Inclusion and Equity Matters:

The Role of Community Colleges in Diversifying the STEM Pipeline

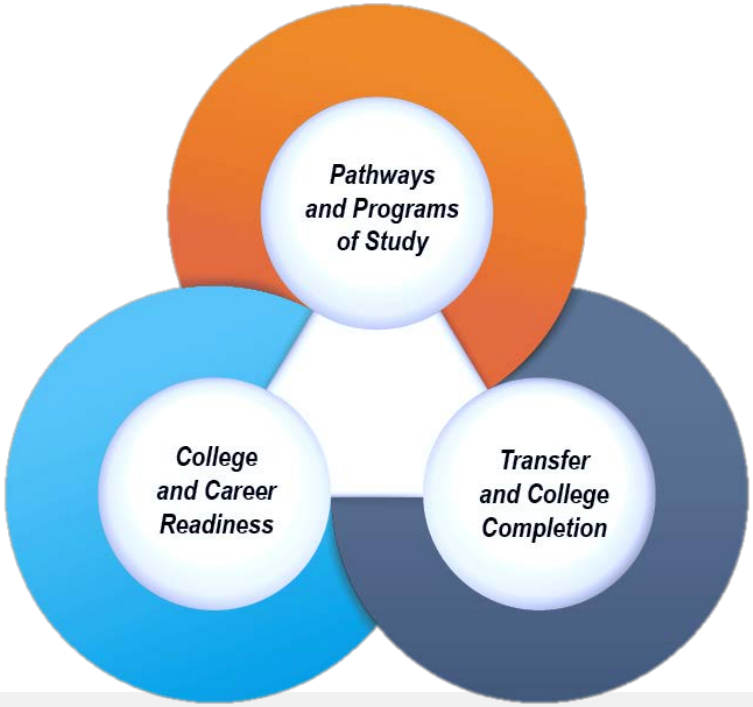
Webinar Presented for the
Louis Stokes Midwest Center of Excellence (LSMCE)

Dr. Eboni M. Zamani-Gallaher
University of Illinois at Urbana-Champaign

OCCRL
Office of Community College Research and Leadership

OCCRL Mission

OCCRL researchers study policies, programs, and practices designed to enhance outcomes for diverse youth and adults who seek to transition to and through college to employment.



Perceptions of Community Colleges

- Perception vs. reality
- Once the culprit, now the cheerleader
- Shifting persistent perceptions

The Community College Landscape

- Origins of U.S. Community Colleges
- Institutional Types
- Student Demographics

Top 10 Largest Number of Public Community Colleges

U.S. News and & World Report 2015

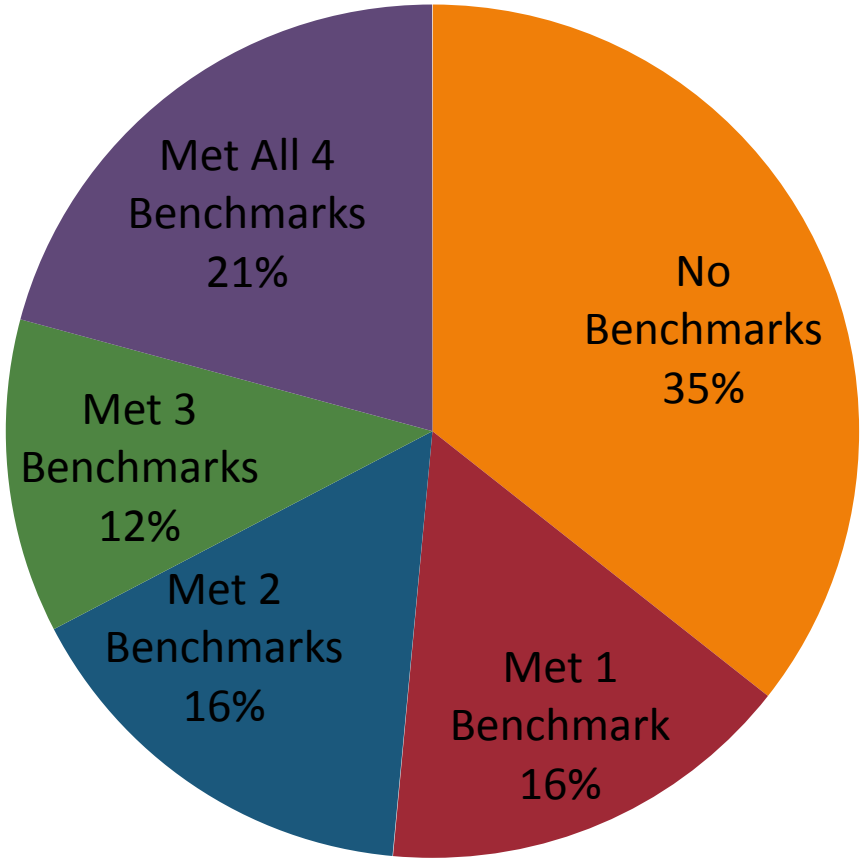
California	117
Texas	62
North Carolina	60
Illinois	48
New York	39
Minnesota	32
Michigan	30
Georgia	29
Ohio	26
Kansas	25

