Does Friends' Gender Matter for Students' Academic Performance?

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Motivation

- Gender peer effects on academic performance are of interest to parents, policy makers, and researchers.
- Peer factors are inputs in the educational production function, like individual factors, family factors, and school factors.
- Peer effects are externalities that spill over from peers' outcomes (endogenous) or peers' exogenous characteristics (contextual).

Previous Research

- Gender composition effects have been studied a lot in the context of the proportion of female students in an aggregate level, such as classroom.
  - Positive effect: Hoxby, 2000; Lavy and Schlosser, 2011; Eren, 2017; Dewan et al., 2017; Gong et al., 2019
  - Negative effect: Fryer Jr and Levitt, 2010; Bertrand and Pan, 2013; Joensen and Nielsen, 2016; Dustmann et al., 2018
- However, such a broad reference group specification cannot capture the effects generated from social interactions among the students.
- Using proportion cannot capture the effect of being social-integrated.

Endogenous Friends Variables

- We use the number of same-gender and opposite-gender friends in a school-level friendship network.
- The fundamental challenge is the non-random formation of the peer groups.
- We are also concerned about reverse causation and measurement errors.

$$y_{ics} = \alpha_0 + \alpha_1 \text{FOS}_{ics} + \alpha_2 \text{FFS}_{ics} + X'_{ics}\alpha_3 + C'_{cs}\alpha_4 + S'_s\alpha_5 + \alpha_{\text{county}} + \varepsilon_{ics}$$

- α_1 and α_2 are upward biased due to the endogeneity.
- We estimate the model using the instrumental variables.

Identification Strategy

- The first stage equation is given by running an OLS regression for each of the endogenous variables, FSS and FOS, on all instrumental variables and exogenous variables:

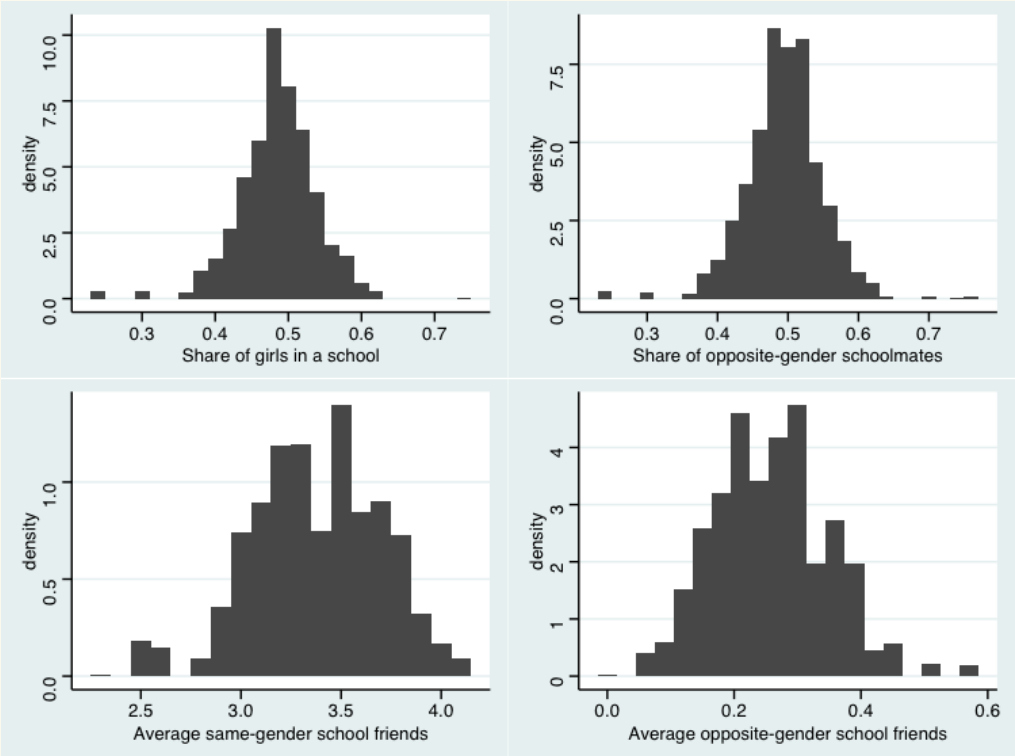
$$FSS_{ics} = \eta_0 + \eta_1 Z_{ics} + X'_{ics}\eta_2 + C'_{cs}\eta_3 + S'_s\eta_4 + \eta_{\text{county}} + u_{ics}$$

$$FOS_{ics} = \theta_0 + \theta_1 Z_{ics} + X'_{ics}\theta_2 + C'_{cs}\theta_3 + S'_s\theta_4 + \theta_{\text{county}} + v_{ics}$$

- The predicted FSS and FOS are then inserted into the regression equation to carry out an IV estimation to identify the effects.

