Published in final edited form as:

Soc Sci Q. 2014 March 1; 95(1): 253–268. doi:10.1111/ssqu.12022.

The Gender Gap in High School Physics: Considering the Context of Local Communities

Abstract

Objectives—We focus on variation in gender inequality in physics course-taking, questioning the notion of a ubiquitous male advantage. We consider how inequality in high school physics is related to the context of students' local communities, specifically the representation of women in STEM occupations in the labor force.

Methods—This study uses nationally representative data from the National Longitudinal Study of Adolescent Health (Add Health) and its education component, the Adolescent Health and Academic Achievement Transcript Study (AHAA).

Results—Approximately half of schools are characterized by either gender equality or even a small female advantage in enrollment in this traditionally male subject. Furthermore, variation in the gender gap in physics is related to the percent of women who are employed in STEM occupations within the community.

Conclusion—Our study suggests that communities differ in the extent to which traditionally gendered status expectations shape beliefs and behaviors.

Introduction

Given the prominent role of education in shaping individuals' future life chances, educational disparities have long been a topic of concern for social scientists. While men historically held strong advantages in the domain of education, women have reached parity on most educational markers, and have eclipsed men in terms of college attendance and baccalaureate attainment (Buchmann and Diprete, 2006). Because of the quite dramatic educational progress of women in the last few decades, the few remaining instances of inequality stand in stark relief.

Specifically, gender disparities remain in the fields of science, technology, engineering, and mathematics (STEM). At the secondary level, female students continue to lag behind male students in rates of physics course-taking in high school (Riegle-Crumb, Farkas, and Muller, 2006; Ma, 2011b). Indeed this gender disparity has remained fairly constant over the past 30 years even as the overall percentage of students taking physics has increased (Freeman, 2004; Nord et al., 2011). This gap stands in contrast to trends in advanced math course-taking, as females have reached parity with male students in rates of completing high school calculus (Hyde et al., 2008), as well as trends in test scores, such that while small gender gaps in math and science achievement remain, they have shrunk considerably over the last several decades (Xie and Shauman, 2003). Despite progress on these other indicators, the

most currently available national statistics indicate that in 2009, 36 percent of female high school graduates had taken physics compared to 41 percent of male graduates (Nord et al., 2011). Furthermore, this gender disparity foreshadows patterns at the postsecondary level, where women have made little inroads into physical science and engineering college majors over the last thirty to fifty years (England and Li, 2006). High school physics is clearly a critical location of inequality to examine and therefore is the focus of this paper.

Specifically, we consider potential variation in patterns of gender inequality within the United States regarding physics course-taking, and in doing so question the notion of a ubiquitous male advantage. Building on the insights of several recent international studies which find that gaps in math and science achievement among high school youth are related to the status of women in other social domains, most notably, the labor force (Guiso et al., 2008; Fryer and Levitt, 2010; Penner, 2008), we consider how inequality in high school physics course-taking is related to women's employment status within local communities. Utilizing nationally representative data from a recent sample of high school students, we examine whether gender gaps in physics may be smaller in scope in those communities where more women are employed in STEM occupational fields, as traditional gender norms and stereotypes may be less salient in such contexts. This article contributes to the extant literature on gender inequality by offering evidence that local environments have the capacity to construct their own micro-level gender systems where individuals are less constrained by traditional definitions of gender.

Background

Previous Literature

This study is guided by theories of gender as a social structure or system, one that is constructed across multiple levels or dimensions, ranging from the macro level of large-scale institutions and broad cultural beliefs to the micro level of local environments and personal interactions (Risman, 2004). Past research has documented how inequality is created and maintained by reinforcing connections between beliefs, norms, and behaviors across these various domains (Ridgeway, 2011). Yet it is also important to focus on variation in the extent of inequality and search for those places gender appears to be less salient in shaping expectations and behaviors (Eisenhart and Finkel, 1998; Deutsch, 2007; Risman, 2004). When viewing gender through this lens, theorists argue that gender can be alternatively constructed or deconstructed in ways that resist or subvert traditional paradigms, revealing that gender differences are neither inevitable nor omnipresent.

Recent international research provides empirical support for this idea. Specifically, it suggests that countries themselves can be viewed as gender social systems with their own related norms, practices and cultural beliefs. And while many countries share similarities, there is nevertheless important variation between them regarding status expectations and norms related to gender. In other words, countries can and do differ from one another in the degree and definition of gender inequality, yet within countries there are clear connections between the disparities in different levels and domains, such as education and the labor force. Given the long-standing stereotypes of math and science as male fields (Buck et al.,

2008), several studies have examined the connection between the gender gap in these subjects in high school and other manifestations of gender inequality in the larger society.

