Peer Gender Composition and Non-Cognitive Factors

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Abstract

This note studies the relationship between the gender composition of a student's peers and two of their non-cognitive factors: sense of belonging and self-worth. Using data from Add Health and exploiting idiosyncratic variation in the share of female peers across grades within schools, I find positive but small effects of a higher share of female peers for male students. I do not find statistically significant effects for female students, but I can rule out large positive effects.

Keywords: Non-cognitive factors, Peer effects, Educational economics, Sense of belonging, Self-worth

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1. Introduction

Non-cognitive factors are significant determinants of both educational and labor market outcomes, in some settings explaining more variation in these outcomes than cognitive skills (Almlund et al., 2011; Borghans et al., 2008; Bowles et al., 2001). Despite their importance, we are still learning about the development of non-cognitive factors, particularly among adolescents (Kautz et al. 2014). Drawing from existing research that demonstrates how an adolescent's peers affect their cognitive skill formation, we may expect that an adolescent's peers could affect their non-cognitive factor formation, too (Epple and Romano, 2011; Sacerdote, 2011). This note investigates the relationship between a particular type of peer effect, peer gender composition, and non-cognitive factors.

Previous studies find that students with a higher share of female peers do better in the classroom (Gong et al., 2019; Hoxby 2000; Lavy and Schlosser 2011), and there are compelling reasons to believe that this relationship exists for non-cognitive factor formation. Being surrounded by similar peers may help a student feel like they belong in their community, make it easier to develop friendships, and improve the student's happiness and mental health. Dweck et al. (2014) and Farrington et al. (2012) provide extended commentary on these non-cognitive factors and how they may relate to peer groups. In two studies that examine the relationship between peer gender and non-cognitive factors directly, Gong et al. (2019) find that male students exhibit a higher life fulfillment and confidence for the future when they have more female classmates and female students report lower levels of unhappiness, and Lavy and Schlosser (2011) find that the self-reported quality of inter-student relationships (i.e., feeling socially adjusted and believing students help each other) improves for both male and female students when they have more female peers.

This note estimates the causal effect of peer gender composition on two additional non-cognitive factors – sense of belonging and self-worth – using a data set ubiquitous in the peer effects literature, the National Longitudinal Study of Adolescent to Adult Health (Add Health). The literature suggests two hypotheses: (1) female students and (2) male students will have a stronger sense of belonging and self-worth when they have more female peers. Based on the aggregation of eight measures, I find that male students do report a stronger sense of belonging and self-worth when they have more female peers, but the effects are small. There are no appreciable effects for female students.

2. Data

Add Health is a nationally representative survey of seventh to twelfth graders in the United States (Harris, 2009). The first survey instrument, an in-school questionnaire, provides data on demographics, peer groups, and non-cognitive factors for 90,118 students; I use a subset of 60,129 students for this analysis. The online appendix describes the construction of the subsample and provides a table of descriptive statistics.

I analyze the responses to eight questions (shown in Table 1) that measure sense of belonging and self-worth.[2] Dweck et al. (2014) define "sense of belonging" as the feeling that students are "included and respected by others in school" (p. 17), and I use "self-worth" to describe the mindset of a student having a positive opinion about themselves. Each question was asked on a 5-point Likert scale with options ranging from "Strongly disagree" to "Strongly agree". Given the ordinal nature of the responses, there is no obvious way to aggregate the individual questions into their broader non-cognitive factor. For my primary specification, I use

[2] The eight questions were chosen from the in-school questionnaire because they most closely reflected the desired outcomes. A full list of questions can be found in the Add Health Codebook Explorer (https://addhealth.cpc.unc.edu/documentation/codebook-explorer/#/).

the count of questions that a student answered “Agree” or “Strongly agree” as my outcome. The appendix contains histograms of the count of “Agree” or “Strongly agree” responses for each non-cognitive category and the responses to each individual question.

Table 1: Non-cognitive factors (count "Agree" or "Strongly Agree")

Survey Question	All		Female		Male	
	Mean	SD	Mean	SD	Mean	SD
Sense of belonging	2.59	1.40	2.54	1.42	2.63	1.38
"I feel socially accepted"	0.68	0.47	0.65	0.48	0.71	0.45
"I feel loved and wanted"	0.73	0.45	0.73	0.45	0.73	0.44
"I feel close to people at this school"	0.58	0.49	0.58	0.50	0.59	0.49
"I feel like I am part of this school"	0.60	0.49	0.59	0.50	0.61	0.49
Self-worth	2.74	1.28	2.54	1.33	2.95	1.20
"I have a lot of good qualities"	0.83	0.38	0.80	0.40	0.86	0.35
"I have a lot to be proud of"	0.79	0.41	0.76	0.43	0.82	0.38
"I like myself just the way I am"	0.68	0.47	0.60	0.49	0.76	0.43
"I feel like I am doing everything just about right"	0.44	0.50	0.37	0.49	0.51	0.50
Observations	60,229		31,445		28,684	

3. Empirical Strategy

I employ a similar method as Hoxby (2000) and Lavy and Schlosser (2011) to isolate plausibly exogenous variation in the share of female peers; I assume that variation in the share of female students within a school and across grades is uncorrelated with unobserved determinants of non-cognitive factors. By focusing on within school variation, this assumption is not violated by endogenous sorting into schools if the sorting occurs equally in all grades. I conduct a balance test to check for observable violations of this assumption by regressing the share of female peers in a school and grade on individual control variables, school dummy variables, and grade dummy variables. As shown in Appendix Section E, only one relationship is statistically significant at the 10% level, which is expected given the number of control variables even if no true correlations exist in the population.

