and Engineering, 1996 and 2006.

SOURCE: National Science Foundation, Division of Science Resources Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 1995–2008
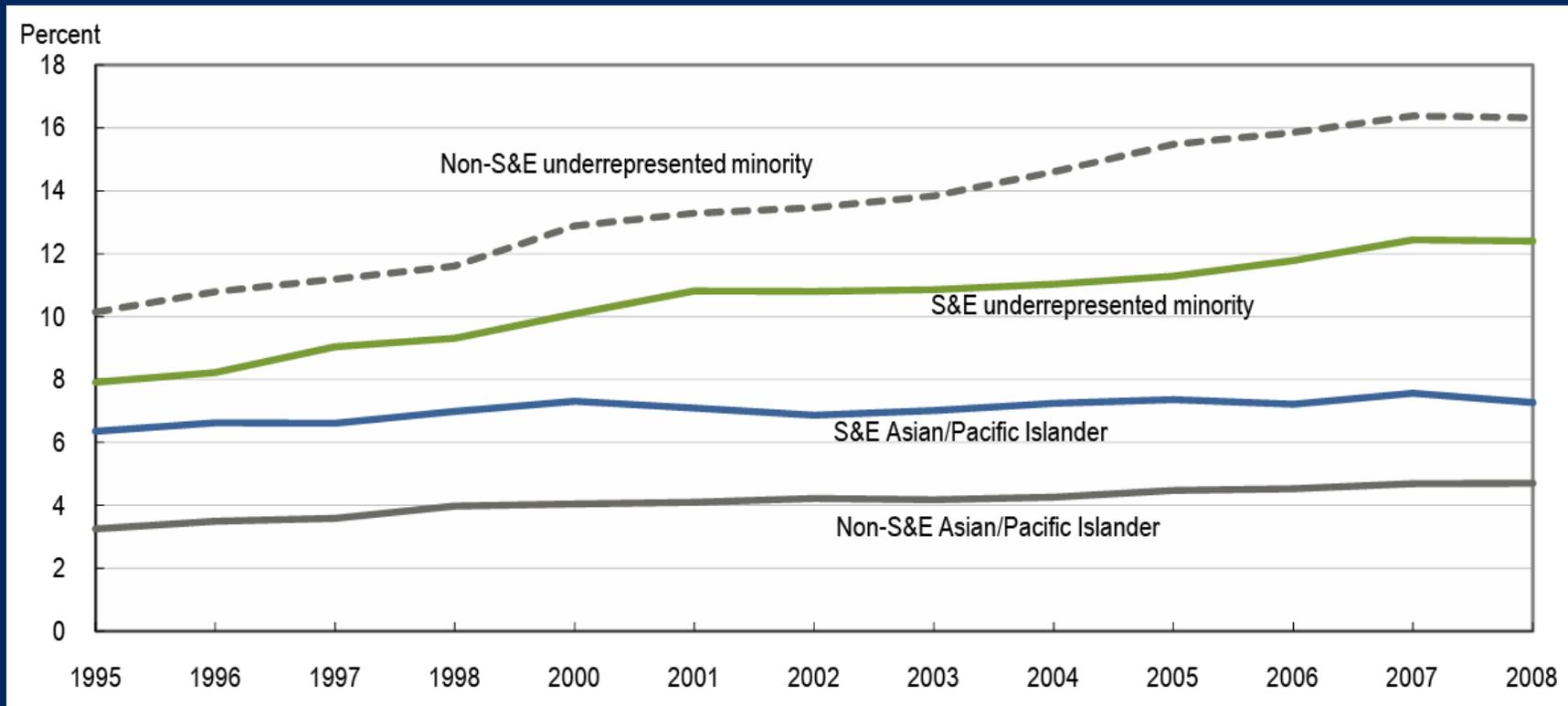