For example, Guiso et al. (2008) considered variation across forty countries in the gender gap in math achievement tests among 15 years olds as part of the Program for International Assessment Study (PISA). They found that while girls' international average was slightly lower than boys', there was nevertheless a substantial degree of variation in gender inequality; for example, girls outscore their male peers in some countries such as Iceland. Importantly, the authors found that this variation was not random, but rather countries with more equitable math scores had higher scores on the World Economic Forum Gender Gap Index (GGI), a scale where a high value indicates comparatively greater gender equality in economic participation and opportunities, educational attainment, political empowerment, and health and survival. These results were net of per capita Gross Domestic Product (GDP) and other potentially confounding measures. An examination of PISA data by Fryer and Levitt (2010) found comparable results, as did a study by Hyde and Mertz (2009), who found that higher national scores on the GGI index were associated with a smaller male advantage among those in the top five percent of the math test distribution.

Finally, a recent study by Penner (2008) reveals similar patterns. Examining data from more than twenty countries included in the Third International Mathematics and Science Survey (TIMSS) he found not only extensive variation in the size of mean differences across countries as well as the direction of the advantage, but also discovered that contrary to expectations, females have higher test score variance than males in several countries in the sample. In considering the association between variation in the test score gap and women's status at the national level, Penner (2008) explored separate measures for the labor force, the domestic sphere, the political sphere, etc. Results indicated that women's status in the labor force, including the percentage of female managers, is most closely related to gender differences in math test scores throughout the achievement distribution. These findings suggest that girls and their parents and educators are likely aware of future opportunities when making educational choices and investments (Schultz, 1995).

Taken together, these studies indicate that gender gaps in math and science among young people are not isolated incidents of inequality, but rather part of a country's gender system and therefore connected to disparities in other domains such as the labor force. Yet at the same time, there is international variation in the degree of gender inequality, suggesting that gender may be less salient as a status characteristic shaping expectations and behaviors in some countries than in others. Rather than simply acknowledging the theoretical likelihood that the salience of traditional gender norms and beliefs can vary across contexts, these studies comprise a relatively small body of research that explicitly attempts to model this variation.

This Study

We build on this prior research exploring variation across countries by considering whether a much smaller context might be relevant to consider. We suggest that more local environments have the potential to construct their own micro-level gender systems where individuals are less constrained by traditional norms and beliefs across domains.

Specifically, utilizing nationally representative data from a recent sample of high school students, we explore variation across the different contexts of local communities within the U.S. We focus on gender gaps in physics course-taking as one of the few remaining vestiges of math and science disparities between males and females in high school. To the extent that we find variation in the gap across schools, this offers evidence contrary to the notion that males and females have naturally or innately different preferences that led to consistent gaps in choice of courses (Charles and Bradley, 2002).

We then consider the relationship between the gender gap in physics course-taking and women's status in the labor force, building on the insights of Penner (2008) about the strong link between gaps in math achievement among young people and this particular domain of inequality among the adult population. Yet we focus not just on the labor force writ large, but on women's representation in STEM occupations specifically. In communities where women have higher levels of employment in these particular occupational fields, traditional gender norms and stereotypes pertaining to math and science may be less salient and consequently, girls, their friends, parents, and teachers may make decisions that are not constrained by typical gender scripts.

Specifically, the presence of women in these professions can alter the perception of the opportunity structure and therefore change girls' mental pictures of what is possible (Ma, 2011a). While this process could occur via women in STEM occupations acting as role models for young girls, this is but one likely minor method of transmission. It is also possible that communities with a larger STEM female labor force are home to STEM-related corporations or organizations that have outreach programs to local schools that come into play. Parents, teachers, and counselors are also likely actors in this process, and to the extent that their beliefs and actions are less shaped by traditional gender norms in communities with a larger female STEM workforce, their subsequent interactions and exchanges with female high school students may be more encouraging of decisions to take physics.