I estimate a linear-in-means model with school and grade dummy variables to measure the relationship between peer gender composition and non-cognitive factors. Let y_i be a non-cognitive factor for student i, $\overline{female}_{-isg}$ the share of female peers in student i's school and grade, excluding student i, X_i a vector of student characteristics, ϕ_s a vector of school-specific dummies, and ϕ_g a vector of grade-specific dummies. The estimating equation is,

$$y_i = \beta\overline{female}_{-isg} + X_i\gamma + \phi_s + \phi_g + \varepsilon_{isg}.$$

Student characteristics include the student's gender and race, whether the student was above the median age for their grade, if they were born in the United States, and how many other people lived in their household. I use the Add Health adjusted sample weights in all regressions, and I

estimate standard errors using a Taylor linearization adjusting for the survey's regional stratification and clustering by school (Chen and Chantala, 2014).

4. Results

Table 2 contains the estimated effect of a unit increase in the share of female peers in a student's school and grade on the count of affirmative sense of belonging and self-worth responses. Each pair of columns presents results for a different sample: all students, female students only, and male students only.

Table 2: Baseline regression estimates

	All		Female		Male	
	Belonging	Self-worth	Belonging	Self-worth	Belonging	Self-worth
	(1)	(2)	(3)	(4)	(5)	(6)
Share female	0.295	0.242	-0.00550	-0.197	0.714*	0.633*
	(0.318)	(0.176)	(0.408)	(0.258)	(0.352)	(0.270)
Female	-0.107***	-0.427***				
	(0.0149)	(0.0173)				
Controls	Y	Y	Y	Y	Y	Y
Observations	60,129	60,129	31,445	31,445	28,684	28,684

The table contains estimates from regressions of the number of "Agree" or "Strongly Agree" responses to the sense of belonging and self-worth question categories on the share of female peers within a student's school and grade, individual covariates, and school and grade dummy variables. Standard errors are adjusted for the stratification and clustering of the survey design. Observations are weighted by the inverse probability of their selection using weights provided by Add Health. Appendix Section F reproduces this table with coefficient estimates for control variables displayed.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

I do not find significant evidence that female students are more or less likely to have a higher sense of belonging or self-worth with an increase in the share of female peers, but the coefficients and standard errors rule out practically significant positive effects. I do find evidence that male students report both stronger belonging and self-worth, but while the effect is statistically significant, it is not large. A five percentage point increase in the share of female peers (roughly equivalent to a one-standard deviation increase) leads to male students reporting 0.036 and 0.032 more affirmative responses to the four belonging and four self-worth questions, respectively. This corresponds to 1.4% and 1.1% of the mean, or 2.6% and 2.6% of the standard deviation, which is comparable to the effect sizes found by Lavy and Schlosser (2011) and Gong et al. (2019) for males. In addition, while Gong et al. find that a higher share of female peers results in lower rates of reported unhappiness among female students, they find that only males report greater life fulfillment, confidence for the future, and private recreation with their classmates.

To test the robustness of the findings, I re-estimate the estimating equation under a variety of specifications. First, I estimate a model without individual level controls. As shown in Appendix Section G, the estimated effect for an increase in the share of female peers is similar in magnitude for both female and male students whether control variables are included or not. Next, I change the outcome variable to be the average numerical response to the non-cognitive questions and present the results in Appendix Section H. Female students report lower sense of belonging and self-worth, but the difference is not statistically different from zero. For male students, a five percentage point increase in the share of female peers leads to an increase in sense of belonging of 0.561 (3.3% of a standard deviation) and an increase in self-worth of 0.496 (3.2% of a standard deviation). Appendix Section I presents results from using each of the eight

non-cognitive measures as outcomes individually. None of the eight estimated coefficients for female students are statistically different from zero, and they vary in sign and magnitude. All eight of the estimated coefficients for male students are positive, most have a similar magnitude, and half are statistically different from zero at the 5% level. This suggests that my two conclusions are not driven by the choice of including a particular survey question. As a final robustness check, I use simulation methods to test how sensitive the results are to measurement error in the share of female peers. Appendix Section J demonstrates the extent that measurement error may be present, describes my procedure for using simulation methods to integrate out measurement error, and presents new coefficient estimates. Under the stated assumptions on the nature of the measurement error, I find similar results: effects for female students are small, negative, and not statistically different from zero, and effects for male students are small, positive, and statistically different from zero at the 5% level.

5. Conclusion

Although many researchers have established the importance of non-cognitive factors, the literature on how to develop these factors is still growing. This note finds evidence that a mechanism for cognitive skill development, peer gender composition, is a minor input into the formation of two non-cognitive factors, sense of belonging and self-worth, for adolescent males. While I do not find evidence that peer gender composition is also a determinant of sense of belonging and self-worth for female adolescences, it may play an important role for other non-cognitive factors.

6. References

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