Adults with Associate's Degrees

U.S. Department of Education, National Center for Education Statistics. (2012). *The Condition of Education 2012* (NCES 2012-045)

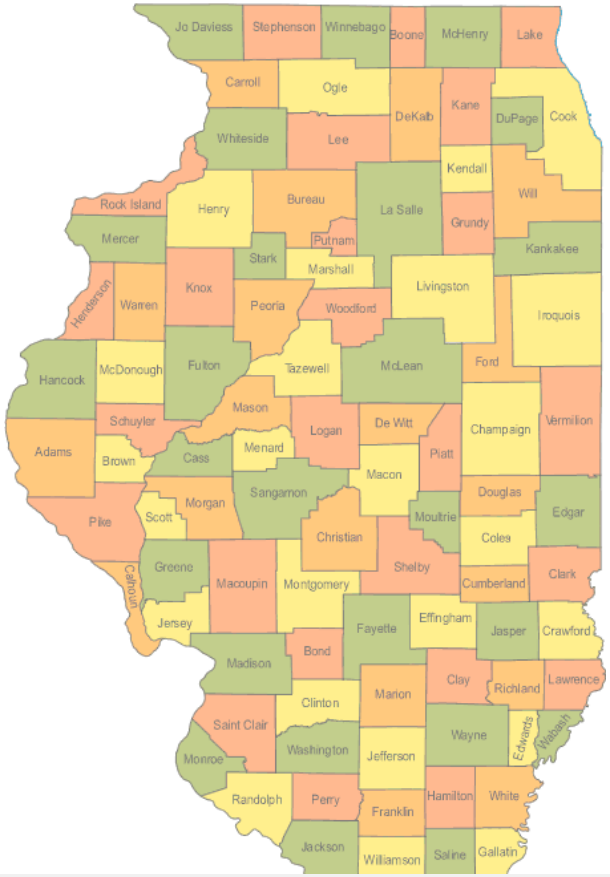
Associate's	833,337	100.0%
White	552,863	66.3
Black	113,905	13.7
Hispanic	112,211	13.5
Asian/Pacific Islander	44,021	5.3
American Indian/Alaska Native	10,337	1.2

