Frances McClelland Institute
Children, Youth, and Families

Examining Latino[1] Adolescents' Gender and STEM Identities in Relation to STEM Commitment and Grades

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Literature Review

Latino Students

- Latino students are the largest and fastest growing ethnic group in US public schools (Gramlich, 2017).
- Latinos are underrepresented in obtaining 4-year college degrees in science, math, engineering, and technology (STEM; NCES, 2016).
  - Only 7% of Latinos are employed in STEM fields (Pew Research Center, 2018).
- Additionally, men continue to outnumber women in engineering, math, and computer science (AAUW, 2010; NSF, 2011; Perez-Felkner et al., 2012). Further, only 2% of Latinas and 4% of Latinos hold science and engineering positions (National Science Foundation(NSF), 2015).
  - Thus, Latina girls may be doubly disadvantaged, given their increased likelihood to experience negative stereotypes due to both their ethnic and gender competence in STEM (Bouchey & Harter, 2005; Brown & Leaper, 2010).
- One construct that may be particularly important to understanding on gender and ethnic disparities in STEM is identity.
  - Scholars suggest schools should focus on the development of Latino adolescents' STEM identity (e.g., Gándara, 2006).

STEM Identity, Commitment, & Grades

- Identity development is particularly salient in adolescence when cognitive capacities and logical reasoning increase (Erickson, 1968). As such, examining STEM identity, or the degree to which youth identify to math or science, is an important next step for understanding Latino youth STEM trajectories.
- The expectancy-value perspective suggests that when students' personal identifications are important to them, they place a higher value on the activities that promote these identifications (Eccles, 2009; Eccles & Wigfield, 2002).
- Indeed, previous work among a diverse population of college undergraduates and graduate students finds that STEM identity is related to commitment to a STEM career (i.e., science career; Chemers et al., 2013). Additionally, prior work has found that STEM identity is related to higher exam grades for Hispanic and Black high school students (Andersen & Ward, 2013).
- Yet, given prior research indicates that girls tend to score lower than boys in STEM ability beliefs and values (Weinburgh, 1995), the link between STEM identity and commitment and between commitment and performance might likely differ for Latino girls and boys.
- Thus, the purpose of this study was to examine the relations between Latino adolescents' gender, STEM identities, STEM commitment and performance.

Study Goals

- **Goal 1**: Examine direct effects of gender, and STEM identity on STEM commitment and grades.

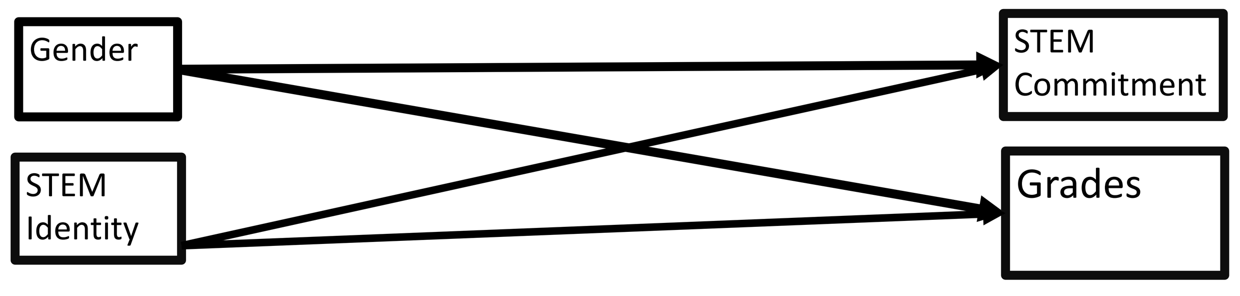

Figure 1. Direct Effects Models

- **Goal 2:** Examine whether gender was a significant moderator between
  (a) STEM identity and STEM Commitment and
  (b) STEM commitment and grades.