We note that it is not our intent to make causal claims, and it is beyond the scope of this study to pinpoint the actual mechanisms that might lead to this association. Rather we seek to provide a quantitative thick description of covariance in gender inequality, providing empirical evidence of contexts where traditional gender roles appear to be 'undone' that will inform the literature. We suggest that an association between gender inequality in physics course-taking and women's presence in STEM occupations in the community (detected net of a set of control variables to help guard against spurious results) speaks to the connection between different domains of the social system of gender, while also offering evidence of the potential for gender to be alternatively constructed in local contexts.

Data

This study uses data from the National Longitudinal Study of Adolescent Health (Add Health) and its education component, known as the Adolescent Health and Academic Achievement Transcript Study (AHAA). Beginning in the base year of survey collection in 1994, about 200 adolescents in grades 7-12 were selected from each of 80 pairs of schools (high schools and their feeder middle schools), with approximately equal numbers of males

and females in each grade, resulting in a total sample of 20,745 (Bearman, Jones, and Udry, 1997). Parents were also interviewed, as well as school administrators, providing additional information about students' families and schools. The longitudinal design of Add Health includes the initial student survey in 1994-95, with follow-ups in 1995 and 1996. In 2001-2002, Add Health administered a third wave of data collection for 15,197 respondents, or 73% of the original Wave I sample. Additional information about Add Health can be found at www.cpc.unc.edu/projects/addhealth.

The AHAA data set is a new component of the Add Health that contributes major new education data to its parent survey. The Wave III Add Health data collection included a signed release to collect high school transcripts from all Add Health respondents. Approximately 92.9% of Wave III Add Health respondents signed a valid transcript release form (N=14,113) and the AHAA collected high school transcripts from almost 87% of them (N=12,258), or approximately 81% of the Wave III sample. Each course that appeared on a student's transcript was coded with a standard coding scheme, the Classification System for Secondary Courses (CSSC), which was developed by NCES and has been used in all major transcript studies, including the National Assessment of Educational Progress (NAEP). Grades and credits earned were also coded to be comparable across the nation. Importantly for the purposes of this study, the AHAA data also includes contextual data from the National Center for Education Statistics (NCES), which attached Census 2000 data on issues such as labor force characteristics, to school districts.

Because we are interested in high school course-taking, our analytic sample is limited to students in the 9th, 10th, 11th, or 12th grades in the base year. We also choose to focus on public schools, excluding private schools from our sample as they are more likely to have uniform course-taking requirements that limit student choice (Bryk, Lee, and Holland, 1993). Finally, we limit our sample to students with valid information on our dependent variable, our focal independent variable for the percentage of adult females in STEM occupations, as well as gender and race-ethnicity. Missing data for all other variables are imputed via multiple imputation. Our final analytic sample includes 63 schools and 5821 students. All analyses are weighted.

Variables

Our dependent variable is a dichotomous indicator of whether or not the student took physics by the end of high school, as evidenced by his/her high school transcript. The Add Health/AHAA data is uniquely suited to explore the variation across schools in the existence and scope of the gender gap in physics course-taking because unlike other national education datasets, it has large representative within-school samples of approximately two hundred students per school (Joyner and Kao, 2000).ⁱ

ⁱBecause Add Health collected an "In School" survey from the entire student body of the sampled schools, we were able to use this "In School" sample weight along with the students' transcript sample weight to construct the sampled students' weight within their school. We then use this approximation of the students' representativeness within their school to estimate Physics course-taking for the entire school. We also use this weight, along with the school sample weight, for our analyses. To check for robustness, analyses were also run using just the transcript weight with comparable results.

A key focus of this paper is the role of the social context of communities in shaping gendered patterns of science course-taking. To examine this, we utilize the afore-mentioned contextual census data from the AHAA study. The unit of measurement for these variables is the district in which the Add Health school is located, and we treat this as a proxy for the local community. The census data includes information on various occupational fields. For the analyses here, we include a measure of the percentage of employed women in the community who are employed in STEM professions, including those in technology, mathematical, architectural, and engineering fields. These occupations capture a large share of the predominantly male-dominated science-related workforce. Further, to discern whether gender patterns of physics course-taking in high school are related to women's presence in high status occupations in the labor force more generally, or that specifically in STEM fields, we also include a measure of the percentage of women employed in professional occupations regardless of specialty. As seen in Table 1, the percentage of women employed in STEM occupations ranges from 0 percent to 11 percent with a mean of 1.62 percent, and the percentage of employed females in professional occupations ranges from 8 percent to 37 percent with a mean of 23.21 percent.ⁱⁱ

In addition to these measures, we include other school-level indicators. To capture aspects of social class beyond the student's own family, we include a measure of the percentage of parents in the school with college degrees. Indicators of region (Northeast, South, and Midwest vs. West) are also included. In exploratory analyses, we also controlled for the school's size, urbanicity, community size, and magnet status, but these variables were never statistically significant and therefore are excluded from our final models for parsimony.