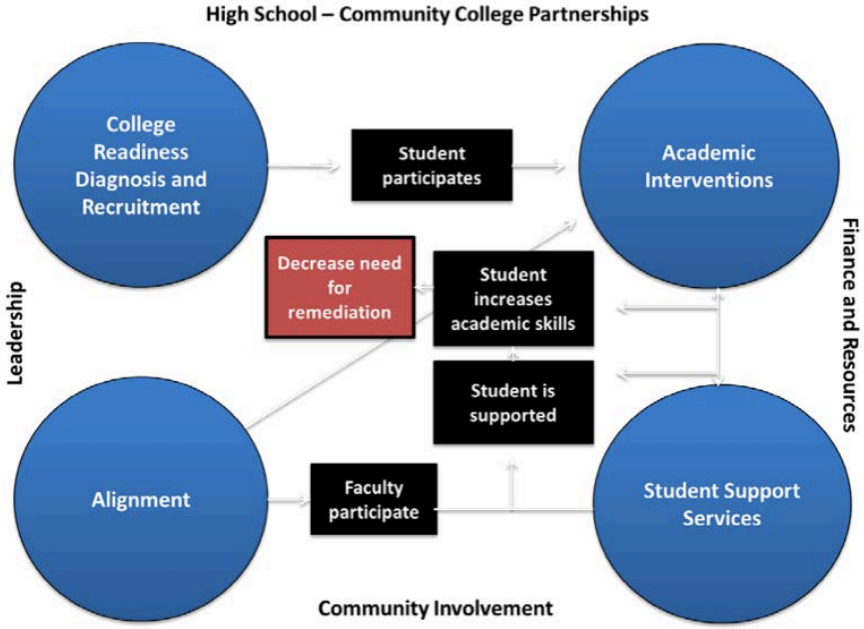
College Readiness Benchmarks Attained

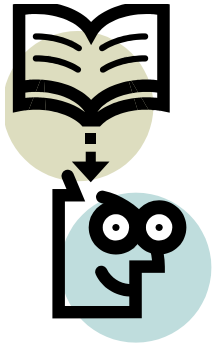


2012 Condition of College and Career Readiness Retrieved from http://www.act.org/newsroom/data/2012/index.html

Illinois STEM CCR







Key Literature on STEM and CCs

- Women and racially/ethnically diverse groups are the fastest growing populations in the U.S. workforce

- The United States ranked 20 out of 24 countries in the percentage of 24-year-olds who had earned a first degree in the natural sciences or engineering

- 2.7 percent of African Americans, 3.3 percent of Native Americans and Alaska Natives, and 2.2 percent of Hispanics and Latinos who are 24 years old have earned a first university degree in the natural sciences or engineering

- STEM job growth is expected and necessary in the U.S. to remain globally competitive (The Council of State Governments, 2010)

- Women are 60% more likely to earn a college degree than men (U.S. Census Bureau, 2011), however there remains a discrepancy in STEM programs

- 32.4% of Asian American/Pacific Islander aspirants complete a Bachelors degree; 24.5% of White students, 7.9% of Hispanics and 13.2% of African Americans aspirants complete BA/BS degrees (Malcom, 2010)

- 6% of employees in STEM are African American compared to their White counterparts at 72% (Malcom, 2010)

- Low transfer rates by men and women of color make recruitment into STEM from community college populations problematic

- Studies on women of color and transfer students reveal common experiences of those in STEM, such as isolation, not belonging, discrimination, low self-confidence, and concerns of financial aid

- Starobin and Laanan (2008) ascertain that the community college environment can foster meaningful mentorship relations to encourage careers in STEM

Statement of the Problem

- Women and racial/ethnic minorities enter into STEM disciplines at lower rates than men do

- It has been arguable whether community colleges can further enhance student success for a diverse society and global workforce in lieu of low transfer rates and transfer shock (Goldrick-Rab, 2006; Townsend, 1999)

- Student attendance patterns demonstrate what is referred to as student swirl (Sturtz, 2006) whereby student behavior in obtaining a college credential is less predictable

A Study of Transfer and STEM

- Based on the aforementioned literature, the overall aims of this study were to explore prevalence of transfer type among STEM transfer students at a Midwest comprehensive university

- To look at STEM majors transfer attendance patterns (i.e., number of previous colleges) that illustrate swirling and may effect academic performance -- transfer shock as measured by overall cumulative GPA

Research Questions

- Is there an association for race/ethnicity and gender with STEM major, transfer hours earned, number of prior colleges attended, and transfer type among transfer students majoring STEM disciplines?

- Are there any between- or within-group differences in transfer type, GPA, and transfer credit hours earned by race/ethnicity among transfer STEM majors?

- Does increased mobility of attendance (i.e., two or more prior colleges attended), transfer type (e.g., vertical, lateral, reverse) or fewer transfer credit hours earned predict transfer shock (i.e., impact GPA) for STEM students?

Conceptual Underpinnings

Social Mobility

– Morgan, Grusky, & Fields (2006)

Student Swirl

– (Selingo, 2012)

Transfer Shock

– (Hills, 1965)

Context

- Two out of every five undergraduates are transfer students. More than 8,400 students identify as transfer students
  - Almost 10% of the total student body are STEM majors
  - Over 40% STEM majors are transfer students

- 65% of the STEM majors are White (male or female)

- Students of color majoring in STEM disciplines consisted of 18% African American, 4% Asian, and 3% Hispanic/Latino. No other racial/ethnic category comprised more than 1%, while 6% of STEM majors did not designate a racial identifier

Methods

- Exploratory, ex post facto inquiry and analysis of secondary data
  - Look “backwards” to see what causes difference or condition to occur (e.g., some students swirling or not; some experiencing transfer shock)

- Data was accessed through the Institutional Research Office

- Sample included STEM student majors that transferred between 2010-2012, which yielded a total net sample of 1,064 transfer STEM students

Descriptive Findings

- 42% female, 58% male
- 66.3% identified as White (non-Hispanic), 12.6% African American, 3.6% Asian American/Pacific Islander, and 3.6% Hispanic, 9.5% race/ethnicity unknown and 4% nonresident-alien.
- 37.5% of White transfer STEM students were women (n=264); by contrast, females comprised the majority of STEM transfer majors for students of color (n=121)
- 65.3% STEM transfer females of color were African American

