What Counts as STEM Careers Matters: Gender and Motivational Predictors Vary by Definition

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Outline

Background

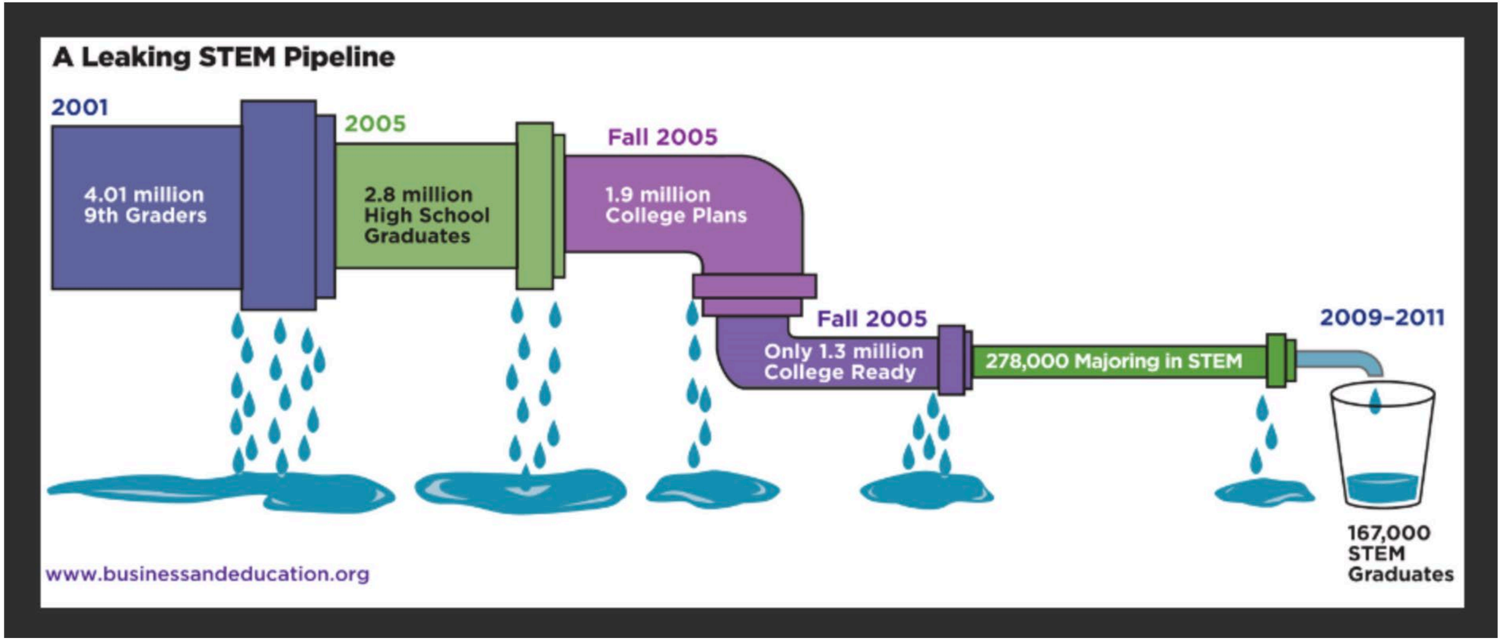
Research questions

Current study methods and results

Implications

Background

- STEM: Science, technology, engineering, and mathematics



Breiner et al., 2012; Heilbronner, 2013; LaForce et al., 2017

Does it matter what counts as STEM?

Situated Expectancy-value theory (SEVT)

Expectancies of success

Subjective task values

(Including interest, utility)

(STEM) Career interest

- SEVT originally adapted to explain gender differences
- On average, (White) girls have lower levels of math expectancies of success, interest, and utility value

Eccles et al., 1983; Eccles & Wigfield, 2020; Guo et al., 2015; Jiang et al., 2020; Nagy et al., 2006, 2008; Wang, 2012

Differences in predictors by definition: Gottlieb, 2018

- Math utility only predictive of STEM; Science utility only predictive of STEM+M

Odds of planning a STEM/STEM+M career in 9th grade at the BA level, compared to White boys

	STEM	STEM+M
White girls	.79**	2.57***
Black girls	.45**	2.92***

Research Questions: Does it matter what counts as STEM?