At the student level, variables include gender (coded 1 for female and 0 for male), race/ethnicity (African American, Latino, and Asian, with white as the reference category), parent education level (coded as a series of dummy variables with high school graduation as the reference), and family income (logged). Maternal occupation is also included as a dichotomous variable for whether the mother is in a professional or managerial occupation. Detailed information on specialty or field are unfortunately not available from Add Health, so it is not possible to control on whether mothers themselves are employed in science-related occupations. Finally, measures of students' academic background are controlled, specifically their freshman year grade point average and an indicator for whether they began high school taking the normative course of earth science (or a higher course) vs. a lower level basic or remedial science course.

ⁱⁱIn exploratory analyses, we also included a measure of the percentage of males in STEM occupations, but this variable was never statistically significant and was highly correlated with the percentage of females in STEM occupations in the community ($r=.91$); therefore, we exclude it from our final models. Additionally, based on a reviewer's recommendation, we also ran analyses that included measures for the overall proportion of the labor force in the area that is employed in STEM and a separate measure for the proportion of that STEM labor force that is female. The interaction between female and the proportion of the STEM labor force that is female was positive and statistically significant, while the interaction between female and the overall proportion of the labor force employed in STEM occupations was not significant, indicating that indeed it is female representation in local STEM employment that is associated with girls' physics course-taking, not overall local STEM employment.

Results

Descriptive Analyses

To explore the variation across schools in the gender gap in physics, we calculated effect sizes for proportions known as Cohen's 'h' (Cohen, 1988). This is calculated with the following formula: $2 \cdot \arcsin(\sqrt{pm}) - 2 \cdot \arcsin(\sqrt{pf})$, where pm is the proportion of males taking physics, and pf is the proportion of females taking physics. We then follow Cohen's classification of the magnitude of effect sizes (Hyde et al., 2008). Specifically, effect sizes greater than .66 are considered large, those between .36 and .65 are considered moderate, and those between .11 and .35 are considered small. An effect size of .10 or smaller is generally interpreted as indicating no substantive difference between estimates.

Table 2 demonstrates that there is indeed substantial variation among schools in the gendered pattern of physics course-taking. Almost one-quarter of schools had roughly equitable proportions of males and females taking physics. Additionally, over a quarter of schools were home to a female advantage in rates of physics course-taking. While this advantage was large in only about 2% of schools, it was moderately sized in approximately 5% of schools and small in roughly 21% of schools. Certainly many schools exhibited a male advantage, as approximately 18% had a small male advantage, about 21% had a moderate size advantage, and 11% had a rather large advantage. Given this pattern, a singular estimate of the gender gap calculated across all schools would indicate an average male advantage in rates of physics course-taking (as consistent with past research and our subsequent analyses presented in Table 3). Yet we think it important to note that such an average belies the fact that approximately half of schools are characterized by either no gender difference or a female advantage. Clearly the data does not reveal a consistent and indisputable advantage in favor of males.

Multivariate Analyses

After looking at physics course-taking descriptively, we use hierarchical generalized linear modeling (HGLM) to explore whether the gendered context of the community, specifically the percentage of women in STEM occupations in the local labor force, is related to the gender gaps in physics. We model this dichotomous outcome using the HLM software developed by Bryk and Raudenbush (1992).ⁱⁱⁱ We grand mean center all variables except gender for improved interpretability. As shown below, we include student-level predictors at level 1, and then our community and school predictors at level 2.

$$\text{Level 1: Physics}_{ij} = b_{0j} + b_{1j} (\text{female}) + b_{2-13} (\text{individual-level controls}) + e_{ij}$$

$$\begin{aligned} \text{Level 2: } b_{0j} &= \gamma_{00} + \gamma_{01} (\% \text{females in STEM occupations}) + \gamma_{02} (\% \text{females in professional occupations}) + \gamma_{03-06} (\text{school} \\ b_{1j} &= \gamma_{10} + \gamma_{11} (\% \text{females in STEM occupations}) + \gamma_{12} (\% \text{females in professional occupations}) + \gamma_{13-16} (\text{school} \end{aligned}$$

ⁱⁱⁱHLM also calculates estimates of standard errors that account for the correlated error terms of students clustered within the same school. We report results from unit-specific models (Raudenbush 2006).