Doctoral degrees awarded in S&E and non-S&E fields to U.S. citizens and permanent residents, by race/ethnicity: 1989–2007
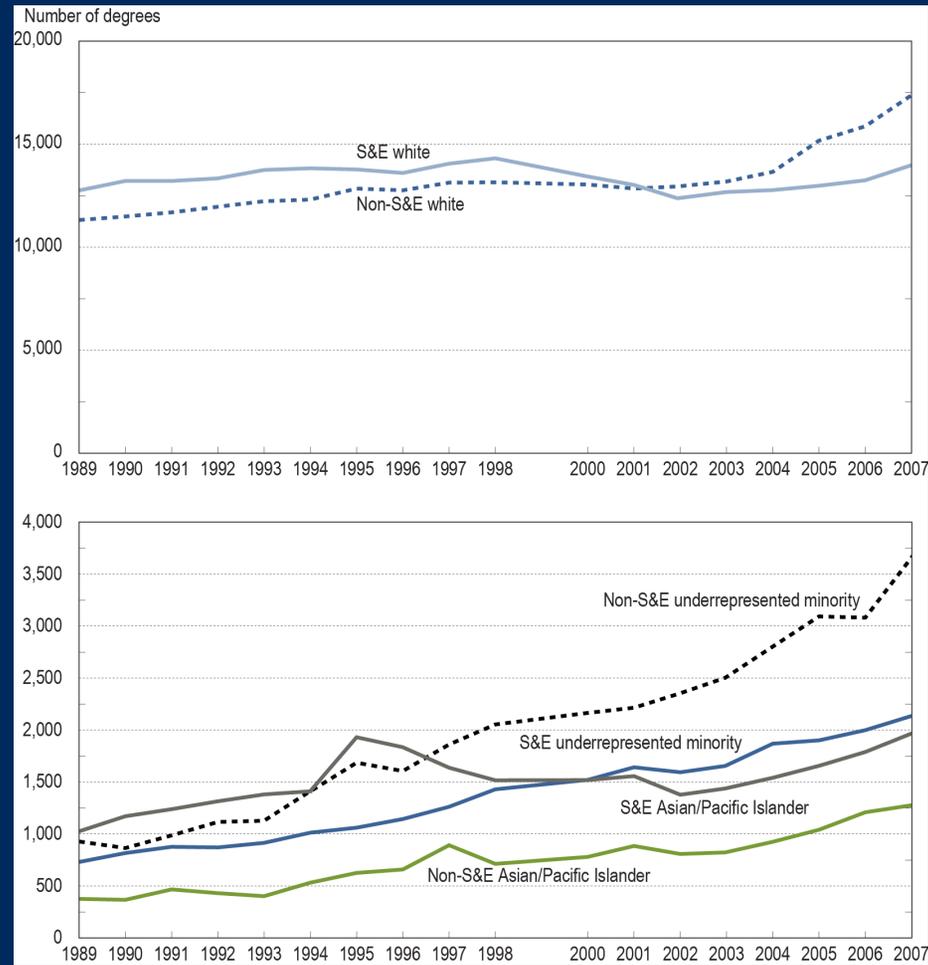

