Stereotype Threat as a Barrier to Women's STEM Participation

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Supported by grants 0734124 & 0913195 from the National Science Foundation

Overview

- Introduction to stereotype threat and supporting research
- Results from middle school students in California
- Recommendations to reduce stereotype threat in the classroom

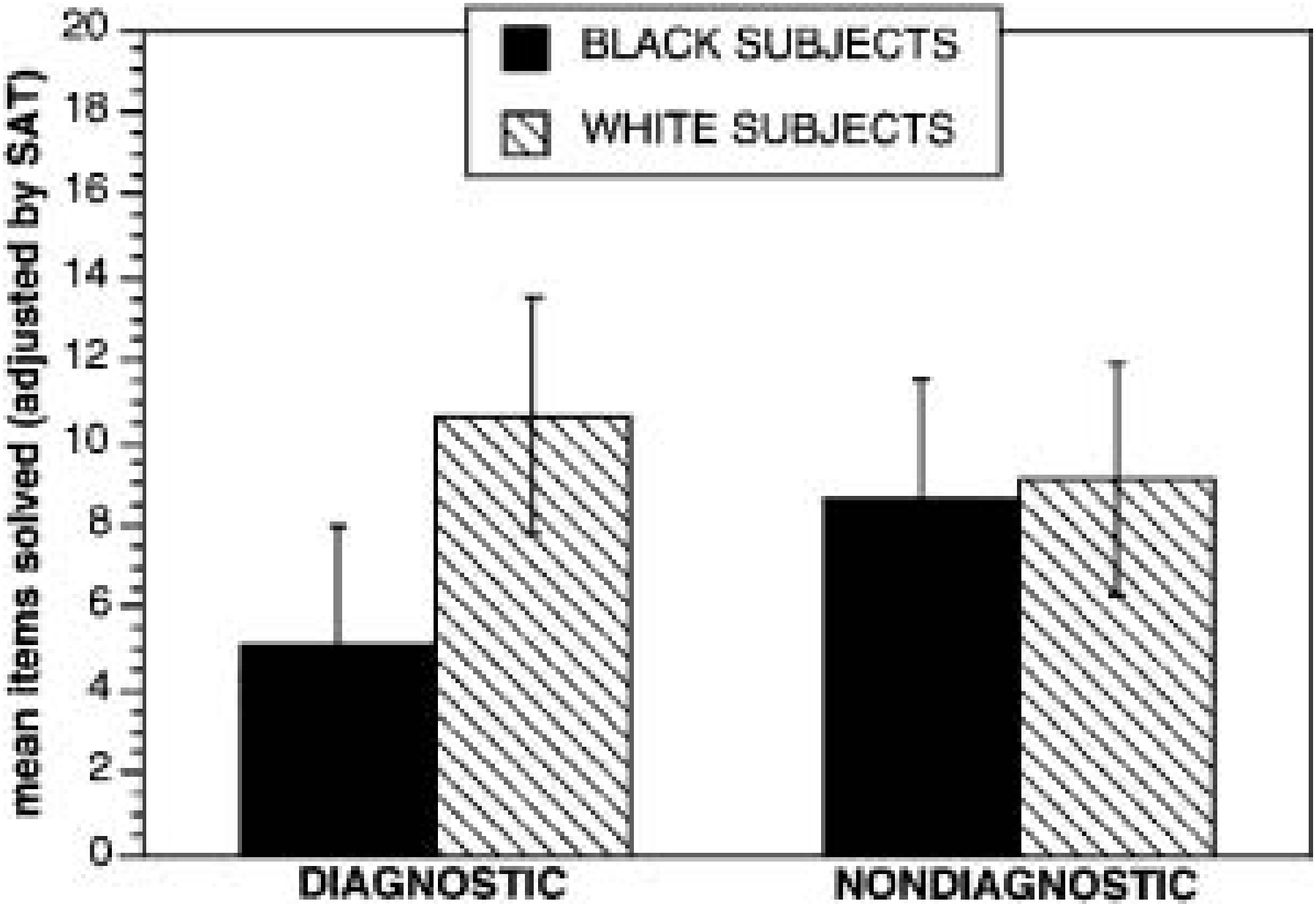
Stereotype Threat

- Stereotype threat is the fear of confirming a negative stereotype about one's group (Steele & Aronson, 1995)
- Awareness that one's behavior might be viewed through the lens of stereotypes creates a “threat in the air”
- Those who highly identify with the domain or their social group are at greatest risk

Stereotype Threat

- African American and European American Stanford students (Steele & Aronson, 1995)
- Made racial stereotype of intelligence salient by describing test as:
  - Diagnostic of ability
  - Non-diagnostic (control)
- Examined test performance on a challenging verbal test