Results of these analyses are displayed in Table 3, both as logistic coefficients and as odds ratios. We first show estimates for analyses that fit only the level 1 model. As expected, we see that taking the average across all schools, females are significantly less likely than male students to enroll in physics. Further, students with higher GPA's, those who enter high school taking earth science or a higher level course, and those from families with higher levels of parental education are significantly more likely to take physics.

Next, by including cross-level interactions between the level 2 variables and the slope for the effect of gender on physics at level 1, we can examine whether community labor force characteristics are related to an increase or decrease in the gender gap in physics. The results shown in model 2 reveal a statistically significant positive interaction, such that as the percentage of females employed in STEM occupations increases, the odds of girls taking physics compared to boys also increases. Put differently, schools in communities with a higher percentage of women in such fields have less of a female disadvantage in rates of physics course-taking. The percentage of women in the community employed in all professions does not significantly predict gendered patterns of course-taking (although it does predict an overall higher probability of taking physics as indicated by the positive interaction with the intercept). Finally, we note that the gender gap in high school physics is also larger in the Midwest than in the West.

To better gauge the effect of women's employment in STEM occupations, we calculated how an increase in this measure would impact the predicted female probability of taking physics, (as well as the corresponding male probability) with all other variables held at the mean. When the percentage of adult females in these occupations is at the mean (about 1.62 percent), the predicted probability of girls taking physics is approximately .15 (compared to a predicted probability of about .25 for high school boys). When the percentage of women in STEM occupations reaches about 5% (two standard deviations above the mean), girls' probability of taking physics increases to .22, thereby coming closer to boys' average predicted probability. When the percentage of females in these occupations increases to about 7 percent (three standard deviations above the mean), girls' predicted probability of taking physics increases to approximately .27, while boys' probability remains unchanged. Thus in communities where the employment of women in STEM occupations is much higher than the norm, high school girls have a higher predicted probability of taking physics compared to boys.

Conclusion

Within the United States and across much of the developed world, long-standing gender educational disparities favoring men have disappeared or even reversed in favor of women (Charles and Bradley, 2002; Buchmann and Diprete, 2006). Yet inequality remains in STEM fields, particularly those in in physical sciences (England and Li, 2006). This paper focused on the gender gap in high school physics course-taking with the goal of exploring variation in its existence and scope, as well as its association with gendered aspects of local communities. In doing so, we depart from most of the previous research on gender gaps in math and science in the U.S., which tends to focus on individual-based arguments.^{iv} For example, studies have examined how girls' academic background and skills as well as their

interests and attitudes all work to shape their course-taking decisions (Eccles, 1994; Correll, 2001; Xie and Shauman, 2003).

In contrast, we seek to contribute to the literature by considering gender as a social system, exploring variation in science course-taking gaps across local contexts and the potential connection to women's status in the labor force. Using nationally representative data on high school students, the results of our analyses revealed that there is substantial variation across schools in the extent to which girls are under-represented in physics courses. The aggregate pattern of male advantage in high school science course-taking, cited in a wealth of reports from organizations such as the National Science Foundation and the Department of Education as well as in academic research journals (National Science Board, 2004; National Academy of Science, 2007; AAUW, 2008), obscures the fact that a large percentage of our nation's high schools are characterized by gender equality or even a female advantage in rates of enrollment in this traditionally male subject. Such evidence indicates that a male advantage is likely neither innate nor inevitable.

Additionally, the analyses show that the degree of gender difference in physics course-taking varies in relation to the gendered context of the local community labor force. The male advantage in high school physics is significantly smaller or non-existent in schools situated within communities where more women are employed in STEM professions. This association is net of a host of rigorous controls to capture potentially confounding effects, including women's representation in professional fields across all specialties. This observed link is consistent with theories of gender as a social system, characterized by reinforcing connections between norms, practices, and beliefs operating across different domains of social life such as education and the labor force (Risman, 2004; Ridgeway, 2011).

Furthermore it also provides empirical support for the idea that the salience of gender varies across contexts, so that not only countries but also communities differ from one another in the extent to which traditionally gendered status expectations shape beliefs and behaviors (Deutsch, 2007). In communities where a higher percentage of working women are employed in STEM occupations, larger gender stereotypes at the societal level may be subverted by a picture of what is possible that differs from that typically associated with more traditional gender roles. Such alternative definitions of gender likely permeate the interactions and experiences not only of high school girls, but those of parents, teachers, and men and women throughout the community.