SOURCE: National Science Foundation, Division of Science Resources Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 1989–2007.

illinois.edu

Employed doctoral scientists and engineers, by race/ethnicity and occupation: 2006

Scientists

- American Indian/Alaska Native 0.7%
- Other 0.3%
- Hispanic 3.1%
- Black 3.2%
- Asian 17.9%
- White 74.7%

Engineers

- American Indian/Alaska Native 0.3%
- Other 0.0%
- Hispanic 2.7%
- Black 2.0%
- Asian 32.9%
- White 62.0%
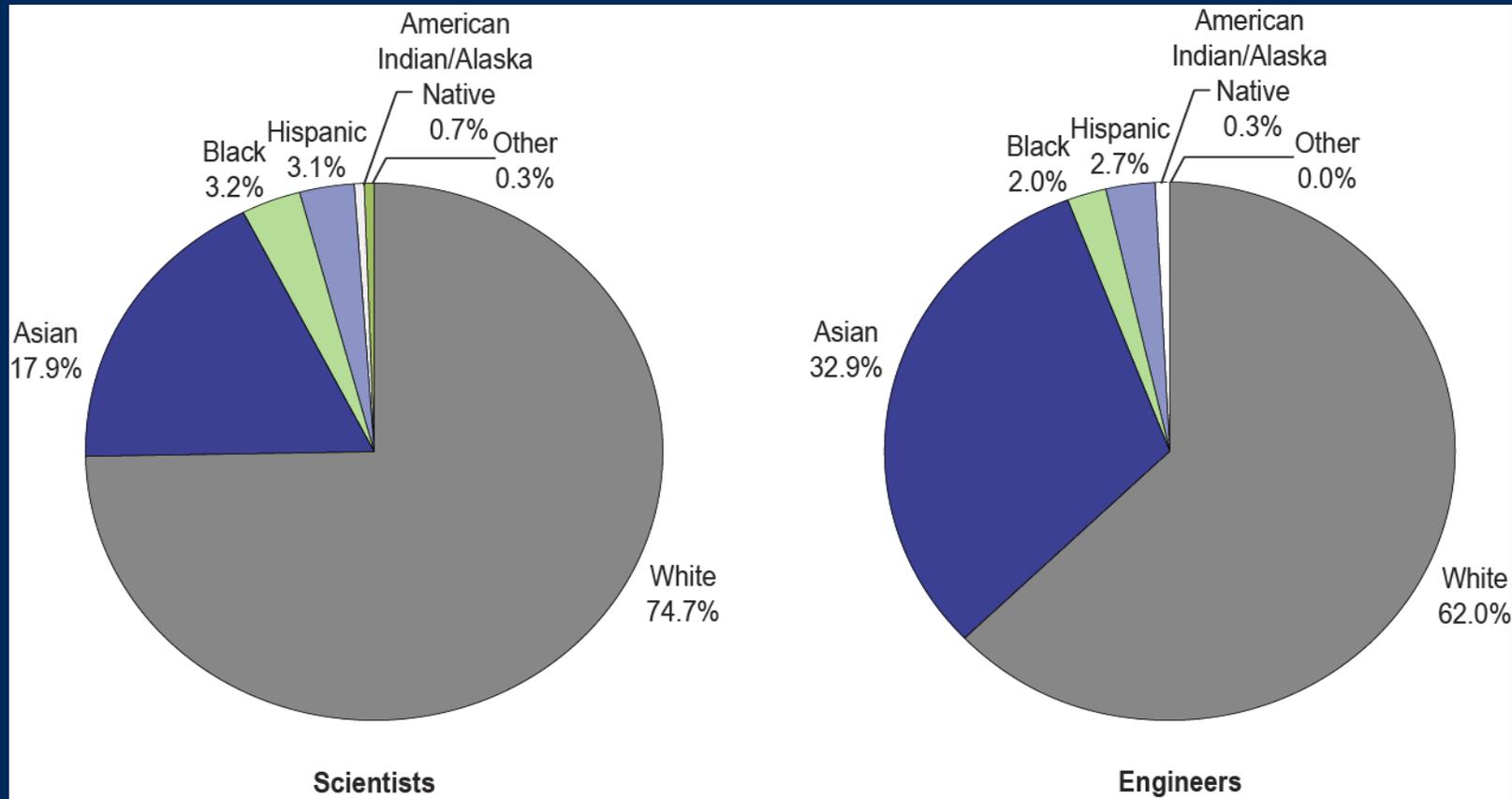
SOURCE: National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT).

illinois.edu

Overview of STEM Intervention Programs

- STEM intervention programs seek to recruit and retain underrepresented populations in the STEM fields, as well as encourage their advancement into graduate programs in STEM majors:
  - Academic Bridge Programs   -Mentoring & Advising
  - Research Opportunity Programs   -Financial Support
  - Tutoring   -Social Networks & Support

- Intervention programs have been shown to benefit students who participate in their services, and students in STEM fields in general:
  - Aid in transition to college and choice of STEM majors
  - Increase awareness of STEM majors and careers
  - Create opportunities for access for underrepresented groups
  - Aid in transforming composition of the STEM workforce

Project STEP-UP

- STEM Trends In Enrollment & Persistence for Underrepresented Populations (STEP-UP)

- STEP-UP Intervention Program Component
  - What theories or perspectives guide the design of STEM intervention programs?
  - How are STEM intervention programs structured?
  - How are STEM intervention programs funded?
  - What are the common challenges that STEM intervention programs face?

