PROMISE:
Diversifying the STEM Education to Career Pathway

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“an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy (National Center on Gifted and Talented, 2013).”
“The National Academy of Sciences suggests that, without the participation of individuals of all races and genders, the increasing demand for workers in STEM fields will not be met, potentially compromising the position of the United States as a global leader” (NSF, 2014).

“The additional benefit of developing a STEM-literate and well-trained domestic workforce is that this ensures that we adequately address challenges related to healthcare improvement, national production capacity, and research excellence” (Allen-Ramdial & Campbell, 2014).

While 44% of White students and 62% of Asian students scored at proficient or above in MATH, only 13% of Black students and 20% of Hispanic students did – 8th grade (NAEP, 2017).

While the average score in Science was 166 for White students and 164 for Asian students, it was 132 for Black Students and 140 for Hispanic Students (NAEP, 2015).
Fewer than 10% of Black and Latino students complete the high school mathematics sequence, which includes algebra, geometry, trigonometry, and pre-calculus.

Latino and Black students are academically four years behind their White counterparts and score below approximately 75% of White America in mathematics.
According to the Washington-based Center for Political and Economic think tank, the U.S. workforce could employ as many as 140,000 additional Black and Latino college graduates in STEM fields annually if the gap in college completion by Blacks and Latinos closed to roughly match that of the White and Asian student graduation rates (Roach, 2014).

According to the U.S. Census Bureau, the median income for Blacks is $32,229 and $38,624 for Latinos, almost $20,000 less than Whites; but for Latinos and Blacks in STEM careers, the median income is $75,000 which is only about $10,000 less than Whites (Landivar, 2013).
Our modern understanding of science and knowledge originates from the **European Enlightenment**.

Nonwhites and women have historically been viewed as emotional, irrational, childlike, and not possessing scientific capabilities.

Beyond the structures that hinder minority gains in the sciences, interpersonal biases continue to be a factor for those who work in the STEM fields.

**Research** continues to demonstrate how academic and workplace settings are often spaces in which feminine and ethnic identities are not valued or recognized.

The historical and institutional meaning of what it means to be a scientist (a white male identity) continues to under privilege diverse populations.
Methodology

Diversifying STEM to Education Pathway, N = 415

Through qualitative research methodologies, students engaged in STEM, their parents, STEM educators, STEM professionals, and Community Organizations that implement STEM programming were asked to provide their perspectives and share their stories related to the intersection between race and STEM.

The Motivation of Black and Latino Students to Engage in STEM, n = 281

- 106 high school students, 86 middle school students, 27 STEM educators, 51 parents and 11 college students.

Diversifying STEM Think Tank, n = 134 from 64 organizations

- To understand from the perspectives of STEM professionals, Educators, and Diversity/Inclusion Officers strategies to diversify and strengthen the STEM education to career pipeline.

Critical Race Theory

Attempts to understand American education and reform, acknowledging the unique perspective and voice of people of color as victims of oppression in racial matters and valuing their story telling as a legitimate way to convey knowledge (Khalifa, Dunbar, & Douglas, 2013).
Factors to Motivate Black and Latino Students to Engage in STEM Education ($n_t = 281$, $n_r = 655$)

- Obligation to Black/Latino Community/Break Negative Stigma - Be different
- Future Success/STEM is a Prominent, Progressive Field
- Learning: Discovery of Knowledge and real-life applicability
- STEM Passion/Enjoyment
- Solve Problems/ To Advance Humanity
- Family/ Teacher Influence
- Challenge/ Competitive Nature of STEM
- Money
- Self-Motivated
- Not good at math
- Leadership

$n_t =$ Total # of Participants, $n_r =$Total # of Responses

Since subjects can respond more than once to the question, the values for $n_t$ and $n_r$ are often not equal.
“I think the gap exists because humanity is tearing us apart. Something that would motivate me to engage in STEM is us blacks and Latinos working together to make the world a better and more positive place and for us not to think we can’t follow our dreams.”
PERSPECTIVE
High School Student