Instrumental Variables

- parents' strictness with friends making
- share of opposite gender schoolmates
- school-level average number of same gender friends
- school-level average number of opposite gender friends



Summary

Three main contributions of the paper:

- We use students' school friendship network and divide into two groups respectively, i.e., same-gender and opposite-gender friends.
- We employ a novel set of instrumental variables to address the endogeneity of friends' gender composition.
- We explore the possible channels through which being popular of same gender and opposite gender affects academic achievement.

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Data

- China Education Panel Survey (CEPS)
- It is the first national, representative, longitudinal survey of middle school students in China.
- The baseline survey was conducted in the 2013-2014 academic year.
- The baseline survey includes 19,487 students, of which 10,279 students from the 7th grade and 9,208 students from the 9th grade.
- The follow-up survey was conducted in the 2014-2015 academic year. Only data for the 7th grade cohort is available.
- The sample size we use for this study is 18,457.

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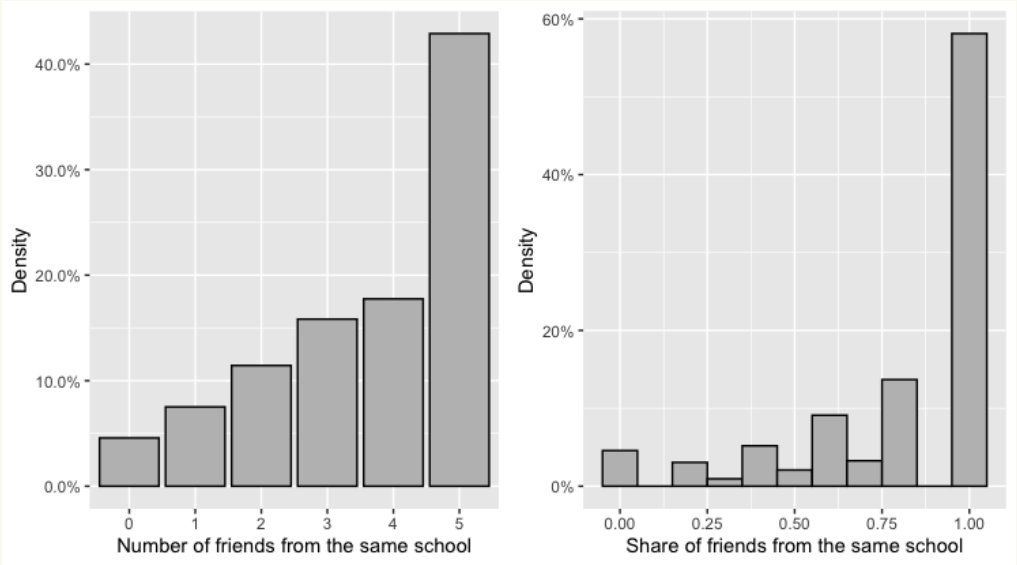
Friendship Network

- In the baseline survey, students were asked to nominate up to five friends. Individuals could leave nominations blank, but could not exceed the limit of five nominations.



- Basic demographics of friends are included: gender, Hukou status, is he/she in the same school and/or class.
- Friends' behaviors, such as studying hard, expecting to go to college, skipping classes, criticized or punished for violating school rules, etc, are also available.

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Descriptive Statistics of Variables

	N	mean	St. Dev.	min	max
School FSS	18,457	3.3868	1.5402	0	5
School FOS	18,457	0.2593	0.6506	0	5
Outcomes:					
Chinese	18,441	70.2265	9.7054	6.1645	98.4746
Mathematics	18,427	70.1514	9.8401	8.4217	145.1149
English	18,426	70.1941	9.8343	11.3495	107.8161
Total	18,386	210.6265	25.5760	55.4928	293.9303
Instruments:					
School-level average number of FSS	18,457	3.3755	0.3234	2.3125	4.0920
School-level average number of FOS	18,457	0.2588	0.0889	0	0.5625
% of opposite gender schoolmates	18,457	0.4943	0.0540	0.2455	0.7545
Parents' strictness with making friends: no	18,457	0.1898	0.3922	0	1
Parents' strictness with making friends: moderate	18,457	0.4966	0.5000	0	1
Parents' strictness with making friends: serious	18,457	0.3135	0.4639	0	1