Data & Methods

- Data
  - Interview data has been gathered from 9 large, public, research universities.
  - 47 participants:
    - 11 male, 36 female
    - 27 white, 19 African American, 4 Hispanic, 1 Native American, and 1 Asian American.
  - A total of 97 documents and reports were gathered from the STEM intervention programs.

- Methods
  - Qualitative Methods
    - Semi- structured interviews with program administrators
    - Content Analysis

1867

illinois.edu

Common Trends Among Intervention Programs

- Evolution of Programs
  - Change of Mission
  - Selection of Participants
  - Student Qualifications
- Collaborative Efforts
- Financial Support and the Impact on Delivery of Services
  - National & State Budget Deficits
  - Sources of Funding
- Assessment Efforts in Measuring Outcomes
- Staff/ Program Expertise

Common Trends:
Evolution of Programs

- ## Merit vs. Development

  – "The [summer research] program has changed for most of [the universities that offer this program]. It was a program that was meant to provide students with an opportunity to conduct research. And so the focus wasn't necessarily on getting them into graduate school right away. Because we even took sophomores so it would be a couple of years before they could even consider that. But it was more a chance for them to work with a faculty member and to understand what graduate education was about, what research was about. And so it wasn't as rigorous of a program".

  – "Again, in the past it was, "Let's bring these students in and give them this opportunity, and let's change the world. Let's make sure students have this kind of exposure," and at that time it was the proper legal thing to do. But now we have to look at things differently and try to correct whatever is the issue here and deal with our issue of inclusion."

Common Trends:
Evolution of Programs

- ## Selection of Program Participants

  – "…we look at their high school class rankings and their math ACT score because our math ACT has the strongest correlation with their success in our chemistry classes, more so than science reasoning. So very much it's the math ACT. We go slightly below the average, so we go with a competitive ACT score, so the average math ACT in our chemistry classes is a 28. "

  – "It [summer research program] has changed drastically in the past three years. When I started the average GPA score for students was a 3.0. And while admissible to graduate programs in STEM fields, that's not going to get you any love. So this year we are just finalizing our cohort. We're at a 3.65 [GPA] for the students in our cohort."

Common Trends:
Evolution of Programs

- Student Qualifications

  – "Again, those things have evolved and we're right now at the place where we're really wanting to see which of these students will be admitted by the departments. We know that there are many that are admissible, so we're wanting them to gain admission. That's a real—it's a more clearly stated goal than what we've had in the past".

Common Trends:
Collaborative Efforts

- "So, every department has chief advisors, and our group meets, as a whole, with the chief advisors once a month and with the associate heads of the departments once a month. And at any time we can bring up women engineering issues. And we do. So, we rely on the departments to help us with the Undergraduate Research program. We rely on them to help us with the orientations with the student visits. So, I like that we're not separate. We are part of the fabric of the college. And that, I think, helps get the message out to the departments in a much more effective way".

- "Across the departments, we have a core group of people that would do anything to support these initiatives. I've been working with one faculty member for the seventeen years that I've been here, every year. And if I don't do something with him then he seeks me out and wants to know what can he do?"?

Common Trends:
Financial Sustainability

- Sources of Funding
  - Funding Source(s)
    - *Soft Funds*
    - *Hard Funds*
    - *Corporate Funds*
- Institutional Support & Commitment
- Influence of Policies

Common Trends:
Financial Sustainability

- ## Sources of Funding
  - ### Soft Funds
    - *Participants noted that having their program funded by soft money hindered their ability to sustain their intervention program.*
    - *Soft funding also contributes to staffing shortages and turnover faced by many programs*

Common Trends:
Financial Sustainability

- ## Soft Funds: Programming

  - "Gift money, grant money, things like that. He [the Dean] gives us zero money for programs. Now, there have been times where we've been not doing as well raising money, where the dean will do something that he calls back stop our programs. So, you have to plan six or eight months in advance. You may not have the money yet. It's like if you don't start the planning, waiting on the money, then you're not going to have the program. So, he'll say, "I'll back stop the program, which means that if the money doesn't come in, I'll guarantee it, but keep trying to get the money and keep planning the program." Usually, the money comes in, and it's okay. But if he has to give us a couple hundred dollars at the end, he will. So, mostly he hasn't had to. But the fact that he's willing to do that allows us to plan".