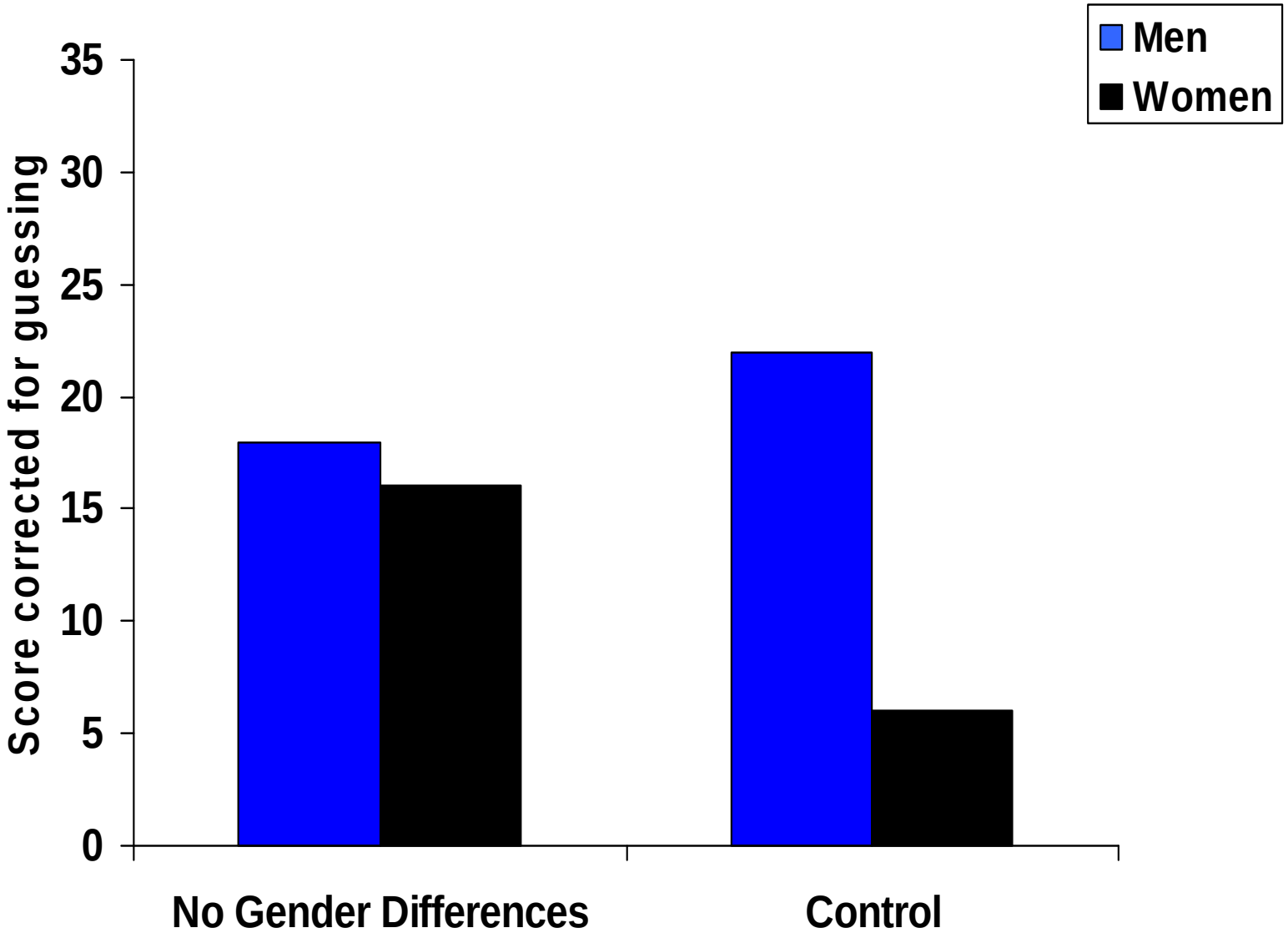
Steele & Aronson (1995, Study 2)



Stereotype Threat

- Male and female participants (Spencer et al., 1999)
- Eliminate stereotype threat about women and math (already in the air…)
  - No mention of gender
  - Say there are no gender differences on the test (reduces the possibility that performance will be attributed to gender)
- Examined test performance on a challenging math test

Spencer et al. (1999, Study 3)



Individual Differences in Stereotype Threat

- Identification with domain (Steele, 1997)
- Strong gender identity (Schmader, 2002)
- Endorse gender stereotypes (Schmader, Johns, & Barquissau, 2004)
- Believe that intelligence is fixed rather than malleable (Inzlicht & Good, 2006)
- Have low expectations for performance (Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2002)

Situations that Trigger Stereotype Threat

- Diagnostic versus non-diagnostic tests
  - Evaluative scrutiny
- Stereotype is made salient
- Primed with race or gender identity
  - Indicate race or gender on form before test
  - Numeric minority in group testing situation
- None: A threat is in the air

Effects of Stereotype Threat

- Lower test performance (Steele & Aronson, 1995)
- Avoidance of math and related majors (Steele, James, & Barnett, 2002)
- Lower behavioral intentions for math related activities (Davies, Spencer, Quinn, & Gerhardstein, 2002)
- Less representation of women and ethnic minorities in STEM fields (Good et al., 2008)
- Discounting, devaluing, and disengagement from domain (Aronson et al., 2002)
- Self-handicapping strategies (Stone, 2002)
- Reduced sense of belonging to the stereotyped domain (Good, Dweck, & Rattan, 2008)

How Does Stereotype Threat Work?

- Cognitive Mechanisms
  - Negative thought suppression
  - Depletes working memory resources
- Physiological Mechanisms
  - Produces physiological stress and threat responses
  - Impairs prefrontal processing
- Affective Mechanisms
  - Suppression of negative emotions to self-regulate
  - Consumes executive resources needed to perform well on cognitive and social tasks
  - Disrupts performance on sensorimotor tasks
  - Lowers behavioral control

(Schmader, Johns, & Forbes, 2008)

Stereotype Threat Effects

- Most research about women and math has been done with college students. What about K-12?
  - Does stereotype threat decrease girls' math performance?
  - Does stereotype threat decrease girls' attitudes and intentions in math?
  - Does stereotype threat lead to disengagement, discounting, and devaluing?

