

## **Native-Born and Foreign-Born Black Students in STEM: Addressing STEM Identity and Belonging Barriers and their Effects on STEM Retention and Persistence at the Two Year College**

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## Background

Two-year colleges provide a rich, diverse student population (people of color, women, older students, veterans, foreign born students, international students, first-generation college-goers, low-income, and working parents) with access to higher education who thus have the *potential* to increase participation of underrepresented students in STEM. Unfortunately, graduation and transfer rates for black students (native-born and foreign-born) are still significantly lower than those of their non-black counterparts (with the exception of Pacific Islanders and Native Americans) at both the two-year college and four-year college.

Factors influencing retention and persistence in STEM majors are diverse and often interconnected. Leading reasons for low STEM retention and persistence at both the two-year and four-year colleges are: uninspiring introductory courses, lack of math preparation, and an academic culture not welcoming of women, minorities, and non-traditional students.<sup>1,2</sup>

Numerous efforts have been initiated to increase the numbers and success of underrepresented students majoring in STEM disciplines; however, factors influencing retention and persistence of STEM majors continue to be problematic.

It is important to focus on the culture of STEM education because the social, psychological, and structural dimensions of STEM in these institutions influence how students connect their personal identities to their academic domains and view themselves as learners in those domains (their academic identities), which subsequently affects their efforts and achievement.<sup>3-5</sup> In STEM fields, underrepresented minorities are particularly vulnerable to disengagement with the “STEM culture” (leaving a STEM field of study) due to beliefs about their ability to succeed in STEM, even when accounting for prior academic preparation.<sup>6</sup> The relationship between institutional or disciplinary culture, race, and ethnicity is especially relevant to racial and ethnic minorities that are even more underrepresented in STEM than they are in most other fields.<sup>7,8</sup>

In 2014, 10.5 million foreign-born persons had a college degree or higher, representing about twenty-nine percent of the total 36.7 million U.S. foreign-born population ages 25 and over. Foreign-born Americans are earning STEM degrees in disproportionately large numbers, compared to the native-born U.S. population.<sup>9</sup> Thirty-three percent of all graduates with engineering degrees are foreign-born, twenty-seven percent are graduates in computers, math, and statistics, and twenty-four percent are in physical sciences.<sup>9,10</sup> Of the entire foreign-born population receiving STEM degrees, foreign-born blacks and native-born blacks make up only eight percent of all STEM graduates.<sup>11</sup> Surprisingly, however, foreign-born black students are enrolling in post-secondary institutions and graduating at higher rates than native-born black students.<sup>12</sup>

In today's society, ethnicity and nationality are often subsumed by race and thus the distinctions among people of the same race are commonly ignored.<sup>13,14</sup> The most prevalent example is the homogenization of being described as black or African-American. STEM research on underrepresented minorities, particularly African-Americans, merges native-born and foreign-born blacks as a single demographic or excludes foreign-born data altogether together without examining the cultural differences among the two groups.<sup>15</sup> The over-representation of homogenized African-Americans in higher education complicates and stifles evidence of academic disparities, post-secondary policies, and STEM best practices.

This paper examines the differences between native-born and foreign-born blacks pursuing an undergraduate STEM degree. Despite sharing a racial minority status, these two groups differ in their perception of post-secondary education and in their response to adversity (academic attainment) in STEM. Through the STEM program, we compare Native-born and Foreign-born Black undergraduates' perceptions and report how each group addresses and overcomes the barriers of STEM identity and belonging in the "culture of STEM" through the STEM program activities, i.e. STEM industry visits, undergraduate research opportunities, and tutoring sessions. We report graduation and transfer rates of both groups participating in the STEM program.

### Institution

The STEM program sits in the two-year college of a diverse, multi-campus urban research university in metropolitan Atlanta. The college is the major provider of associate degrees and student transfer opportunities in Georgia and a gateway to higher education, easing students' entry into college-level study. With a student population of more than 21,000 students, representing all ages and backgrounds, the college serves the largest number of dual enrollment, international, online, transfer and first-time freshman students in the University System of Georgia. The Fall 2011 full-time enrollment (FTE) for both STEM and Non-STEM students was 20,466. Due to the non-traditional status of many of the students, an equation is employed to calculate full-time equivalents when defining FTE. Table 1 shows enrollment and graduation rates for STEM and non-STEM students. STEM students are defined as those that have enrolled in or taken Pre-Calculus and/or Principles of Chemistry.