Common Trends:
Financial Sustainability

- ## Hard Funds

    - *Intervention programs that were noted as being a line item on their college/university budget expressed their institution's long-term commitment to their programs and related diversity efforts.*

    - *The funding source of these programs is seen as a campus priority, and has been sustainable overtime due to the institution's commitments and funding decisions.*

Common Trends:
Financial Sustainability

- ## Hard Funds: Program Sustainability

  - "Our programs—part of our programs are also supported by the dean and the dean's structure, like the program that is supported by the dean through their corporate funds that they raised. Some other programs are funded by our own efforts, through our alumni, through some proposals that we write. I think it's appropriate for us to do a little bit of proposal writing. And the perceptions there would be, "If we have an idea, let's raise some funds to support it. But if it's an important idea, then the dean should be involved." I'm glad to say he has been very involved to support some of the ideas that we have".

illinois.edu

Common Trends:
Financial Sustainability

- Corporate Funds
  - Competing stories
    - *"(The program)receives no funding from state money ...all of the funding comes from the industry".*

    - *"The corporate funding is repetitive and it doesn't depend on the results of the program. We've given them the results and it doesn't matter [if the program doesn't work]".*

Common Trends:
Assessment Efforts in Measuring Outcomes

- ## Research and Evaluation Challenges

    – "That is our big weakness. There have been periods when the evaluation has been better than others. And so, I'd have to say we get a D-. The best we do anymore in the last couple of years has been to provide data for the Central Database. We have had opportunities to track students, but when the staffing changes – there's no excuse. We have not done it, even though we know and I know that we need to be able to predict. Much of what we do now is more anecdotal than I'd like".

Common Trends:
Assessment Efforts in Measuring Outcomes

- ## Research Challenges

  – "So, no, there's been no evaluation. There's some pressure to do it. I've asked, I mean, I got to the point where I asked the associate director flat out, "What are you looking for? Do you want me to just give you percentages? Or, do you actually want me to start gathering data or getting general information about our students versus other students, for example?" And trying my best to do some sort of regression analyses that show differences between the two. And I sort of got a horrified look as soon as I mentioned the word regression, and was told, "No, no, I'm not sure we need that level of detail".

Common Trends:
Staffing/Program Expertise

- ## Staffing Trend

    - The general trend shows that women administrators working in Women in Engineering (WIE) or Women in Science (WIS) have bachelors and/or advance degrees in respective engineering or science fields.

    - The majority of administrators working in traditionally underrepresented minority programs do not have a bachelors and /or advance degree in the sciences but in various, unrelated majors.

    - Few administrators have been formally trained in student services

illinois.edu

Recommendations

- Pursue stable, recurring funding

- Purposeful staffing

- Investigate opportunities for collaboration inside & outside home institution to assist with

– Service delivery

– Program design

– Program assessment

– Funding

Recommendations

- TRIO as a STEM Intervention Resource
  - TRIO programs have a demonstrated track record of enabling student access and engagement
  - TRIO programs have a demonstrated record of sustained student support
  - TRIO programs have the demonstrated capacity to effectively deliver counseling and advising services
  - TRIO programs used a staffing model that is skill and credential-based

Limitations

- Nine sites that are large, four-year, research intensive, and predominantly white universities

- Response rate based on self-selection

- Recruitment to participate based on publicly available information of STEM intervention programs on each institutions' website

- Programs are housed in certain STEM fields

- No contemporaneous statements from students participating in programs

Questions and Discussion

Contact Information

Project STEP-UP

217-244-5274

stem@education.illinois.edu

http://stepup.education.illinois.edu/