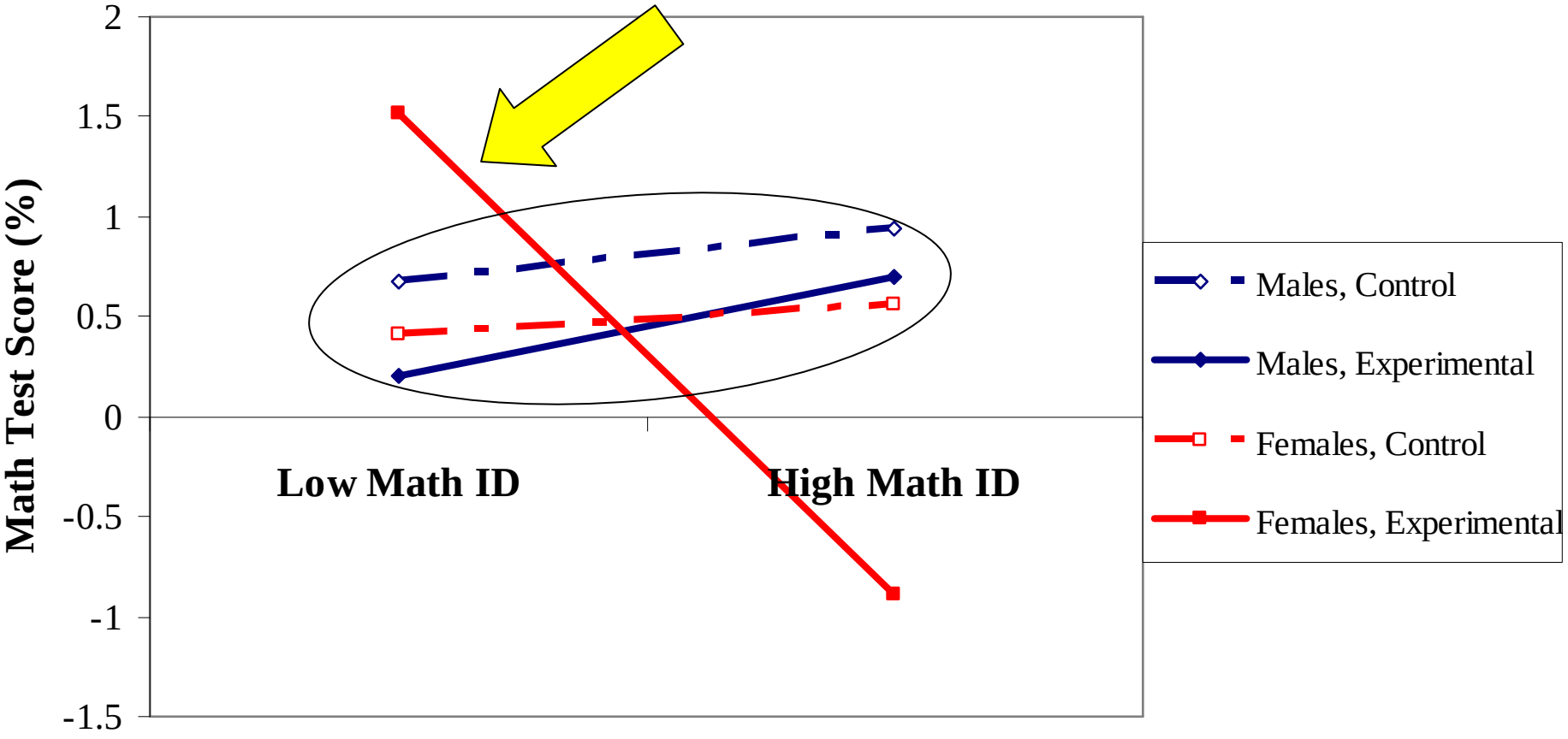
Hypotheses

- Females who are highly identified (math or gender) will be negatively affected by stereotype threat
  - Performance, attitudes, intentions, disengagement, devaluing, discounting
- This effect will be more pronounced for females in honors math classes