**Table 1. Institutional enrollment, graduation, and transfer rates for STEM and non-STEM students entering 2011-2012.**

	<b>STEM Students</b>	<b>Non-STEM Students</b>	<b>Total</b>
Enrollment (FTE)	4402	18702	20466
Graduates 2013-2014 (Associates degree)	154 (3%)	1533(8%)	1,687 (8%)
Transfers 2013-2014 (to 4-year institution)	542 (12%)	5302 (28%)	5844 (29%)

## Program Information

Beginning in Spring 2012, through National Science Foundation funding, a STEP program was developed for 2-year, full-time students, with a minimum 2.8 grade point average. To participate, students must have U.S. citizenship or status as permanent resident alien or refugee alien and be majoring in a STEM field of study. The objectives of the program are two-fold: 1) to increase the number of students (U.S. citizens or permanent residents) who enroll in all STEM fields (chemistry, biology, math, geology, physics, computer science, and engineering) and 2) to increase the number of students who graduate and/or transfer to four-year colleges/universities to complete their STEM baccalaureate degrees. STEP (at this 2-year institution) does this through a number of student support mechanisms for accepted STEM students:

- Implementing SI in many first-year courses (math and chemistry in particular)
- Summer Bridge Research Opportunities (3 week, 8 week, and Research Experiences for Undergraduates (REU) options)
- Civic Engagement (students are required to complete 10 hours per semester)
- Industry Visits (day-long trips to local STEM-relevant companies)
- University Visits (tours of campuses and research labs at 4-year institutions)
- Student Stipends (variable and determined by participation in program elements)

In an effort to increase degree attainment and transfer in STEM fields, STEM industrial and academic partnerships were developed to allow for student visits and research opportunities. Through partnering with external institutions, students are exposed to possible academic and career pathways, including research fields, institutions to which they could transfer to obtain their 4-year degrees, and potential employers.

Additionally, through multiple activities in the program, students come together regularly and are able to form a social network of their peers. The regular interactions of these URM STEM students foster a camaraderie that is often seen as students choose to take classes together, create informal study groups, and interact socially outside of the college.

Students participate in the program for an average of 3 semesters (including a summer semester). Stipends are given to those participants that meet the following criteria each semester: (1) be enrolled as a full-time student (12 credit hours during the fall and spring semester); (2) maintain a cumulative minimum GPA of 2.8 and a minimum semester GPA of 2.5; (3) participate in a minimum of 10 hours of STEM civic engagement activities per semester; (4) participate in a minimum of six STEM-related activities (STEP-sponsored and others). Stipend amounts vary depending on the classification of the participant. Additional stipends are given for participation in Summer Bridge I undergraduate research experience (3 weeks), Summer Bridge II undergraduate research experience (8 weeks), and REU participation. STEP sponsors multiple STEM activities each semester, including STEM industry visits and college visits.

In this publication, foreign-born is referred to persons with no U.S. citizenship at birth. All other Blacks are classified as native-born. This population includes naturalized citizens and legal permanent residents. Participants self-classified as U.S. citizens or Permanent Residents on the program application.

## Cultural Distinction Theory and Academic Attainment of Foreign-born and Native-born Blacks

More than 12% of all black undergraduate students enrolled in U.S. colleges and universities are foreign-born.<sup>15-17</sup> Foreign-born blacks make up twenty-seven percent of the black student population at selective colleges and forty-one percent of the Black student population at Ivy League institutions.<sup>15, 17</sup> Within the past five years, there has been a growing body of research on the comparison of college access and experiences between foreign-born and native-born blacks.<sup>18,19</sup> Much of the literature (educational experiences and outcomes in the United States) has been conducted by anthropologists or sociologists and very few studies have been conducted by STEM practitioners.

Cultural distinction theory posits that foreign-born blacks possess cultural values and experiences that are distinctive compared to those of native-born blacks, who have an ancestral history of slavery and post-slavery experiences. The differences may enhance socioeconomic and educational attainment of foreign-born blacks, who were socialized in a society where they are the racial majority, thus potentially creating an achievement gap between foreign-born and native-born blacks.<sup>20</sup> To further understand cultural distinction theory, Ogbu & Simmons<sup>21</sup> classify foreign-born blacks and native-born blacks as voluntary and involuntary minorities, respectfully. Foreign-born blacks (voluntary minorities) are those who have chosen to come to the United States in order to obtain a better future, and as such, they may not internalize the cultural dynamics of America or feel particularly a part of the relationship between American Whites and non-Whites. The voluntary minorities' accommodate without assimilation by overcoming language differences and differences between their cultural systems and that of the dominant host society.<sup>22</sup>

Native-born blacks (involuntary minorities) are those that (1) did not choose but were forced against their will to become a part of the United States, and (2) usually interpret their presence in the United States as forced by white people.<sup>21</sup> Native-born blacks (involuntary minorities) often do not share the same level of positive expectations for their future as foreign-born blacks<sup>23</sup> thus, tend to experience the more challenges with academic performance and adjusting to school than foreign-born blacks (voluntary minorities). This cultural difference is often observed in the academic attainment performance gap that exists for both foreign-born blacks and native-born blacks in comparison to their white counterparts, but more specifically, in the performance gap that exists between the two groups.