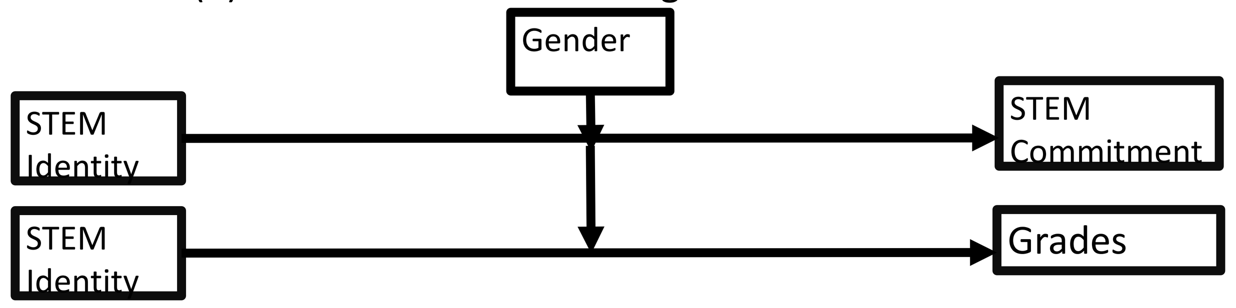

Figure 2. Gender Moderation Models

Method

Participants and Procedures

The sample included 288 families with middle school students (*Mage* = 13.69, *SD*= .56; 42% female; 86% U.S.-born) who were recruited from middle schools in Central Texas; participants completed telephone interviews in either English or Spanish.

Measures

Demographics. Adolescent gender (0=male, 1=female), Parent reports of their highest educational degree (e.g. high school diploma), Nativity (U.S. Born=1, Foreign Born=0)

STEM Identity. Science and math identity were assessed using an adapted academic measure of college major academic identity for use among middle school students (Walker & Syed, 2013). The modified questions focused on academic identity in science and math (the original items focused on college majors). The science identity subscale (9 items; e.g., "I think I am a good science student" "α"=.85) and math identity subscale ("9 items; e.g., "I think I am a good math student."" α=.86).

Grades. Adolescents reported on their overall grades by answering, "What grades do you earn in school?" Response options included "mostly As," "about half As and half Bs," "mostly Bs," "about half Bs and half Cs," "mostly Cs," "about half Cs and half Ds," "mostly Ds," and "mostly below Ds."

Analysis Plan

All analyses were conducted in SPSS version 24. First, descriptive analyses were conducted. Second, four regression models were run to examine gender and STEM identity's relation to STEM commitment (Goal 1). Third, to test for gender as a moderator in links between STEM identity and STEM commitment and between STEM identity and overall grades, STEM identities were mean centered and multiplied by gender to create the interaction terms. Finally, the significant interaction terms were probed . Non-significant control variables were removed from the final models to report parsimonious results.

Results

Goal 1. Direct Effect Models (See Table 1)

- **Gender:** There were *no significant* gender effects on math commitment, however there emerged a significant relation between gender and science commitment and grades indicating that *girls* reported *higher* levels of science commitment and grades than boys.
- **Math Identity:** There emerged significant positive associations between math identity and math career commitment and grades; *higher* levels of math identity were associated with *higher levels* of math commitment and grades.
- **Science Identity:** There emerged significant positive associations between math identity and math career commitment and grades; *higher* levels of science identity were associated with *higher* levels of science commitment and grades .

Goal 2. Gender as a Moderator

A. STEM IDENTITY → STEM COMMITEMENT

- Gender did not moderate associations between math identity and math commitment.
- Gender did significantly moderate the association between science identity and science career commitment. The association between science identity and science commitment was stronger for girls (β = -.22, $p < .05$) than boys (β = .22, $p < .05$; see Figure 3).

B. STEM COMMITMENT → GRADES

- Gender did not moderate associations between STEM commitment and grades.

Table 1. Summary of Regression Analyses (*N* = 288)

	Science Career Comm.				Math Career Comm.				Overall Grades			
	b	*SE*	β	*p*	*b*	*SE*	β	*p*	*b*	*SE*	β	*p*
Intercept	-.00	.23		.99	.47	.26		.07	3.82	.35		.00***
Control												
Highest Fam. Ed.	-	-	-	-	-	-	-	-	.10	.02	.23	.00***
Nativity	-	-	-	-	-.31	.13	-.11	.02	-	-	-	-
Main Effects												
Gender	.21	.10	.10	.03*	-.13	.09	-.07	.15	.63	.12	.28	.00***
Science ID	.78	.06	.60	.00***	-	-	-	-	.19	.09	.13	.03*
Math ID	-	-	-	-	.82	.06	.65	.00***	.36	.09	.25	.00***

Note. ID = Identity; Comm. = Commitment; Fam. = Family; Ed. = Education.
*$p < .05$. **$p < .01$. ***$p<.001$