Steps to Math Success Project

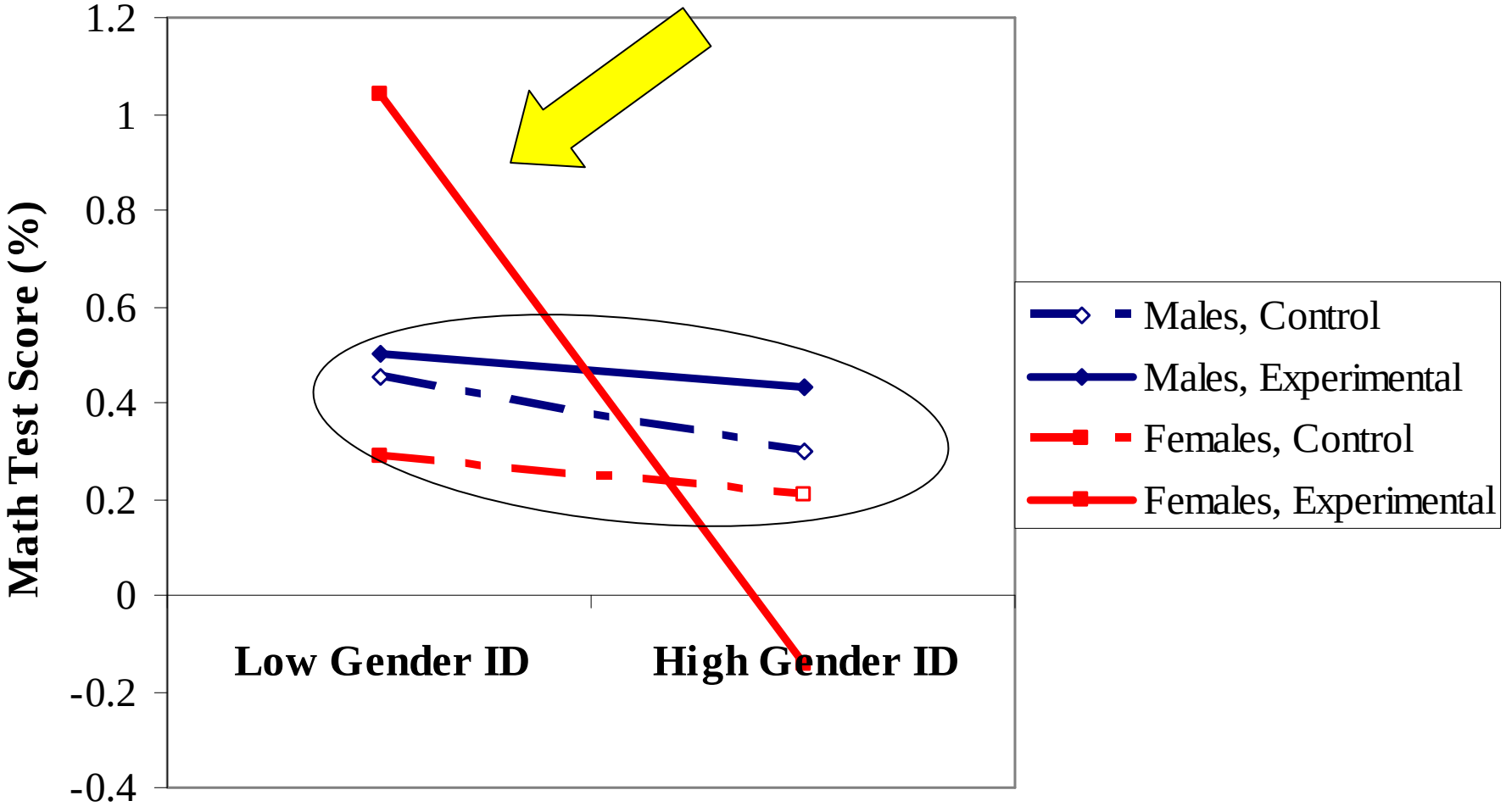
- Three-year study examining effects of stereotype threat in middle school (6-8th grade)
- 7th & 8th Grade Pre-/Algebra students in Pomona Unified School District (*N* = 1124)
- Pre-questionnaire assessed math identity, gender identity, attitudes, intentions, disengagement, devaluing, discounting
- Stereotype threat manipulation (gender differences, no gender differences)
- Math test and post-questionnaire
- Debriefing and fun math activity

Math Performance (Non-honors, 7th grade)



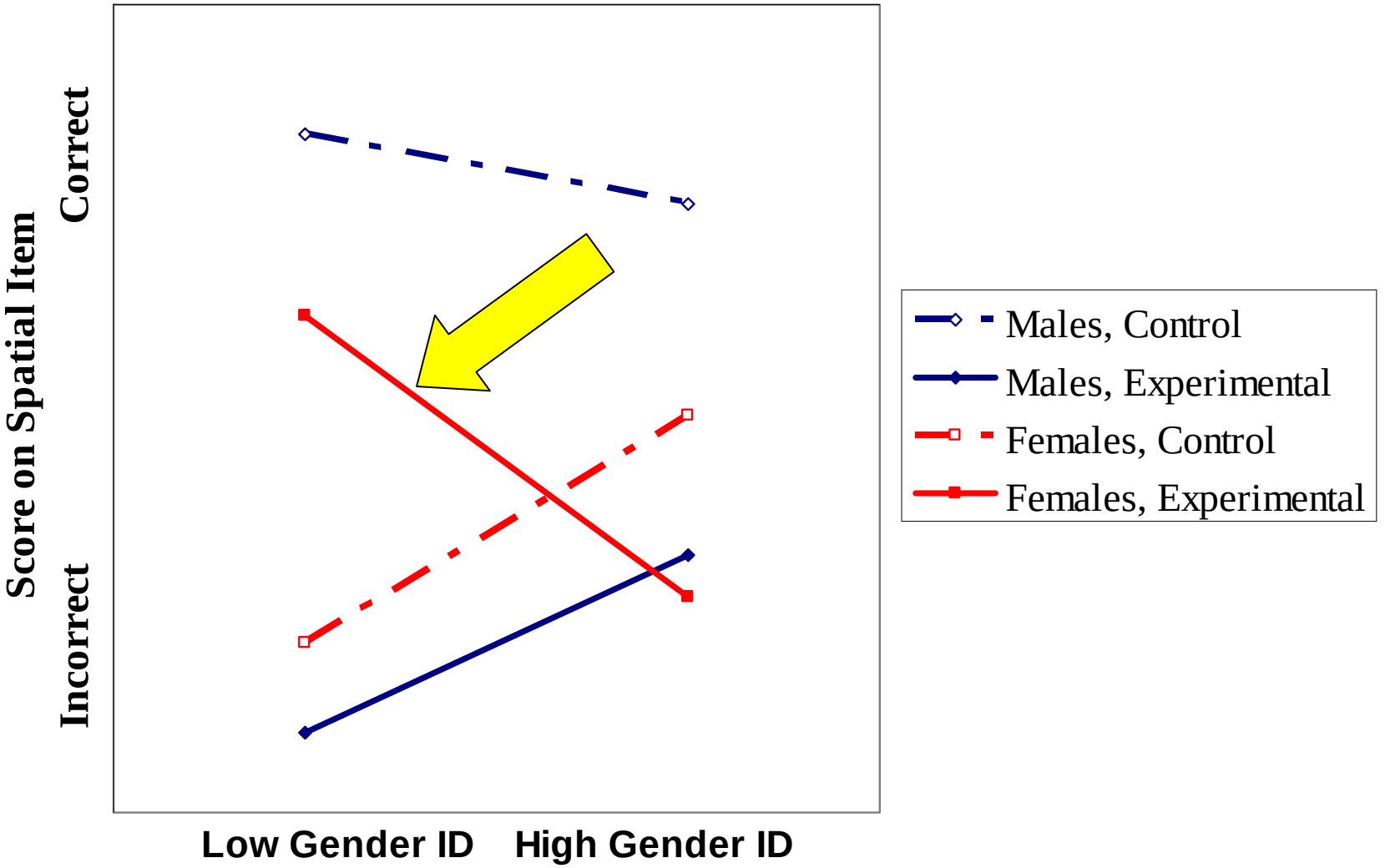
$F(1, 91) = 4.58$, $p = .035$, $R^2 = .297$

