

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

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Level Playing Field Institute
ESTABLISHED 2001

INTRODUCTION AND PURPOSE



Context

- ❑ 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



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Program Context

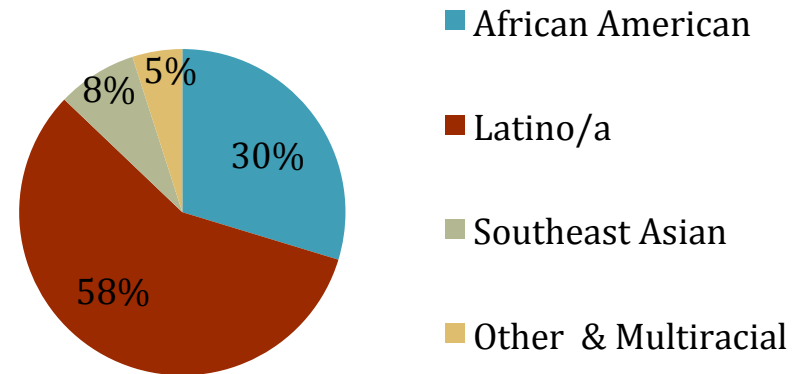
- ❑ Study took place within a five-week, **three-year STEM-focused summer residential/academic program**
- ❑ Four sites in Northern and Southern CA
- ❑ Serves **low-income, first-generation, high school students of color** (50% female)



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-

Race/Ethnicity



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



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Factors Influencing Initial STEM Interest

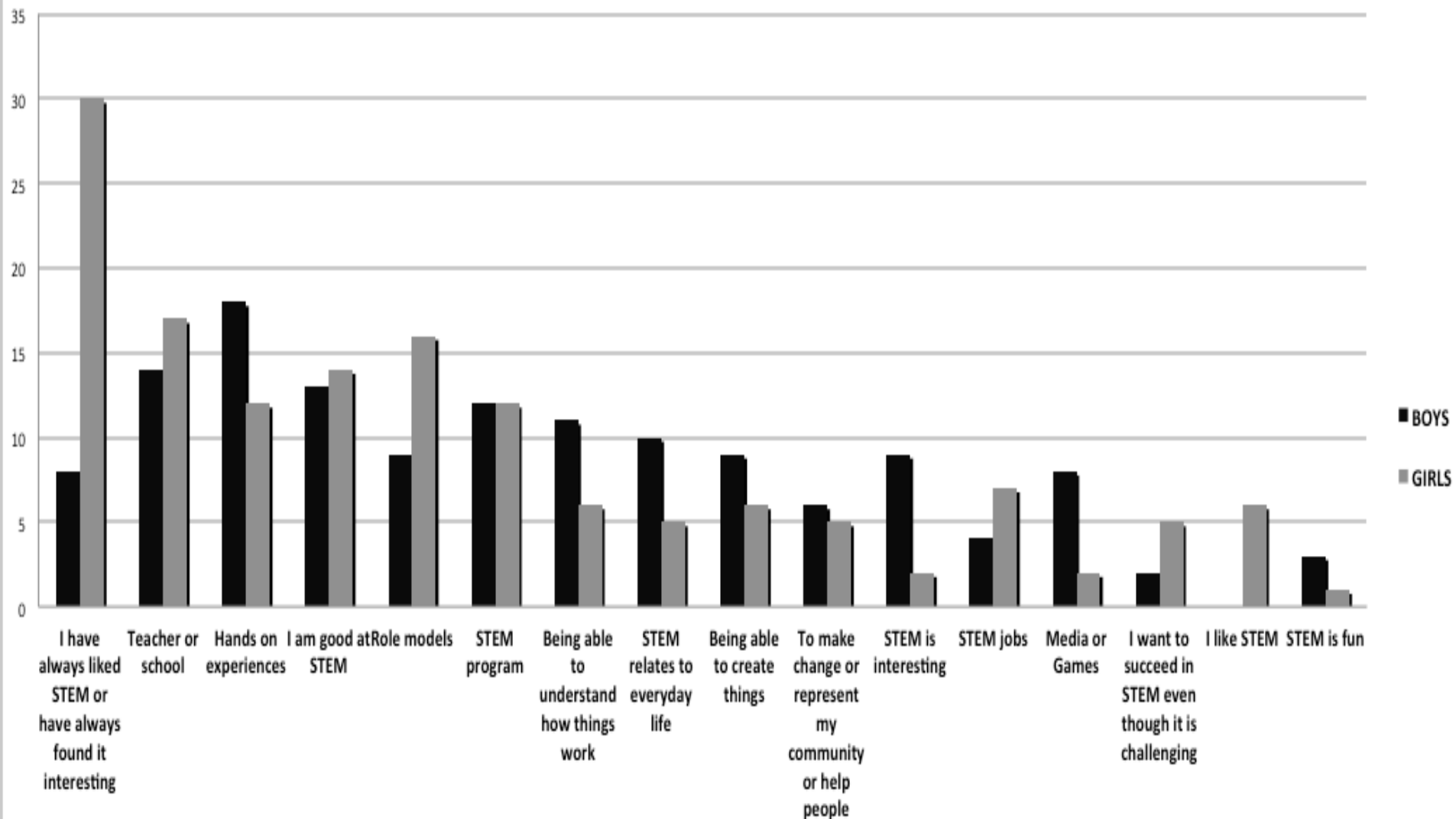
- Students traced their **STEM interest** to several key variables
- Among **boys**:
 - ▣ Factor most frequently mentioned **was hands-on experiences**, which impacted their initial engagement with STEM
 - *“When I was younger my dad would take me to the flea market to buy and sell tools and make a profit. 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.