It is well beyond the scope of this study to pinpoint the mechanisms and processes that underlie the association we observe between gendered trends in the labor force and in schools. Quantitative research such as ours is necessarily limited by the availability of data. For example, no current national surveys query students, parents, or teachers about topics such as gender norms within their communities or their awareness of larger issues of inequality. Future research could perhaps explicitly address these and related topics, and consequently shed more light on the construction of gender roles across different community

^{iv}A notable exception is a recent study by Ma (2011a) who examined how occupational segregation by gender at the national level influences individuals' choice of college major.

contexts. By calling attention to those places and situations characterized by equality, even if they are less frequent in their occurrence, we can learn more about the factors that continue to create and sustain contemporary patterns of inequality.

References

- American Association of University Women Educational Foundation. Where the Girls Are: The Facts about Gender Equity in Education. AAUW Educational Foundation; Washington, DC: 2008.
- Bearman, Peter S.; Jo, Jones, J.; Udry, Richard. The National Longitudinal Study of Adolescent Health: Research Design. 1997. Available from: <http://www.cpc.edu/projects/addhealth/design.html>
- Bryk, Anthony S.; Lee, Valerie E.; Holland, Peter B. Catholic Schools and the Common Good. Harvard Press; Cambridge: 1993.
- Buchmann, Claudia; DiPrete, Thomas A. The Growing Female Advantage in College Completion: The Role of Family Background and Academic Achievement. *American Sociological Review*. 2006; 71:515–541.
- Buck, Gayle A.; Plano Clark, Vicki L.; Leslie-Pelecky, Diandra; Lu, Yun; Cerda-Lizarraga, Patricia. Examining the Cognitive Processes Used by Adolescent Girls and Women Scientists in Identifying Science Role Models: A Feminist Approach. *Science Education*. 2008; 92:688–707.
- Charles, Maria; Bradley, Karen. Equal But Separate? A Cross-National Study of Sex Segregation in Higher Education. *American Sociological Review*. 2002; 67:573–599.
- Cohen, Jacob. Statistical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum; Hillsdale, NJ: 1988.
- Correll, Shelley J. Gender and the Career Choice Process: The Role of Biased Self-Assessments. *The American Journal of Sociology*. 2001; 106:1691–1730.
- Deutsch, Francine M. Undoing Gender. *Gender and Society*. 2007; 21:106–127.
- Eccles, Jacquelynne S. Understanding Women's Education and Occupational Choices: Applying the Eccles et al. Model of Achievement-Choices. *Psychology of Women Quarterly*. 1994; 18:585–609.
- Eisenhart, Margaret A.; Finkel, Elizabeth. Women's science: Learning and Succeeding from the Margins. The University of Chicago Press; Chicago, IL: 1998.
- England, Paula; Li, Su. Desegregation Stalled: The Changing Gender Composition of College Majors, 1971-2002. *Gender and Society*. 2006; 20:657–677.
- Freeman, Catherine E.; U.S. Department of Education. National Center for Education Statistics. Trends in Educational Equity of Girls and Women: 2004 (NCES 2005-016). U.S. Government Printing Office; Washington DC: 2004.
- Fryer, Roland G.; Levitt, Steven D. An Empirical Analysis of the Gender Gap in Mathematics. *American Economic Journal*. 2010; 2:210–40.
- Guiso, Luigi; Monte, Ferdinando; Sapienza, Paola; Zingales, Luigi. Culture, Gender, and Math. *Science*. 2008; 320:1164–1165. [PubMed: 18511674]
- Hyde, Janet S.; Lindberg, Sara M.; Linn, Marcia C.; Ellis, Amy B.; Williams, Caroline C. Gender Similarities Characterize Math Performance. *Science*. 2008; 321:494–495. [PubMed: 18653867]
- Hyde, Janet S.; Mertz, Janet E. Gender, Culture and Mathematics Performance. *Proceedings of the National Academy of Sciences*. 2009; 106:8801–8807.
- Joyner, Kara; Kao, Grace. School Racial Composition and Adolescent Racial Homophily. *Social Science Quarterly*. 2000; 81:810–825.
- National Academy of Sciences. Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering. The National Academies Press; Washington DC: 2007.
- National Science Board. Science and Engineering Indicators 2004. National Science Foundation (NSB 04-01); Arlington, VA: 2004.
- Nord, Christine; Roey, Shep; Perkins, Robert; Lyons, Marsha; Lemanski, Nita; Brown, Janis; Schuknecht, Jason; U.S. Department of Education. National Center for Education Statistics. The Nation's Report Card: America's High School Graduates. U.S. Government Printing Office; Washington, DC: 2011. NCES 2011462