Descriptive Findings

- 70% of STEM transfer students were in one of five majors
  - Biology (42.2%), Computer Science (10.8%), Applied Computer Science (8.7%), Mathematics (8.7%) and Chemistry (6.5%)

- When examining the data for STEM majors by gender and race/ethnicity, 6 out of every 10 females majored in Biology irrespective of race

- Biology was also the most pursued STEM major among male transfer students, accounting for one-third of men of color and 31.5% of White males

Evidence of Swirling

Examples of 48 Transfer Patterns/Transfer Type

- No degree 2-vertical
- No degree 4-vertical
- 2-4 traditional vertical
- 4-4 traditional lateral
- Vertical/lateral (e.g., 0-4; 2-4)
- 2-2-4-4 lateral/vertical/lateral
- 4-2; 4-0 reverse
- Multiple lateral swirl 4-4-4
- Multiple lateral/vertical swirl 2-2-2-4

Post-hoc Multiple Comparisons
Dunnett's Test

Dependent Variable	(I) Race	(J) Race	Mean Difference (I-J)	Std. Error	Sig.
Major	Student of color	White	-1.268*	.254	.000
		Race unknown/NRA	-1.177*	.344	.002
	White	Student of color	1.268*	.254	.000
		Race unknown/NRA	.092	.300	.986
	Race unknown/NRA	Student of color	1.177*	.344	.002
		White	-.092	.300	.986
Overall credit hours attempted	Student of color	White	-14.448*	3.807	.001
		Race unknown/NRA	-21.103*	5.107	.000
	White	Student of color	14.448*	3.807	.001
		Race unknown/NRA	-6.656	4.195	.304
	Race unknown/NRA	Student of color	21.103*	5.107	.000
		White	6.656	4.195	.304

ANOVA

	Source	SS	df	MS	F	Sig.
Major	Between Groups Within Groups	270.264 12642.945	2 1061	135.132 11.916	11.340	.000
Overall credit hours attempted	Between Groups Within Groups	46921.020 2320829.607	2 1061	23460.510 2187.398	10.725	.000
Overall credit hours earned	Between Groups Within Groups	52916.271 1881370.969	2 1061	26458.135 1773.205	14.921	.000
Transfer credit hours attempted	Between Groups Within Groups	11664.638 951885.530	2 1054	5832.319 903.117	6.458	.002
Transfer credit hours earned	Between Groups Within Groups	11453.176 943030.319	2 1054	5726.588 894.716	6.400	.000
Two-year credit hours earned	Between Groups Within Groups	24795.651 1373037.985	2 863	12397.826 1591.006	7.792	.000

Multiple Regression

- Higher credit hours attempted (b = -1.788, t = -5.451, p < .001) and transfer hours earned (b = 2.509, t = 6.788, p < .001) significantly predicted transfer shock (i.e., lower GPAs) among STEM transfer students of color

- Overall credit hours earned reflected better GPAs among student of color transfer STEM majors (b = -.591, t = -4.263, p < .001)

Limitations

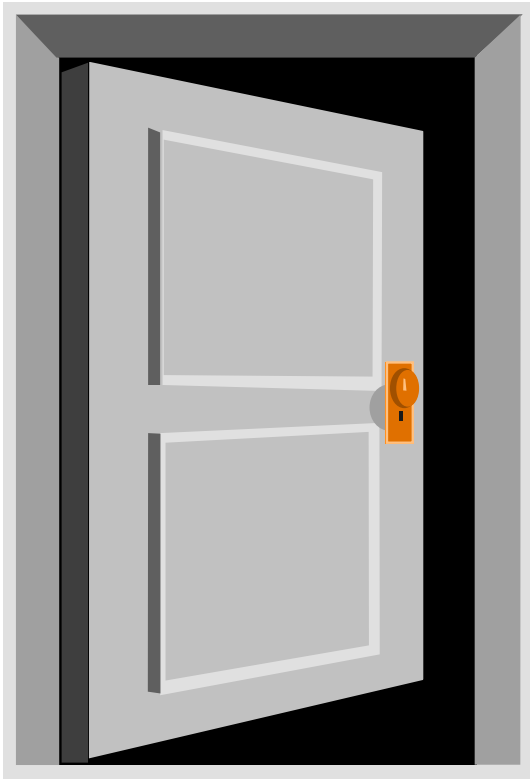
- Study was not drawn from a probability sample as there was no random selection of transfer students
- No claims of being representative of the entire transfer population or STEM majors
- Establishing cause-effect relationships is more difficult than in experiments
- The findings yielded few statistically significant associations, and those emerging can only suggest the possible causation

