Women, Genes, and STEM:
The Effects of Biology and Gendered Environments on High School Course-Taking

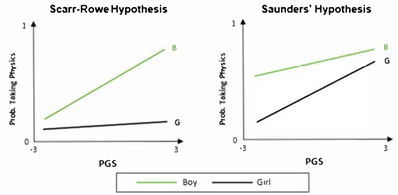
Meng-Jung 'MJ' Lin
PhD Candidate, Department of Sociology
Predoctoral Trainee, Carolina Population Center
The University of North Carolina at Chapel Hill

Abstract

"Why so few women in science?" is a question which has haunted social scientists in an age when gender equality has dramatically improved in other sections of society. Although researchers have examined the influences of biology and gendered environments on decisions to enter or leave STEM, seldom did they consider the interaction between the two factors. To fill the gap, I modeled the likelihood of taking courses in the social sciences or the physical sciences using two genetic measures, the education polygenic score (PGS) and the highest-level math course PGS, together with social factors. Using a sample of 3,067 cases from the National Longitudinal Study of Adolescent to Adult Health, the results of this study suggest the structural influences of gender on the realization of genetic potentials for both girls and boys.

Research Questions

1. How do the genetic and social factors explain the gender gap in advanced science courses in high school?
2. Does the effect of genes differ by gender?



3. How does the interaction of gender and gene vary by school-level socioeconomic status?

Key Hypotheses

- **Example outcome: Physics**
- $Gender \times PGS$
  - Scarr-Rowe Hypothesis: The effect of PGS is stronger for boys than for girls in predicting taking Physics because boys enjoy the more encouraging environment.
  - Saunders' Hypothesis: The effect of PGS is stronger for girls than for boys in predicting taking Physics because girls need a better ability to feel confident to take Physics compared to boys.
- $School\ level\ SES \times Gender \times PGS$
  - Poor environments are a trigger: Girls are less likely than boys to realize their genetic potential in poor environments.
  - Poor environments are a compensator or an enhancer: Girls are more likely than boys to realize their genetic potential in poor environments.

Methods

Data

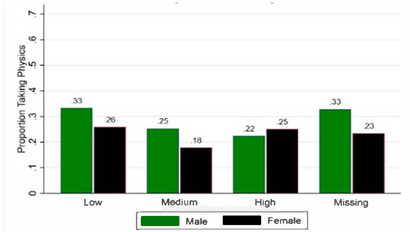
- National Longitudinal Study of Adolescent to Adult Health (Add Health)
- Wave I & the Adolescent Health and Academic Achievement Study (AHAA) in Wave III of Add Health
- Math MTAG PGS and Education GWAS PGS constructed by SSGAC
- Included only European whites
- Sample size: Physics & Advanced Science: 3,028; Calculus: 3,050; English & Social Studies Honors: 3,067

Statistical Analyses

- Multilevel logistic model (level 2: school)
- DV: Whether R took Advanced Courses in high school
- Main IV: highest-level math course MTAG polygenic score, education polygenic score, % eligible for free or reduced price lunch)

Findings

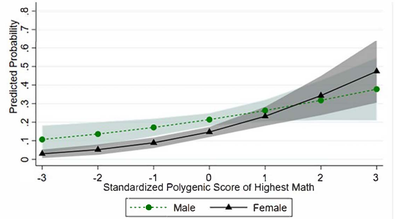
a. Proportion of Males and Females Taking Physics by Gender and Level of Proportion Eligible for Free or Reduced-Price Lunch.



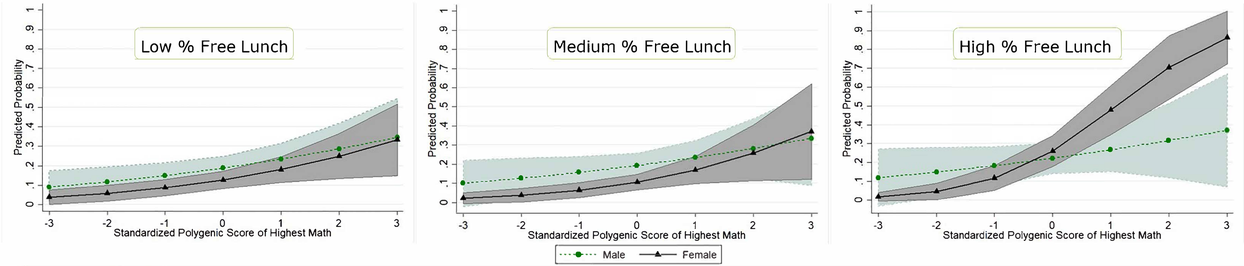
b. Multilevel Models Predicting Physics: Coefficients of Female Unchanged After PGSs Included.

	Physics	
	SES	+PGS
Female	-0.499***	-0.499***
Ability PGS		
Math MTAG PGS		0.450***
Education GWAS PGS		-0.068

c. Gender Differences in the Predicted Probabilities for Taking Physics by Highest-level Math Course Polygenic Score. Saunders' hypothesis supported.



d. Gender Differences in the Predicted Probabilities for Taking Physics by Highest-level Math Course Polygenic Score and Percentage Free Lunch at School. Supports the poor environments are a compensator or an enhancer hypothesis.



Conclusions

1. Females were less likely to take Physics and more likely to take Advanced Science, Honors English and Honors Social Studies than were boys. However, there were slightly more girls than boys taking Calculus, a traditionally male-dominated subject.
2. The addition of PGSs did not explain sufficiently the gender gaps in course-taking, and even widened the gaps.
3. The coefficient of math PGS was stronger for girls than for boys in the gender-separated models when predicting Physics, although the effect of the education PGS was significantly stronger for boys than for girls.
4. Poor schools served as an enhancer for girls with a better math PGS to take Physics.

Acknowledgments This research received support from NIH's Population Research Infrastructure Program awarded to the Carolina Population Center (P2C HD050924) and the Population Research Training grant (T32 HD007168) at The University of North Carolina at Chapel Hill by the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

Contact Meng-Jung Lin
mjlinmj@live.unc.edu

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