“In terms of me being interested in STEM as a Latina, I think it feels good to know that I’m kind of paving the way for someone else, I’m kind of going in there without knowing what to do and I have you guys to help me and it’s kind of like the blind leading the blind. But I mean I know I’ll get through it and that way I can help the next generation.”
PERSPECTIVE
Parent

“His intrinsic motivators are most likely his love to solve critical problems quickly. In elementary school, his nickname was calculator because he could solve problems faster than someone could insert into a calculator. In addition, he wants to represent Latino doctors in STEM because when he was seven years old, he asked me in the hospital, "Where the Latino doctors are at?" I remember replying that they are Latino doctors but they are very few of them. You can become one when you grow up. After that, he made it his goal to want to become a doctor for his want to represent the Latino Race.”
“I know a student; he probably is a 3.7 or 3.5 GPA and is interested in math and science. His motivation is basically society always saying that African American males are not capable. He feels like they are not put to the test, if there is a white student that is in the same class as them that they are not expected to do as well as, and so he feels that he’s motivated by hearing that you’re not able and he says that I am able and that I am going to succeed. I think that goes for a lot of our youth. I think if they keep hearing, sometimes the more you hear that you can’t do something, you know that you can do something. That’s the motivation for a lot of our black males right now.”
Diversifying STEM Education to Career Pathway

D-STEM Equity Model

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The Systemic Problem
Racial Inequality in STEM Education and Careers

STEM Motivation
Factors that generate interest in and motivate Black and Latino students to engage in STEM education, majors and careers

Bridging the Racial STEM Divide
Policy-driven mandates to form stakeholder collaboration and funding

Vision Gap
Opportunity Gap
Cultural Perception Gap
STEM Education Gap
Generational Gap
Economic Gap
Identification Gap
STEM Professional to Educator Gap

Early STEM Exposure
Culturally Responsive STEM Curriculum
Conversations on Race
Personalized Assessment and Evaluation
STEM Leadership Development

Racial Equity in STEM Education and Careers
Increase in motivation of Black and Latino students to engage in STEM education

Racially-based collaborative stakeholder approach to STEM programming (PreK-16) mandated by policy that addresses problems collectively and is driven by STEM motivation factors, with an emphasis on developing culturally-responsive teachers

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Global Scalability

1. Identify groups who are underrepresented in STEM and host “Diversifying STEM Think Tanks” with STEM professionals, educators, students, parents, to gain a better perspective as to why STEM inequities exist (the problem) within the respective group(s) and strategies to address.

2. Hold focus groups with members of identified group who are engaged in STEM to understand what motivates them to engage in STEM.

3. Identify stakeholders who will value from diversifying STEM and policy-makers who are STEM advocates to move toward a collaborative STEM initiative.

4. Identify the most prominent barrier to diversifying STEM that exists for the respective group(s) and prioritize in bridging the gap.

5. Based on the data collected, modify the language in the D-STEM equity model to include identified problem, motivation factors, bridging component, which include diversifying STEM policy development as well as identification of stakeholders and the most prominent barrier.
IMSA Black and Latino Students – STEM Motivation
IMSA

• a public residential college preparatory institution for academically talented students (grades 10-12)
• a diverse student body of 650 from all areas of Illinois
• serves thousands of educators and students in Illinois and beyond through innovative instructional programs that foster imagination and inquiry
• enrichment programs for elementary, middle and high school students.
Student Population of Academy, 2018-2019

• Percentage of students identifying as:
  • 41.7  Asian
  • 35.4  White
  • 8.9  Hispanic or Latino
  • 8.1  Black
  • 5.9  Two of More Races, Non-Hispanic or Latino
Providing Opportunities for Mathematics and Science Enrichment (PROMISE)