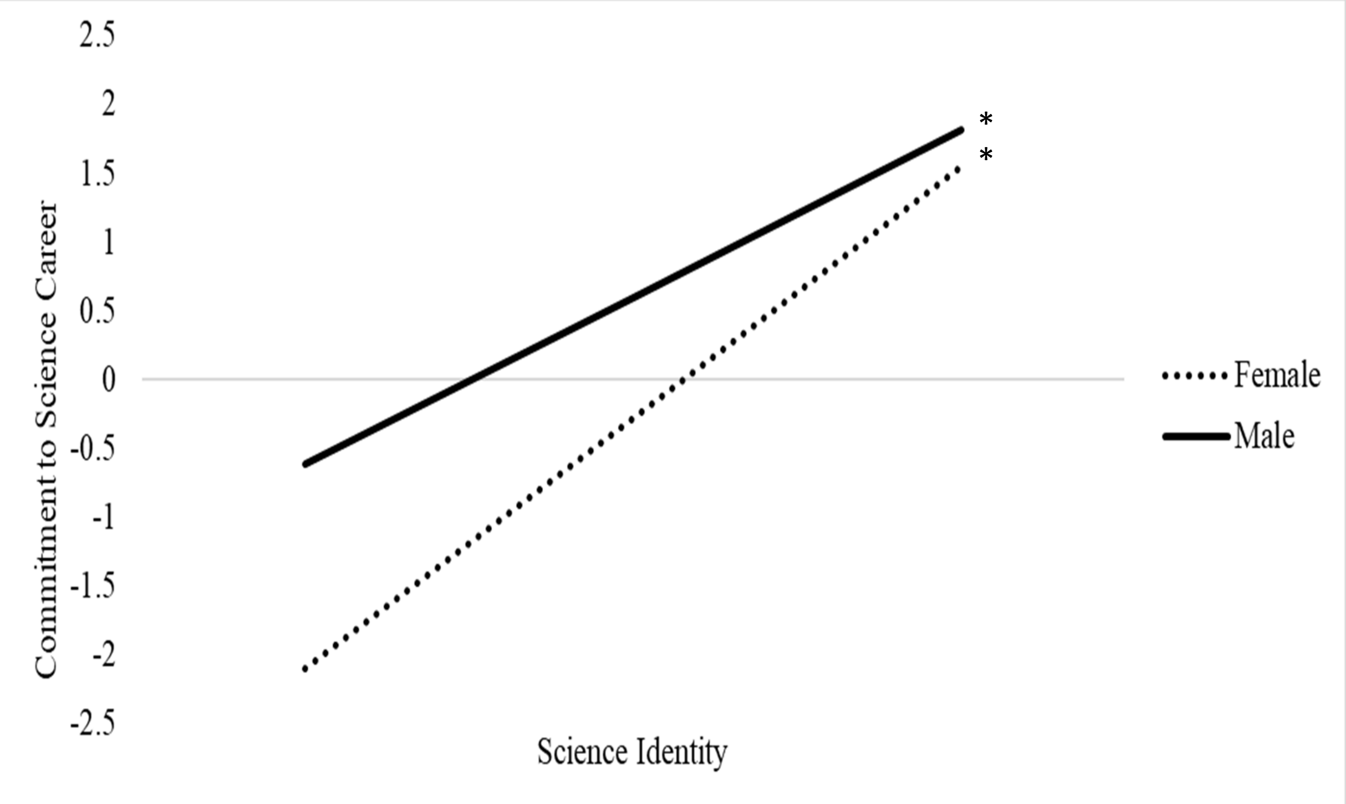

Figure 3. Simple slopes for females and males

Discussion

Goal 1:

- Inconsistent with previous work, girls in our sample reported higher levels of science commitment and grades than boys.
  - It is likely middle school girls have yet to internalize and conform to stereotypical gender career goals (e.g. girls are teachers, boys are engineers; Kurtz-Costes et al., 2008), thus, placing a high importance on their grades so that they can obtain a job in a scientific field (Eccles, 2009; Eccles & Wigfield, 2002).
- Findings corroborate evidence with older samples to indicate that a strong sense of identity in STEM is indeed an important correlate of STEM commitment (Chemers et al., 2013).
  - Thus prevention/intervention efforts focused on bolstering youths' sense of identity in STEM may help to address disparities in STEM careers for Latino youth.

Goal 2:

Science identity was particularly salient for girls in our sample as we found stronger relations between science identity and commitment for girls than boys.

- Guided by expectancy-value theory, perhaps girls place a higher importance on their science identities and engage in more activities that are science related, thus fostering a stronger commitment to obtain a science career as an adult.
- Perhaps gender differences are more likely due to the variety of science topics (e.g. biology, geology) taught in middle school as opposed to the less variable math topics addressed in middle school.

Limitations and Future Directions

- This study used adolescent self-reported cross-sectional data and a sample of youth from a specific southern region in the US. Thus, these findings may not be generalizable to other Latino students.
- Future studies should further examine gender differences between math identity and math commitment over time to examine variations in gender.

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[1]We use the Spanish shorthand, Latino, for the Spanish word *latinoamericano* to refer to individuals of Latin American descent living in the U.S.

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