Factors Influencing Initial STEM Interest (cont.)

□ 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?



Motivation to Continue Studying STEM

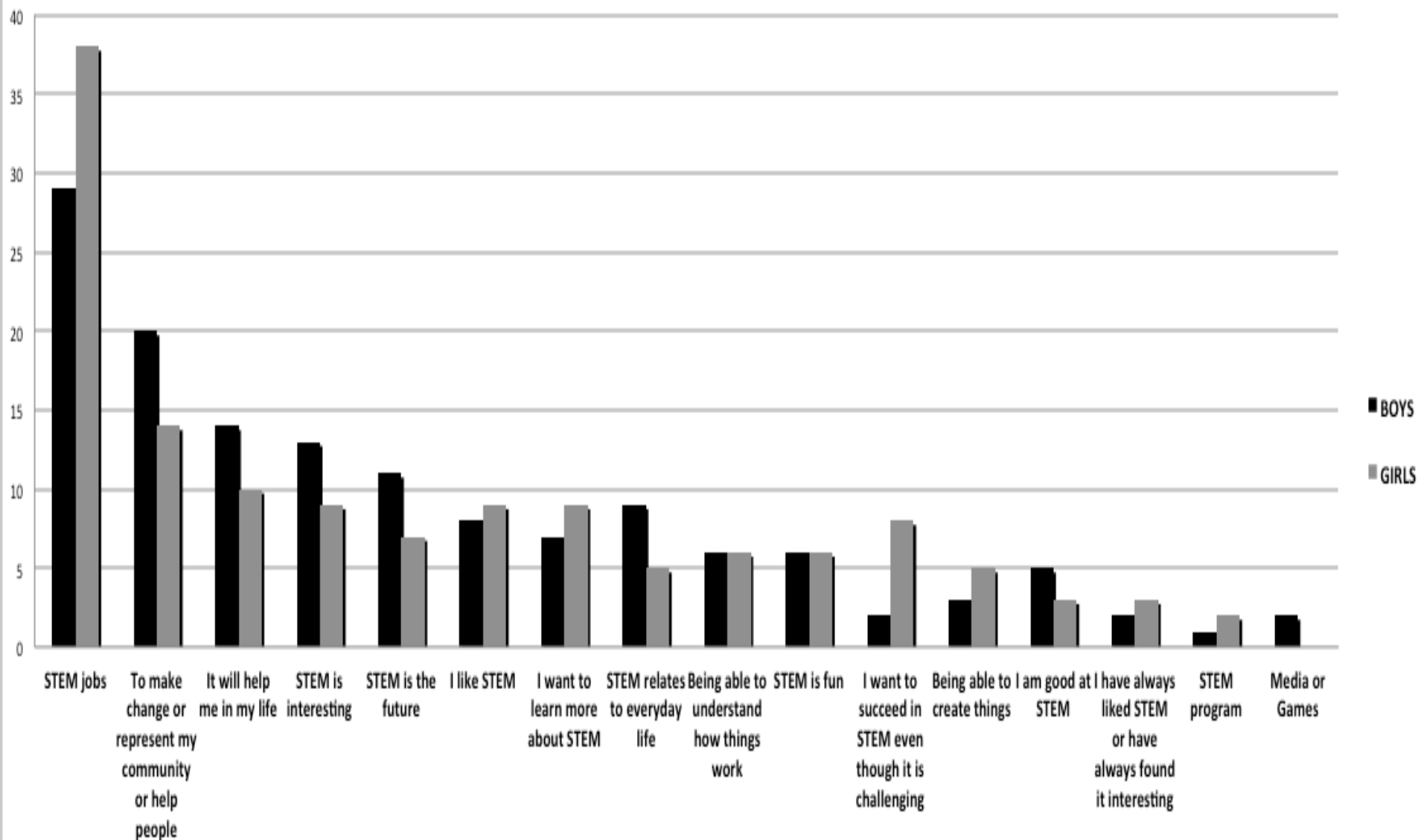
- Factors students identified as motivating them to **persist** in STEM studies
- Among **boys**:
 - ▣ Factor most frequently mentioned was the **prospect of obtaining a job in a STEM field**
 - ▣ Almost as frequently described factor was to “**make a difference**” or represent their communities in STEM
 - “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:

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