Math Performance (Honors, 7th grade)



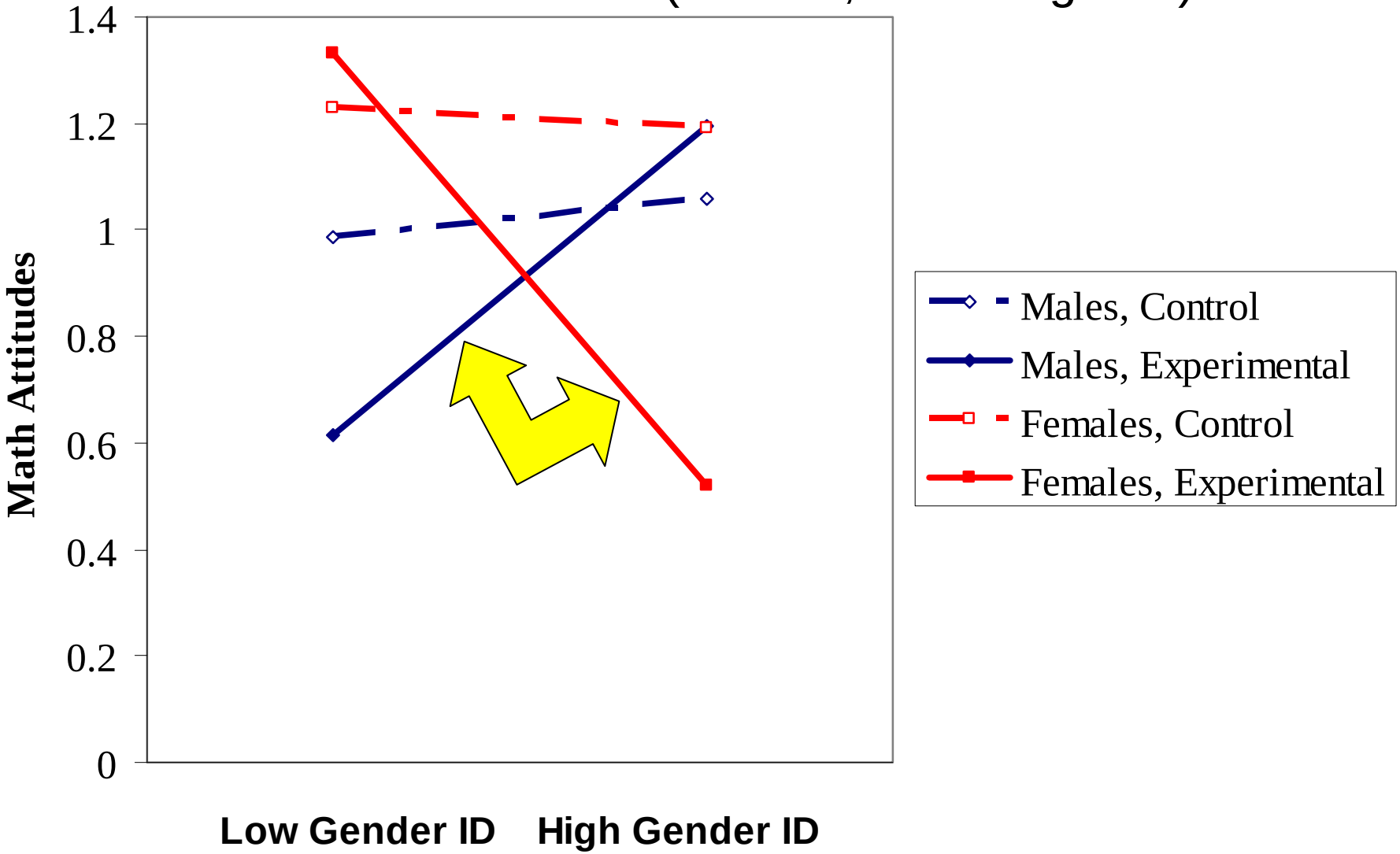
$F(1, 256) = 2.135$, $p = .145$, $R^2 = .376$

Math Performance (Honors, 7th & 8th grade)



