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)

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University of Illinois at Urbana-Champaign
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.

Strengthening Pathways for All Students Through Research and Leadership
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*

<table>
<thead>
<tr>
<th>State</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>117</td>
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<tr>
<td>Texas</td>
<td>62</td>
</tr>
<tr>
<td>North Carolina</td>
<td>60</td>
</tr>
<tr>
<td>Illinois</td>
<td>48</td>
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<tr>
<td>New York</td>
<td>39</td>
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<td>Minnesota</td>
<td>32</td>
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<tr>
<td>Michigan</td>
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<tr>
<td>Georgia</td>
<td>29</td>
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<tr>
<td>Ohio</td>
<td>26</td>
</tr>
<tr>
<td>Kansas</td>
<td>25</td>
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</table>
## Adults with Associate’s Degrees

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate’s</td>
<td>833,337</td>
<td>100.0%</td>
</tr>
<tr>
<td>White</td>
<td>552,863</td>
<td>66.3%</td>
</tr>
<tr>
<td>Black</td>
<td>113,905</td>
<td>13.7%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>112,211</td>
<td>13.5%</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>44,021</td>
<td>5.3%</td>
</tr>
<tr>
<td>American Indian/Alaska</td>
<td>10,337</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

College Readiness Benchmarks Attained

- No Benchmarks: 35%
- Met 1 Benchmark: 16%
- Met 2 Benchmarks: 16%
- Met 3 Benchmarks: 12%
- Met All 4 Benchmarks: 21%

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 affect 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

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<thead>
<tr>
<th>Dependent Variable Major</th>
<th>(I) Race Major</th>
<th>(J) Race Major</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
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<tbody>
<tr>
<td>Student of color</td>
<td>White</td>
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<td>-1.268*</td>
<td>.254</td>
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<td>Race unknown/NRA</td>
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<td>-1.177*</td>
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<tr>
<td>White</td>
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<td>1.268*</td>
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<td>-6.656</td>
<td>4.195</td>
<td>.304</td>
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<tr>
<td>White</td>
<td>Student of color</td>
<td>21.103*</td>
<td>5.107</td>
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<tr>
<td><strong>Major</strong></td>
<td>Between Groups</td>
<td>270.264</td>
<td>2</td>
<td>135.132</td>
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<tr>
<td></td>
<td>Within Groups</td>
<td>12642.945</td>
<td>1061</td>
<td>11.916</td>
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<td><strong>Overall credit hours</strong></td>
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<td><strong>Transfer credit hours</strong></td>
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<td>earned</td>
<td>Within Groups</td>
<td>1373037.985</td>
<td>863</td>
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</table>
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.


Questions
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