INFLUENCE AND MOTIVATION IN STEM AMONG UNDERREPRESENTED HIGH SCHOOL STUDENTS OF COLOR

Alexis Martin & Frieda McAlear
INTRODUCTION AND PURPOSE
Vast underrepresentation of African Americans & Latinos in STEM (Science, Technology, Engineering, Mathematics).

African-Americans & Latinos make up 39% of the U.S. school-aged population, yet comprise just:

- 17% of AP math & science test-takers
- 11% of science and engineering degrees
- 9% of the entire U.S. science & engineering workforce

Underrepresented students of color face barriers to entry & persistence in STEM

- Structural barriers in education access
- Social/psychological barriers in response to disparities

It is critical to determine which variables are most salient in motivating underrepresented adolescent youth to engage & persist in STEM
Purpose and Research Questions

This study aimed to:

- Inform **understandings of motivation and engagement** in STEM by examining experiences of underrepresented high school students of color interested in STEM

- Investigate if **gender differences exist for particular factors**, and whether girls of color have differing perspectives than their male counterparts, in order to counteract the “double-bind” of experiencing two marginalized identities in STEM

Research Questions:

- Among underrepresented high school students participating in a STEM program, **what factors are most salient in influencing interest** in STEM and **motivation to pursue** STEM studies at the secondary and postsecondary level?

- Among underrepresented high school students participating in a STEM program, **do salient factors in STEM influence and motivation vary by gender?**
THEORETICAL FRAMEWORK
Social Cognitive Career Theory
- Byars-Winston, et al., 2010
  - Career-related choices result from interactions between one’s level of self-efficacy & their expectations about outcomes of particular actions

Expectancy-Value Theory
- Eccles & Wigfield, 1995; Wigfield & Eccles, 2000
  - Examines connections between an individual’s expectations for their success & the value they attach to options they view as available
  - These expectations are linked to external inputs, self-concept, and identity
Goal Orientation Theory

- Ames, 1992; Dweck, 1986; Kaplan & Maehr, 2007
  - Framework for why students engage or disengage academically
  - Explains motivations contributing to students’ success in school, particularly focusing on environmental factors

Intrinsic/Extrinsic Motivation Theory

- Deci & Ryan, 1985; Ryan & Stiller, 1991; Plotnik & Kouyoumjian, 2011
  - Intrinsic motivation refers to doing something because it is enjoyable or interesting
  - Extrinsic motivation is defined as doing something because it may lead to a reward or punishment
  - This study utilizes these definitions to examine factors influencing underrepresented adolescent students’ choice to engage with and persist in STEM fields
METHODOLOGY
Program Context

- Study took place within a five-week, three-year STEM-focused summer residential/academic program
- Four sites in Northern and Southern CA
- Serves low-income, first-generation, high school students of color (50% female)
Participants

- N=265
- **Grade:**
  - 10th (35%)
  - 11th (31%)
  - 11th (34%)
- **Socioeconomic Status:**
  - FRPL-eligible: (84%)
  - First-in-Family to complete college (78%)
- **Student Achievement:**
  - Average incoming math grade A-
Study Instrument & Data Analysis

- Comprehensive online pre-and post-program survey.
  - Full survey contained 40 scales aimed at examining students’ STEM attitudes and aspirations.

- For the purposes of this study, two open-ended survey items were utilized:
  - What made you first interested in STEM?
  - Why are you interested in studying STEM in high school and college?

- Using qualitative data analysis software, all responses were coded to produce frequency reports & identify themes.
  - Codes were applied to all data in a grounded approach to gain a complete understanding of the data.
  - Throughout the analyses, participants’ phrasing was kept intact to provide accurate representations of student experiences & perspectives.
OVERVIEW OF FINDINGS
Factors Influencing Initial STEM Interest

- Students traced their STEM interest to several key variables
- Among boys:
  - Factor most frequently mentioned was hands-on experiences, which impacted their initial engagement with STEM
    - “When I was younger my dad would take me to the flea market to buy and sell tools and make a profit. Since then I got an interest in how math was so useful.”
    - “Playing with blocks and drawing got me interested in engineering.”
  - Additional frequently described variables for boys:
    - Wanting to understand how things work
    - Being able to create things
    - Media (video games, movies)
    - Role of teachers in having influenced them to study STEM.
Among girls:

- Factor most frequently described as influencing early STEM interest was more subtle & internal: they had “always been interested” or “always liked” STEM
  - “Ever since I was a child I've always loved science.”
  - “I’ve always loved math.”
  - “I have been interested in science since elementary school.”

- Additional frequently described variables for girls:
  - Being “good at” STEM subjects
  - Role Models
  - “Liking” STEM
  - Role of teachers in having influenced them to study STEM
What made you first interested in science, technology, engineering, or mathematics?

- I have always liked/never liked STEM or have always found it interesting
- Teacher or school
- Hands on experiences
- I am good at
- Role models
- STEM program
- Being able to understand how things work
- STEM relates to everyday life
- Being able to create things
- To make change or represent my community or help people
- STEM is interesting
- STEM jobs
- Media or Games
- I want to succeed in STEM even though it is challenging
- I like STEM
- STEM is fun
Motivation to Continue Studying STEM

- Factors students identified as motivating them to persist in STEM studies
- Among boys:
  - Factor most frequently mentioned was the prospect of obtaining a job in a STEM field
  - Almost as frequently described factor was to “make a difference” or represent their communities in STEM
    - “I want to “be able to change the world and break social barriers”
    - “I want to help people and I want to prove that people of color can achieve greatness in these fields”
  - Additional frequently described variables for boys:
    - Broad notion that STEM will help them in their future
      - “It can take me somewhere good in life.”
    - STEM relates to their daily lives
      - “Math can be applied to almost everything around us.”
      - “I see STEM related stuff all around me now and I want to learn about them.”
    - They are “good” at it. (Note: Girls entered STEM because they felt they were “good at it” but boys persisted in STEM because they feel they are “good at at.”)
Motivation to Continue Studying STEM (cont.)

- Among girls:
  - Factor most frequently mentioned was the **prospect of obtaining a job in a STEM field**
  - Additional frequently described variables for girls:
    - To **“make a difference”** or represent their communities in STEM
    - Broad notion that STEM will **help them in their future**
      - **“It will allow me to better myself”**
    - A desire to succeed in STEM even though it is **“challenging”**
      - *It's one of the subjects I'm not automatically good at, so I want to improve my skills and prove to myself that I can do this despite the obstacles.”*
Why are you interested in studying STEM in high school and college?
Significance

- Much literature has examined STEM interest & persistence at postsecondary level. These findings fill a gap by investigating factors leading to STEM interest & persistence among underrepresented adolescent/high school-age students of color.

- Broad implications for practice & policy around implementation of secondary and post-secondary programs designed to increase and broaden STEM participation.

- Informs strategies to improve outcomes & increase STEM engagement/persistence for students from underrepresented backgrounds.
THANK YOU

For more information about this study or related research and STEM programming for high school students:

- Alexis Martin, Ph.D., alexis@lpfi.org
- Frieda McAlear, M.Res., friedam@lpfi.org