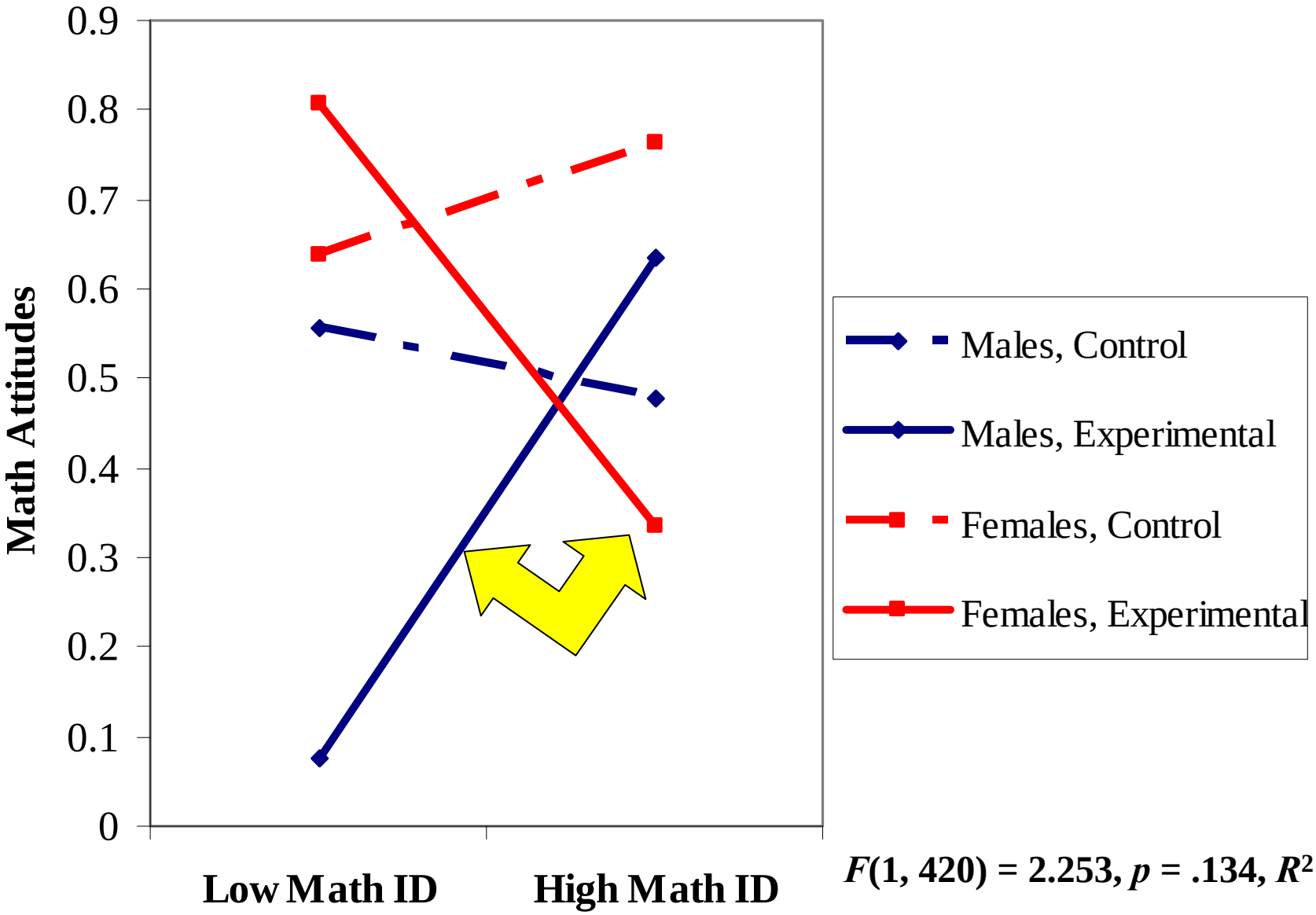
$\chi^2(1, N = 400) = 3.632, p = .057, R^2 = .164$

Math Attitudes (Honors, 7th & 8th grade)



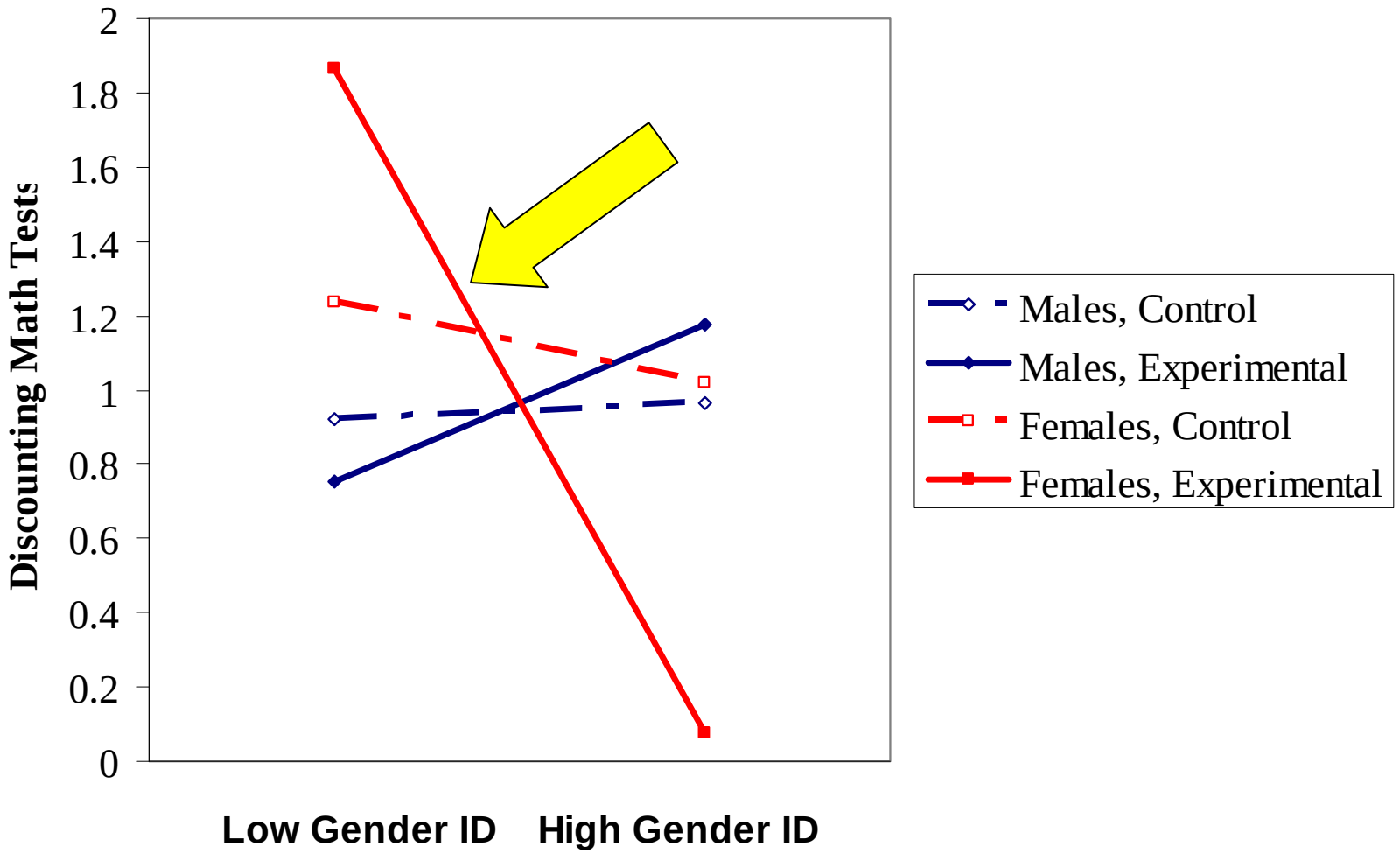
$F(1, 393) = 2.502$, $p = .115$, $R^2 = .099$