- What predicts traditional-STEM career interest?
- What predicts STEM+M career interest?
- i.e., Are there different predictors by definition? Especially interested in motivation

- Based on Gottlieb (2018), we expect varying predictors by definition

Method

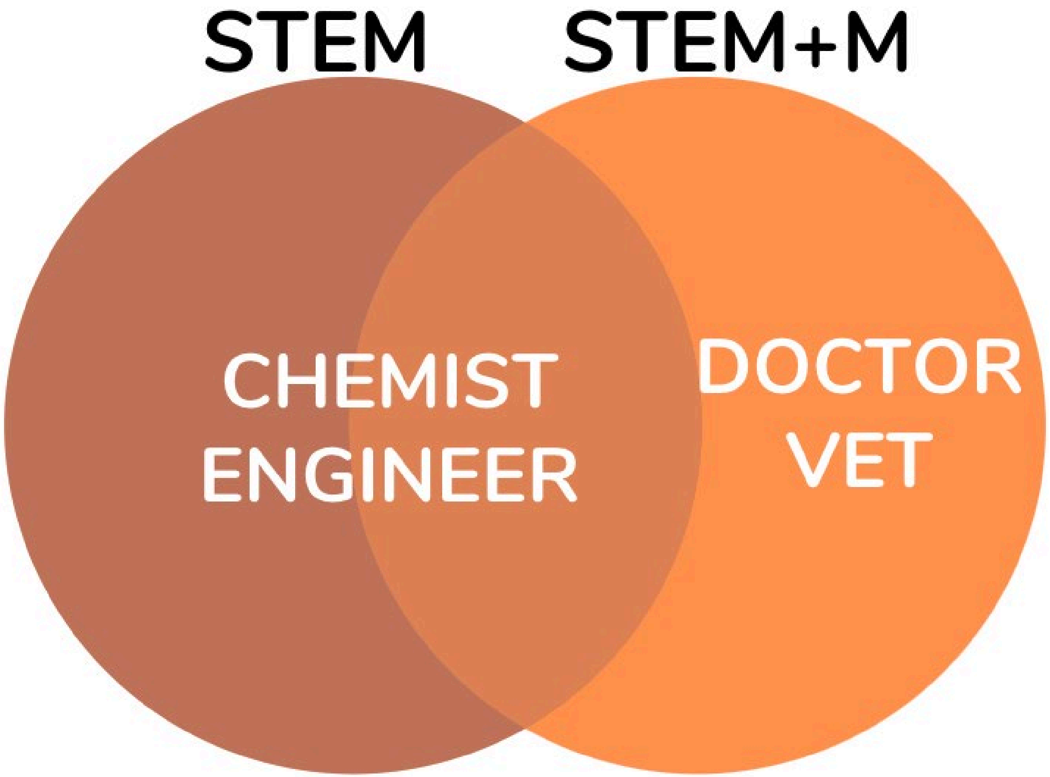
- Participants (n = 455) are part of a longitudinal study looking at math achievement and STEM interest of students in the Southeastern US
- Current work is looking at primarily concurrent relations in 10th grade
- Majority of students come from families with limited resources, attending schools in the Nashville metropolitan area
- 79% of sample is Black, 9% non-White Hispanic