### The Culture of STEM

The explicit and implicit customs, behaviors, and values that are normative within STEM education make up the culture of STEM.<sup>24</sup> An examination of the culture of STEM education is important because of how the social, psychological, and structural dimensions of STEM education in two-year and four-year colleges influence student identity, belonging, self-efficacy, and encouragement. The “STEM culture” a student experiences shapes their awareness and understanding of standards, expectations, and their sense of belonging in STEM. More importantly, the encouragement or lack thereof within the “STEM culture” of the department and/or institution can support or undermine their performance and persistence through their self-concepts and beliefs and their feelings of community and belonging in STEM fields.<sup>3-5</sup>

For historically underrepresented students, such as black students, views of the way race and ethnicity function in their college environment are especially important in their social and academic adjustment.<sup>25</sup> Experiencing a college culture with a hostile or unwelcoming racial environment has been related to social and academic withdrawal,<sup>3,26,27</sup> academic and social isolation,<sup>28-30</sup> and low retention and graduation rates.<sup>31</sup>

### The Homogenization of Blacks in STEM

Foreign-born blacks are enrolling in post-secondary institutions at higher rates than native-born Blacks and foreign-born Blacks are the fastest growing group within the overall Black population pursuing a STEM degree.<sup>15,17</sup> However, many institutions and STEM departments merge foreign-born Blacks and native-born blacks into a single demographic due to a shared race without collecting data on the ethnicity or nativity of the students. Although both groups contribute to racial and ethnic diversity enrollment, retention, and graduation numbers, it is only the racial identity of both foreign-born and native-born blacks that is the marker of diversity.

The practice of merging these two groups without investigating and addressing the needs for academic success reinforces a homogenous perspective of the black population. This homogenization is counterintuitive to the heterogeneity that STEM diversity and inclusion programs support; furthermore, homogenizing blacks in STEM complicates the understanding of best practices for underrepresented minorities, i.e. foreign-born and native-born blacks. More attention must be focused on the experiences and persistence of these two groups to address factors influencing retention and persistence in STEM majors.

### Identity/Belongingness, Encouragement, and Self-Efficacy in STEM

Self-perceptions regarding academic competence are framed by personal and collective identities. Each student has many such identities - racial identity, socioeconomic identity, professional identity, sexual identity, and family identity. These identities are framed by upbringing, experiences, and society at large, and can shift across time either unconsciously or through deliberate effort.<sup>32</sup>

Belonging to valued social groups is a fundamental human need and a sense of inclusion is particularly important for underrepresented groups in STEM when stereotypes imply that they might be unsuitable to certain settings, such as rigorous academic classes.<sup>33-35</sup> Feeling a sense of belonging and acceptance by others in STEM (faculty and peers) is crucial to retention and persistence for these STEM students.<sup>36,37</sup>

Foreign-born blacks may initially distinguish themselves from native-born blacks, but eventually, the system itself imposes a black racial identity, thus forcing foreign-born black students to “identify” with native-born black students. This occurs impart because race is the overall determinant of underrepresented black minorities but is not always an effective grouping based upon cultural distinction theory.<sup>14</sup>

## Barriers in STEM

Despite their heterogeneous backgrounds, members of foreign-born and native-born blacks report experiencing cultural or structural marginalization, peer racism, less equitable treatment by faculty, and stereotyped perceptions that they lack academic aptitude and a strong work-ethic to be successful in STEM.<sup>38-42</sup> These barriers (real or perceived) have been attributed to academic and cultural isolation, lack of peer support, and poor student-faculty relationships that in turn serve as barriers to the success of both foreign-born and native-born students by excluding them from the scientific community and various social networks.<sup>43</sup>

The STEP program seeks to address these barriers through formal and informal approaches. Regular opportunities for participating students to interact with faculty, extensive advising, and the development of a strong social network among their peers through program activities support STEP student success among native- and foreign-born black students.

## Data Collection

We tracked academic outcomes (GPA, graduation, and transfer rates) for all participants of the program (2012-2016). Over the course of these 4 years, the STEP program supported 91 foreign-born black students and 55 native-born black students.

Additionally, during their tenure in the program, participants were asked to complete a number of surveys and interviews to determine their reactions to and perceived outcomes of the various student support activities. Surveys probed psychosocial constructs related to student persistence and success (below) and were conducted annually using a retrospective approach. Though students were strongly encouraged to complete surveys, many participants opted out.