Serving culturally, linguistically and economically disadvantaged (CLED) students who have talent and interest in mathematics and science is a high priority of the Illinois Mathematics and Science Academy. We believe that we must actively recruit from all regions of the state of Illinois. In addition, we believe we must address the challenges of CLED students through contact and intervention in the form of academic enrichment programming early in students' educational experience. The Academy continues to create and develop a culturally rich and inclusive environment that affirms and celebrates individual differences.
PROMISE Program Goals

- Provide academic enrichment in STEM fields
- Improve the eligibility for academy acceptance
- Improve understanding/appreciation of science and mathematics
- Increase the numbers of CLED students in pursuit of degrees and careers in STEM fields
PROMISE History

1993
First PROMISE program for 9th grade students

1997
First PROMISE summer residential program

2010
Initiation of Leading Students to Success (LS2S) Program

2012
Expansion of EIP and LS2S programs

2017
Introduction of the PEEP program
PROMISE Programs

- **Leading Students 2 Success (LS2S)**
  - School-year Saturday program for 7th and 8th graders

- **Summer Enrichment for Academics in Mathematics and Science (SEAMS)**
  - Residential summer program for students entering 9th grade in the fall.

- **Early Involvement Program (EIP)**
  - School-year Saturday program for 9th graders

- **PROMISE and EXCEL Extension Program (PEEP)**
  - School-year support program for IMSA students who were PROMISE and/or EXCEL participants
Leading Students to Success (LS2S)

- Program for high achieving 7th and 8th grade students with interest and aptitude in math and science
- Meets 12 Saturdays on the IMSA campus from October through January
- Students participate in math, science and humanities activities
- 7th grade students take part in leadership skill building activities
- 8th grade students receive SAT preparation instruction
- Some lessons led by IMSA student tutors
Summer Enrichment for Academics in Mathematics and Science (SEAMS)

- A 10-day residential summer program for rising high school freshmen.
- Students receive instruction in math, science, English and SAT preparation.
- Students also take part in leadership skill building and residential life programming
Early Involvement Program (EIP)

- Program for 9th grade students
- Meets concurrently with LS2S program
- Students participate in math, science and humanities activities taught by IMSA faculty
PROMISE Participation Data

- 5th grade
- 6th grade
- 7th grade
- 8th grade
- 9th grade
PROMISE STEM Pipeline

STEM Interest & Exposure
LS2S
SEAMS
EIP
IMSA Student (PEEP)
STEM Major in College
STEM Career
2018 PROGRAM ACHIEVEMENTS:

• 45% of ninth grade PROMISE participants were admitted to IMSA.

• One in six students in IMSA’s admitted Class of 2021 previously participated in PROMISE.
## CLED Student Enrollment, N = Census Day Enrollment (September 10)

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<tbody>
<tr>
<td>CLED – Race*</td>
<td>122 (19%)</td>
<td>119 (18%)</td>
<td>98 (15%)</td>
<td>99 (15%)</td>
<td>98 (15%)</td>
<td>+24%</td>
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<tr>
<td>CLED - SES</td>
<td>111 (17%)</td>
<td>95 (14.5%)</td>
<td>86 (13%)</td>
<td>75 (11.5%)</td>
<td>81 (12%)</td>
<td>+37%</td>
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<tr>
<td>CLED - Geographic Location</td>
<td>32 (5%)</td>
<td>34 (5%)</td>
<td>36 (5%)</td>
<td>43 (6%)</td>
<td>44 (7%)</td>
<td>-27%</td>
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*Includes students identified as Two or More Races who have one identity as Black or African American
IMSA PROMISE Receives 2018 Inspiring Programs in STEM Award

IMSA’s Promise of Equity & Excellence in Stem Education

IMSA’s PROMISE Programs serve students in grades 7th through 9th with academic enrichment at low or no cost while encouraging future admission to its tuition-free residential Academy for 10th through 12th graders.

IMSA is committed to the active recruitment of students, faculty and staff with diverse backgrounds and different viewpoints. Apply at imsa.edu.
References


Thank You

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