- Nosek, Brian A.; Smyth, Frederick L.; Sriram, N.; Lindner, Nicole M.; Devos, Thierry; Ayala, Alfonso; Bar-Anan, Yoav; Bergh, Robin; Cai, Huajian; Gonsalkorale, Karen; Kesebir, Selin; Maliszewski, Norbert; Neto, Felix; Olli, Eero; Park, Jaihyun; Schnabel, Konrad; Shiomura, Kimihiro; Tulbure, Bogdan Tudor; Wiers, Reinout W.; Somogyi, Monika; Akrami, Nazar; Ekehammar, Bo; Vianello, Michelangelo; Banaji, Mahzarin R.; Greenwald, Anthony G. National Differences in Gender-Science Stereotypes Predict National Sex Differences in Science and Math Achievement. *Proceedings of the National Academy of Sciences*. 2009; 106:10593–10597.
- Ma, Yingyi. College Major Choice, Occupational Structure and Demographic Patterning by Gender, Race, and Nativity. *The Social Science Journal*. 2011a; 48:112–129.
- Ma, Yingyi. Gender Differences in the Paths Leading to a STEM Baccalaureate. *Social Science Quarterly*. 2011b; 92:1169–1190.
- Penner, Andrew M. Gender Differences in Extreme Mathematical Achievement: An International Perspective on Biological and Social Factors. *American Journal of Sociology*. 2008; 114:S138–S170.
- Raudenbush, Stephen W.; Bryk, Anthony S.; Cheong, Yuk Fai; Congdon, Richard T., Jr. HLM 6: Hierarchical linear and nonlinear modeling. *Scientific Software International*; Chicago: 2004.
- Ridgeway, Cecilia L. *Framed by Gender: How Inequality Persists in The Modern World*. Oxford University Press; New York: 2011.
- Riegle-Crumb, Catherine; Farkas, George; Muller, Chandra. The Role of Gender and Friendship in Advanced Course-Taking. *Sociology of Education*. 2006; 79:206–228. [PubMed: 20333274]
- Riegle-Crumb, Catherine; King, Barbara. Questioning a White Male Advantage in STEM: Examining Disparities in College Major. *Educational Researcher*. 2010; 39:656–664.
- Risman, Barbara J. Gender as a Social Structure: Theory Wrestling with Activism. *Gender and Society*. 2004; 18:429–450.
- Schultz, T. Paul Investments in the Schooling and Health of Women and Men: Quantities and Returns. In: Schultz, T. Paul, editor. *Investment in Women's Human Capital*. University of Chicago Press; Chicago: 1995. p. 15-49.
- Xie, Yu; Shauman, Kimberlee A. *Women in Science: Career Processes and Outcomes*. Harvard University Press; Cambridge: 2003.

Table 1
Descriptive Statistics

Variable	Mean/Prop	SD
Dependent Variable		
Physics Course Taking	0.279	0.448
Student-Level Independent Variables		
<i>Gender</i>		
Male	0.472	0.499
Female	0.526	0.499
<i>Race/Ethnicity</i>		
Hispanic	0.167	0.373
Black	0.210	0.407
White	0.510	0.500
Asian	0.088	0.283
<i>Academic Background</i>		
GPA	2.629	0.858
On-Track Freshman Science Course	0.831	0.375
<i>Family Background</i>		
Mother in Professional Occupation	0.071	0.256
Logged Income	3.572	0.872
<i>Parent Education</i>		
Less than HS	0.117	0.322
HS	0.244	0.429
Vocational	0.091	0.287
Some College	0.202	0.401
College Deg	0.200	0.400
Advanced Deg	0.146	0.353
School-Level Independent Variables		
<i>Characteristics of Community Labor Force</i>		
Percent of Females in STEM Occupations	1.619	1.670
Percent of Females in Professional Occupations	23.206	5.159
<i>School Controls</i>		
Percent of Parents in School with a College Degree	36.168	14.121
West	0.206	0.408
Midwest	0.222	0.419
South	0.397	0.493
Northeast	0.175	0.383
N=5821 Students & 63 Schools		

Note: GPA ranges from 0 to 4; On-Track Science Course indicates Earth Science and Above; Logged Income ranges from 0 to 6.77; % Female in STEM Occupations ranges from 0 to 11; % Female in Professional Occupations ranges from 8 to 37; and % Parents with College Degree ranges from 10.56 to 73.16; All other variables range from 0 to 1.