1. STEM Engagement – Student engagement can be examined in terms of behavioral engagement (demonstration of interest), emotional engagement (positive reactions), and cognitive engagement (student investment in learning). Example: “I enjoy my STEM coursework.”<sup>44</sup>
2. Institutional Commitment – Previous research has indicated that institutional commitment is a strong indicator of student persistence. Example: “I am committed to completing my program of study at this institution.”<sup>45,46</sup>
3. STEM Identity and Belonging – A sense of belonging and identifying with STEM contributes to student pursuit of STEM careers. Example: “I can see myself in a STEM career.”<sup>47</sup>
4. Encouragement – Studies attempting to get at influences that lead students to major in STEM have elucidated encouragement as a major factor in this decision; feeling encouraged can be a predictor of whether or not students are likely to major in a STEM discipline. Example: “I feel encouraged to get a STEM degree.”<sup>48</sup>
5. Intent to Persist – Student intention to persist is highly indicative of actual persistence. Intent to persist can be examined in a temporal manner, looking at short-term, degree attainment, and long-term commitment. Example: “I intend to take more courses in STEM.”<sup>49</sup>

Students were asked to respond to survey items using a 5-point likert scale (1, strongly disagree to 5, strongly agree). Multiple items were used to measure each construct listed above, and item responses were averaged to identify a construct response average. We used paired-samples t-tests to determine significant differences pre- to post- program; a non-paired samples t-test was employed to examine differences between native-born and foreign-born student responses to the survey items.

## Results

By disaggregating student outcomes data by native-born or foreign-born status of participants, we were able to determine an immediate difference in academic achievement. Though both groups experienced transfer and/or graduation rates higher than those of STEM students at the institution (Table 1), foreign-born lacks had more success in graduating than their native-born Black counterparts in the program (Table 2).

**Table 2. Transfer/and or graduation rates of native-born black and foreign-born black STEP participants (2012-2016)**

	<u>Graduated</u>	<u>Transferred</u>	<u>Graduated or Transferred</u>
<u>Foreign-born black students</u>	<u>28/91 (31%)</u>	<u>45/91 (49%)</u>	<u>80%</u>
<u>Native-born black students</u>	<u>8/55 (15%)</u>	<u>24/55 (44%)</u>	<u>58%</u>

Though native-born and foreign-born black participants transferred to 4-year institutions at similar rates, foreign-born blacks were more than twice as likely to earn a degree prior to transfer. Interestingly, foreign-born blacks also maintained a substantially higher GPA than their native-born counterparts (Table 3).

**Table 3. Average GPAs of native-born and foreign-born black students in program (2012-2016)**

	<u>GPA</u>
<u>Native-born black students</u>	<u>3.12</u>
<u>Foreign-born black students</u>	<u>3.59</u>

In order to explore factors that might be affecting the disparities in graduation/transfer rates, we separated data from student attitude surveys. Interestingly, foreign-born black students (response rate of 65/91, or 71%) were more likely to complete the annual survey than their native-born counterparts (response rate of 24/55, or 44%). This could be an indication of higher academic engagement for foreign-born black students. Though some surveys were incomplete and thus not



included in the analysis, the number of these would not account for the large difference in response rate.

All students demonstrated significant growth on the survey from pre- to post- program across all measured psychosocial constructs (Table 4). There were slight differences between the two populations. For instance, foreign-born black students exhibited lower pre-program averages across all constructs than their native-born counterparts. For post values, these differences were reduced or eliminated. However, we found that none of the differences between the native-born and foreign-born black students in either pre- or post- responses to the items for the constructs were statistically significant.

**Table 4. Average pre- and post-survey construct responses for native-born and foreign-born black participants (2012-2016)**

	Native-born (n=24)		Foreign-born (n=65)		t test
	Pre	Post	Pre	Post	
<b>STEM Engagement</b>	4.17	4.58	3.97	4.42	p < 0.001
<b>Institutional Commitment</b>	3.83	4.27	3.72	4.27	p < 0.001
<b>STEM Identity</b>	4.22	4.64	4.04	4.53	p < 0.001
<b>Encouragement</b>	4.35	4.65	4.02	4.69	p < 0.001
<b>Intent to Persist</b>	4.49	4.79	4.25	4.62	p < 0.001

### Conclusion

Better academic performance by foreign-born black students in the program is in keeping with current trends in the literature. However, only minor differences in responses to survey designed to measure attitude were observed. This could be explained by the low response rate for native-born black students; those who did respond were likely more academically engaged than those who didn't. This would create inflated survey averages for native-born students, masking a true attitude disparity between foreign-born and native born black students in the program. It's possible that with higher n (especially for native-born black population), some of the minor differences we observed could expand, becoming significant.

Alternatively, due to institutional homogenization of blacks and common barriers to STEM identity for both foreign-born and native-born blacks, students of both populations might have similar intrinsic experiences. Regardless, we find that the student support program leads to improvements in attitude for both groups, enhancing engagement, institutional commitment, STEM identity, encouragement, and intent to persist.

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