Conclusions

- Community colleges will be in demand given the increased need for postsecondary attainment for gainful employment

- Despite the transfer function not being seamless across two- and four-year contexts, it still carries a utilitarian function poised to be a catalyst for optimization of educational and career planning

- Exploration of student swirl with segmentation theories needed



Implications for Practice & Research

- Practitioners must ensure seamless continuity of matriculation that will not obstruct educational progress between various segments of higher education

- Future studies need to focus on the crucial needs of this population, their perceptions of transfer readiness, self-efficacy, and whether either foster capital in the form of currency to be spent upon transfer

- Also important is research that gauges student satisfaction with their transfer institutions as well as the receiving universities in facilitating a seamless transition from two- to four-year

References

American Association of Community Colleges (2015). *Fast facts*. Retrieved from http://www.aacc.nche.edu/AboutCC/Pages/fastfactsfactsheet.aspx

Aragon, S. R., & Zamani, E. M. (2002). Promoting access and equity through minority serving institutions. In M.C. Brown (Ed.), *Equity and access in higher education: Changing the definition of educational opportunity* (Readings on equal education), no. 18. NY: AMS Press, Inc.

Baber, L. D. (2015, Winter). Considering the interest-convergence dilemma in STEM education. *The Review of Higher Education*, *38*, (2), 251-270.

Crisp, G., & Nora, A. (2012, July). *Overview of Hispanics in science, mathematics, engineering and technology (STEM): K-16 representation, preparation and participation*. White paper for the Hispanic Association of Colleges and Universities.

Dowd, A. C. (2012). Developing supportive STEM community college to four-year college and university transfer ecosystems. *Community colleges in the evolving STEM education landscape: Summary of a summit*, 107-134. Retrieved from http://cue.usc.edu/Developing%20Supportive%20STEM%20Community%20College%20to%20Four-Year%20College%20and%20University%20Transfer%20Ecosystems.pdf

Gasman, M., & Nguyen, T. H. (2014). Historically Black Colleges and Universities (HBCUs): Leading our nation's effort to improve the science, technology, engineering, and mathematics (STEM) pipeline. *Texas Education Review*, *2*(1), 75-89.

Gasman, M., & Samayoa, A.C. (2015, January 15). Minority serving institutions left out of community college conversation. *The Hill*. Retrieved at http://thehill.com/blogs/pundits-blog/education/229531-minority-serving-institutions-left-out-of-community-college

Harper, S. R. (2010). An anti-deficit achievement framework for research on students of color in STEM. *New Directions for Institutional Research*, 148, 63-74. doi: 10.1002/ir.362

Hills, J. R. (1965). Transfer shock: The academic performance of the junior college transfer. *The Journal of Experimental Education, 33*(3), 201-215.

Hoffman, E., Starobin, S. S., Laanan, F. S., & Rivera, M. (2010). Role of community colleges in STEM education: Thoughts on implications for policy, practice, and future research. *Journal of Women and Minorities in Science and Engineering*, *16*(1), 85-96.

Malcom, L. E. (2010). Charting the pathways to STEM for Latina/o students: The role of community colleges. *New Directions for Institutional Research*, *148*, 29-40.

Palmer, R. T., & Wood, J. L. (Eds.). (2013). *Community colleges and STEM: Examining Underrepresented racial and ethnic minorities*. New York, NY: Routledge.

Starobin, S. S., & Laanan, F. S. (2008). Broadening female participation in science, technology, engineering, and mathematics: Experiences at community colleges. *New Directions for Community Colleges, 142*, 37-46.

Sturtz, A.J. (2006). The multiple dimensions of student swirl. *Journal of Applied Research in the Community College*, *13*(2), 151-158.

The Council of State Governments (2010, August). *Women and minorities in STEM education*. Retrieved from http://knowledgecenter.csg.org/drupal/system/files/FF_Women_STEM.pdf

Questions

Office of Community College Research and Leadership
University of Illinois at Urbana-Champaign
College of Education
51 Gerty Drive
Champaign, IL 61820

Dr. Eboni Zamani-Gallaher, Director
ezamanig@illinois.edu

Update on Research and Leadership
Visit the OCCRL Website at www.occrl.illinois.edu
Email: occrl@illinois.edu
Twitter @OCCRL