Table 2
Effect Sizes of the Gender Difference in Physics Course-Taking by School

Gender Advantage	Proportion of Schools
<i><u>Female Advantage</u></i>	
Large (0.66+)	0.016
Moderate (0.36 to 0.65)	0.048
Small (0.11 to 0.35)	0.206
<i><u>Equity</u></i> (−0.10 to 0.10)	0.238
<i><u>Male Advantage</u></i>	
Large (0.66+)	0.111
Moderate (0.36 to 0.65)	0.206
Small (0.11 to 0.35)	0.175

N=63 Schools

Note: Cohen's $h = 2 \cdot \arcsin(\sqrt{p_m}) - 2 \cdot \arcsin(\sqrt{p_f})$, where p_m is the proportion of males taking physics, p_f is the proportion of females taking physics.

Table 3
Hierarchical Generalized Linear Model of Physics Course-Taking

<i>Gender</i>	<u>Model 1</u>				<u>Model 2</u>			
	<u>Coeff</u>	<u>Std Err</u>	<u>Sig.</u>	<u>Odds Ratio</u>	<u>Coeff</u>	<u>Std Err</u>	<u>Sig.</u>	<u>Odds Ratio</u>
Female, b1	-0.742	0.124	***	0.476	-0.718	0.118	***	0.488
<u>Cross-level Interactions</u>								
Female X Percent Females in STEM Occupations, γ_{11}					0.168	0.078	*	1.183
Female X Percent Females in Professional Occupations, γ_{12}					-0.073	0.039		0.930
Female X School Percent College-Educated Parent, γ_{13}					0.014	0.012		1.014
Female X Midwest, γ_{14}					-0.962	0.389	*	0.382
Female X South, γ_{15}					-0.045	0.381		0.956
Female X Neast, γ_{16}					-0.134	0.372		0.874
<u>Student-Level Controls</u>								
<i>Race/Ethnicity</i>								
Hispanic, b2	-0.033	0.227		0.968	-0.020	0.234		0.980
Black, b3	-0.299	0.168		0.742	-0.309	0.174		0.734
Asian, b4	0.590	0.292	*	1.803	0.655	0.282	*	1.924
<i>Academic Background</i>								
GPA, b5	1.319	0.115	***	3.741	1.337	0.115	***	3.807
On-Track Freshman Science, b6	0.664	0.261	*	1.943	0.607	0.264	*	1.836
<i>Family Background</i>								
Mother Professional, b7	-0.103	0.181		0.902	-0.100	0.187		0.905
Logged Income, b8	0.091	0.090		1.095	0.102	0.088		1.107
<i>Parent Education</i>								
Less than HS, b9	0.096	0.219		1.101	0.066	0.226		1.068
Vocational, b10	0.365	0.196		1.441	0.381	0.197		1.464
Some College, b11	0.838	0.169	***	2.312	0.846	0.170	***	2.331
College Deg, b12	0.589	0.169	**	1.802	0.619	0.172	**	1.857
Advanced Deg, b13	0.688	0.192	**	1.990	0.676	0.193	**	1.966
<u>School-Level Controls</u>								
Percent of Females in STEM Occupations, γ_{01}					-0.023	0.070		0.977
Percent of Females in Professional Occupations, γ_{02}					0.058	0.027	*	1.059

	Model 1			Model 2		
	Coeff	Std Err	Sig.	Coeff	Std Err	Sig.
Percent of Parents in School with a College Degree, $\gamma03$						
Midwest, $\gamma04$				-0.011	0.010	
South, $\gamma05$				0.836	0.309	*
Northeast, $\gamma06$				0.319	0.289	
Intercept, b0				0.645	0.275	*
Level 1 N	-1.006	0.126	***	-1.024	0.119	***
Level 2 N	5821					
	63					

Note: The reference categories are as follows: White for Race/Ethnicity, Earth Science or higher for Freshman Science, High School Degree for Parent Education, and West for Region.

* p<0.05
** p<0.01
*** p<0.001, two-tailed test.