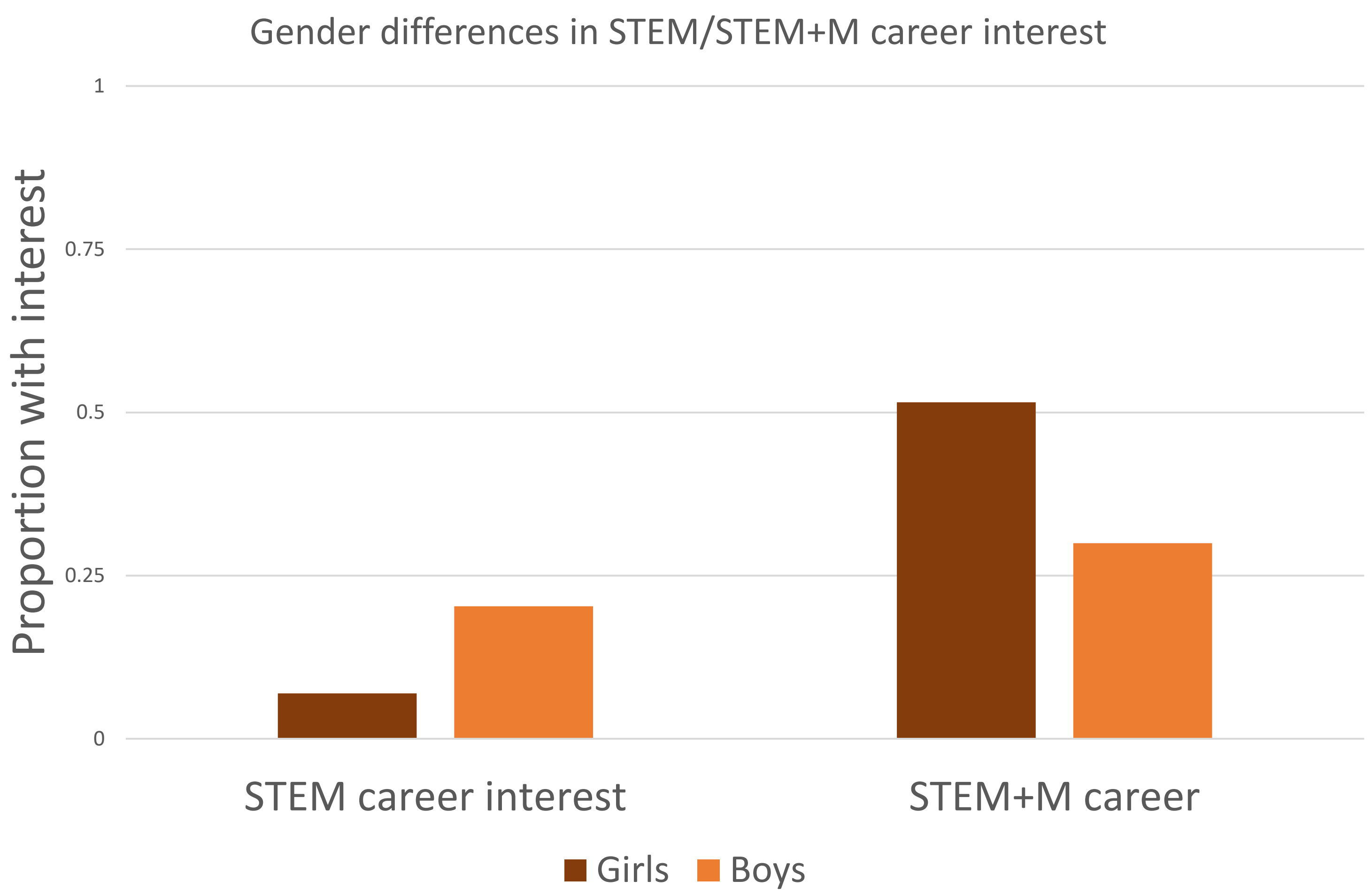
Predictors

- Math achievement measured in 9th grade (Woodcock-Johnson quantitative concepts, KeyMath: numeration, algebra, geometry subtests)
- Trends in International Mathematics and Science Study measure of math and science motivation (10th grade):
  - Expectancies of success: “Math is not one of my strengths” (9 items)
  - Utility value: “I would like a job that uses math” (6 items)
  - Interest: “I enjoy learning math” (5 items)
  - 1 to 4 likert scale

Connolly, 2007; Martin et al., 2012; Mullis et al., 2021; Woodcock et al., 2001

Outcomes (10^{th} grade interview)




Gender differences in STEM/STEM+M career interest
Proportion with interest
1
0.75
0.5
0.25
0
STEM career interest
STEM+M career
Girls
Boys

Logistic regression results: Predictors

	Traditional STEM interest	STEM+M interest
Predictor	Exp(B) (SE)	Exp(B) (SE)
Math Expectancies of Success	1.67	1.50
Math Interest	.86	.68
Math Utility	1.12	1.32
Science Expectancies of Success	1.22	.90
Science Interest	1.31	1.34
9^{th} grade math achievement	1.44	1.24

Controlling for parental education and income levels in 10^{th} grade, and race

Implications

- Found different gender differences in career interest by definition
- Surprising that only one motivation construct was related to STEM/STEM+M career interest given decades of past research (though past research is mostly with White, middle-class students)
    - we found similar null relations when using 6th grade math motivation predicting 10th grade career interest, from both variable-centered and person-centered approaches
    - Also conducted focus groups with subset of students, and found mismatch between students’ career interests and their perceived utility of math
- Interest in STEM drastically changed by definition–from 13% to 42%--and gender differences also flipped when expanding to include medical careers
    - How can we get more students, especially girls and marginalized students, interested in traditional STEM careers?

Implications

- Improving students' utility value for science seems like a particularly important target if one considers careers in medicine to be STEM careers
  - Past utility-value interventions successful at increasing science utility, STEM career interest, course enrollments, and math and science ACT scores (Rozek et al., 2017; Shin et al., 2022)
- Need for more motivation research, and theory-building, with marginalized students

Thank you!

Dr. Bethany Rittle-Johnson

Danny Xu

Children’s learning lab

NSF

Full logistic regression results

	Traditional-STEM Interest			STEM+Medicine interest		
Predictor	Estimate	*SE*	Exp(B)	Estimate	*SE*	Exp(B)
Math Expectancies of Success	.515	.332	1.67	.408	.22	1.50
Math Interest	-.149	.354	.862	-.389	.24	.68
Math Utility	.115	.396	1.12	.274	.25	1.32
Science Expectancies of Success	.197	.325	1.22	-.107	.22	.90
Science Interest	.268	.312	1.31	.290	.21	1.34
Science Utility	***.267***	***.270***	***1.31***	***.585****	***.182***	***1.8***
9th grade math achievement	.363	.189	1.437	.216	.132	1.24