Math Attitudes (Honors, 7th & 8th grade)



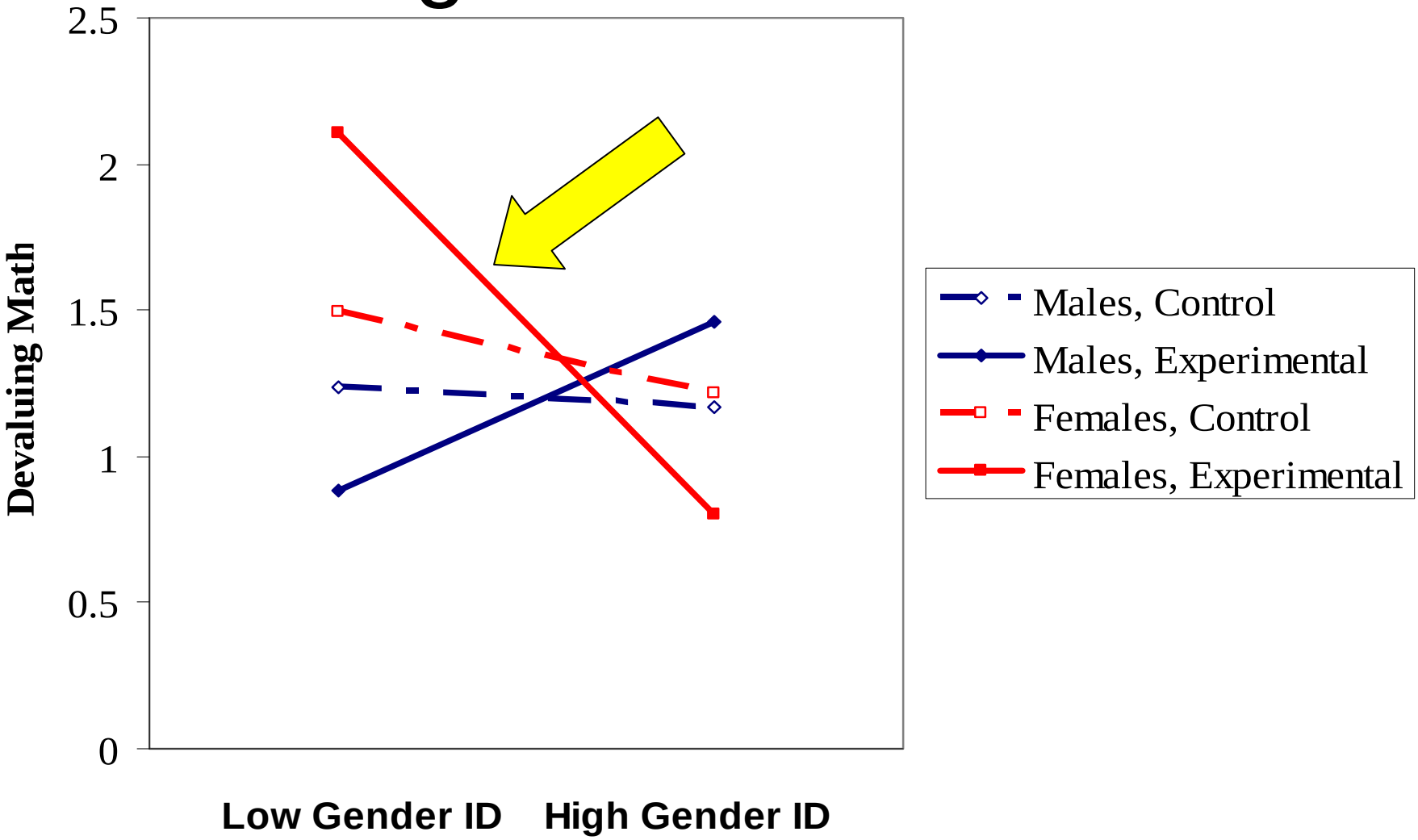
$F(1, 420) = 2.253$, $p = .134$, $R^2 = .154$

Discounting Tests (Honors, 7th & 8th grade)



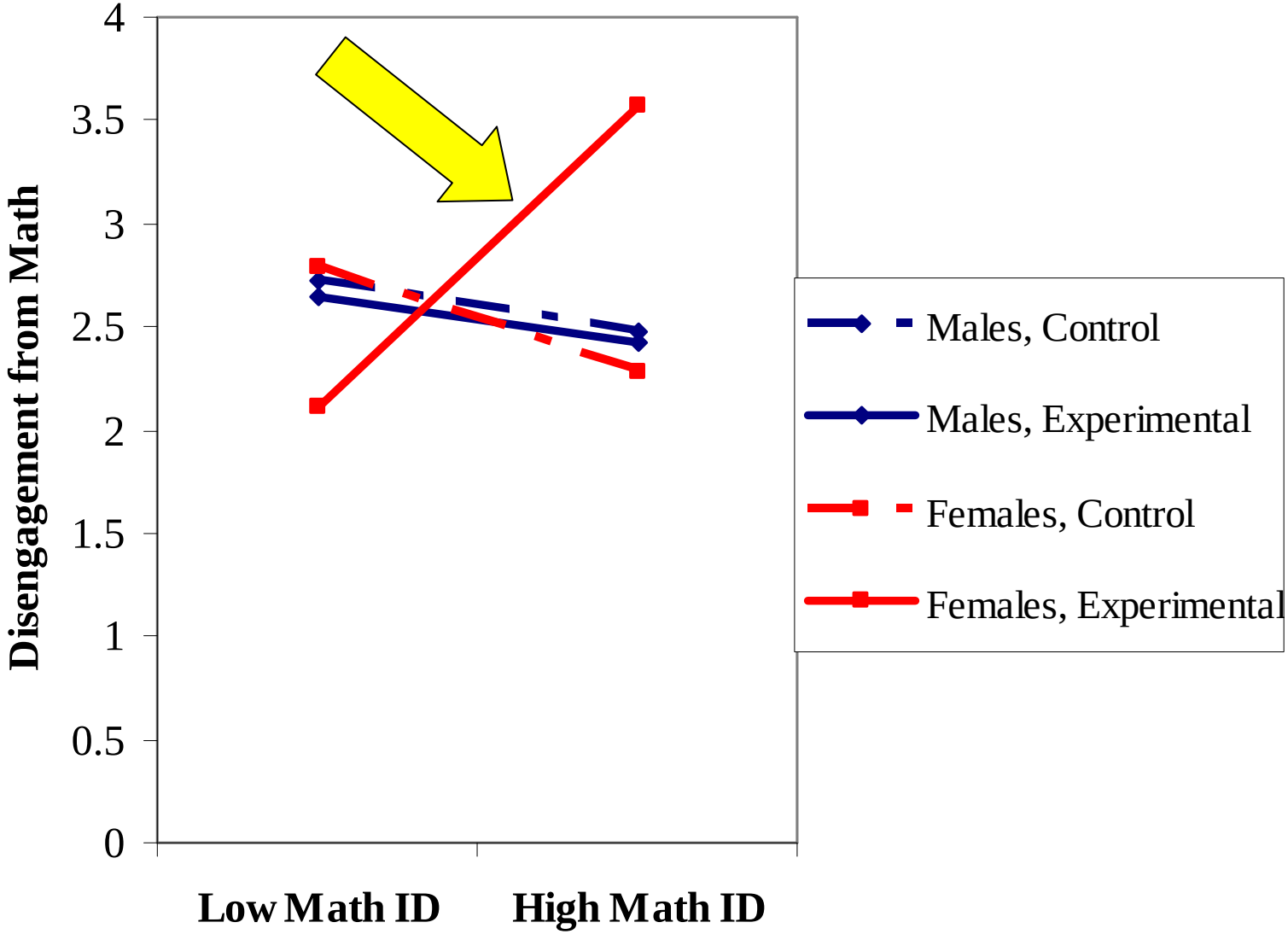
$F(1, 393) = 5.788$, $p = .017$, $R^2 = .111$

Devaluing Math (Honors, 7th & 8th grade)



$F(1, 393) = 4.184$, $p = .041$, $R^2 = .093$

Disengagement (Honors, 7th & 8th grade)



$F(1, 273) = 4.031$, $p = .046$, $R^2 = .212$

How to Reduce Stereotype Threat

- Reframe the task
- Deemphasize threatened social identities
- Encourage self-affirmation
- Emphasize high standards with assurances of capability
- Provide positive role models
- Provide external attributions for difficulty
- Emphasize an incremental view of ability

How to Reduce Stereotype Threat

- Tell people about its effects and it loses power
  - Intervention with women (Johns et al., 2005)
- Describe tests as non-diagnostic
  - Lorbeer Middle School STAR testing
- Ensure gender-fair testing
- Indicate race or gender *after* a test

Marking Gender

- Marking one's gender after (as compared to before) an AP Calculus test led to a 33% reduction in the gender gap in performance (Stricker & Ward, 2004)

Conclusion

- Stereotype threat is a real phenomenon that negatively impacts women's math performance, attitudes, and values
- Stereotype threat is largely situational and therefore…
  - Educators can change students' learning environment to be safe for all learners

Acknowledgements

- NSF STEPS Lab Members: Bren Chasse, Adamina Camacho, Jessica Didway, Libby Sill, Sara Chapman, Kayla Wells, Carolina Nuno, Erika Estrada, Abdiel Flores
- Co-PIs Faye Wachs and Patricia Hale
- Pomona Unified School District
- National Science Foundation

Questions or comments?

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