Main Results

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
		OLS RESULTS		
School FSS	0.0678	0.0089	0.1596***	0.2339*
	(0.0525)	(0.0535)	(0.0512)	(0.1375)
School FOS	0.3400***	0.2171*	0.3593***	0.8944***
	(0.1131)	(0.1143)	(0.1141)	(0.2953)
Observations	17,609	17,596	17,593	17,556
		IV RESULTS		
School FSS	-1.0782***	-1.2194***	-1.3629***	-3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	-1.9793*	-0.8215*	-2.4147**	-5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
Observations	17,609	17,596	17,593	17,556
Diagnostics				
First-stage F statistic	57.984			
	36.909			
Sargan test	2.582	3.544	0.238	0.809

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Robustness Check I: Random Assignment

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
		MAIN RESULTS		
School FSS	-1.0782***	-1.2194***	-1.3629***	-3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	-1.9793*	-0.8215*	-2.4147**	-5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
Observations	17,609	17,596	17,593	17,556
		SCHOOLS WITH RANDOM ASSIGNMENT		
School FSS	-1.3255**	-0.4720	-1.4828**	-3.1712**
	(0.6351)	(0.5713)	(0.6105)	(1.4894)
School FOS	-4.1998**	-0.3980	-2.9107*	-6.9505*
	(1.7636)	(1.5761)	(1.7225)	(4.2039)
Observations	11,700	11,696	11,697	11,696

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Robustness Check II: Alternative Friends

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
		MAIN RESULTS		
School FSS	-1.0782***	-1.2194***	-1.3629***	-3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	-1.9793*	-0.8215*	-2.4147**	-5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
Observations	17,609	17,596	17,593	17,556
		NOT LIMITED TO SCHOOL FRIENDS		
FSS	-2.0401***	-1.7599***	-2.5320***	-6.2869***
	(0.6811)	(0.6824)	(0.7227)	(1.8222)
FOS	-2.3336***	-1.5608*	-2.8984***	-6.7976***
	(0.8454)	(0.8533)	(0.9061)	(2.2826)
Observations	17,609	17,596	17,593	17,556

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Robustness Check III: Additional Controls

	(1)	(2)	(3)
	PANEL A: CHINESE		
School FSS	−1.0782***	-1.1266***	-1.0925***
	(0.3556)	(0.3544)	(0.3587)
School FOS	−1.9793*	-2.0074*	-2.0974**
	(1.0335)	(1.0284)	(1.0526)
	PANEL B: MATH		
School FSS	−1.2194***	-1.2725***	-1.2599***
	(0.3661)	(0.3649)	(0.3690)
School FOS	−0.8215	-0.9090	-1.2222
	(1.0637)	(1.0580)	(1.0823)
Friends' academic performance		✓	
Other parents' strictness measurements			✓

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Robustness Check III: Additional Controls (cont'd)

	(1)	(2)	(3)
	PANEL C: ENGLISH		
School FSS	−1.3629***	-1.4093***	-1.3377***
	(0.3613)	(0.3605)	(0.3643)
School FOS	−2.4147**	-2.3926**	-2.6003**
	(1.0586)	(1.0549)	(1.0772)
	PANEL D: TOTAL		
School FSS	−3.6113***	-3.7557***	-3.6363***
	(0.9218)	(0.9182)	(0.9296)
School FOS	−5.2456*	-5.3622**	-5.9344**
	(2.7056)	(2.6909)	(2.7550)
Friends' academic performance		✓	
Other parents' strictness measurements			✓

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by Grade Level

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
		7TH GRADE 2013 - 2014		
School FSS	−1.4051***	−1.6849***	−1.8462***	−4.9435***
	(0.5003)	(0.5115)	(0.5178)	(1.2974)
School FOS	−4.4722**	−0.8602	−5.5711***	−10.8607**
	(1.8412)	(1.8898)	(1.9266)	(4.8671)
Observations	9,318	9,314	9,316	9,298
		7TH GRADE 2014 - 2015		
School FSS	2.1406	2.0985	1.0564	5.4404
	(1.3252)	(1.6703)	(1.4309)	(3.3909)
School FOS	−5.0320***	2.7513	−3.5014*	−8.0410*
	(1.7195)	(2.1665)	(1.8469)	(4.3745)
Observations	8,702	8,704	8,694	8,693
		9TH GRADE 2013 - 2014		
School FSS	−0.5776	−0.6023	−0.4521	−1.5435
	(0.5735)	(0.5849)	(0.5787)	(1.4772)
School FOS	−0.2232	0.6422	0.4234	0.6450
	(1.3729)	(1.3867)	(1.3859)	(3.5270)
Observations	8,291	8,282	8,277	8,258

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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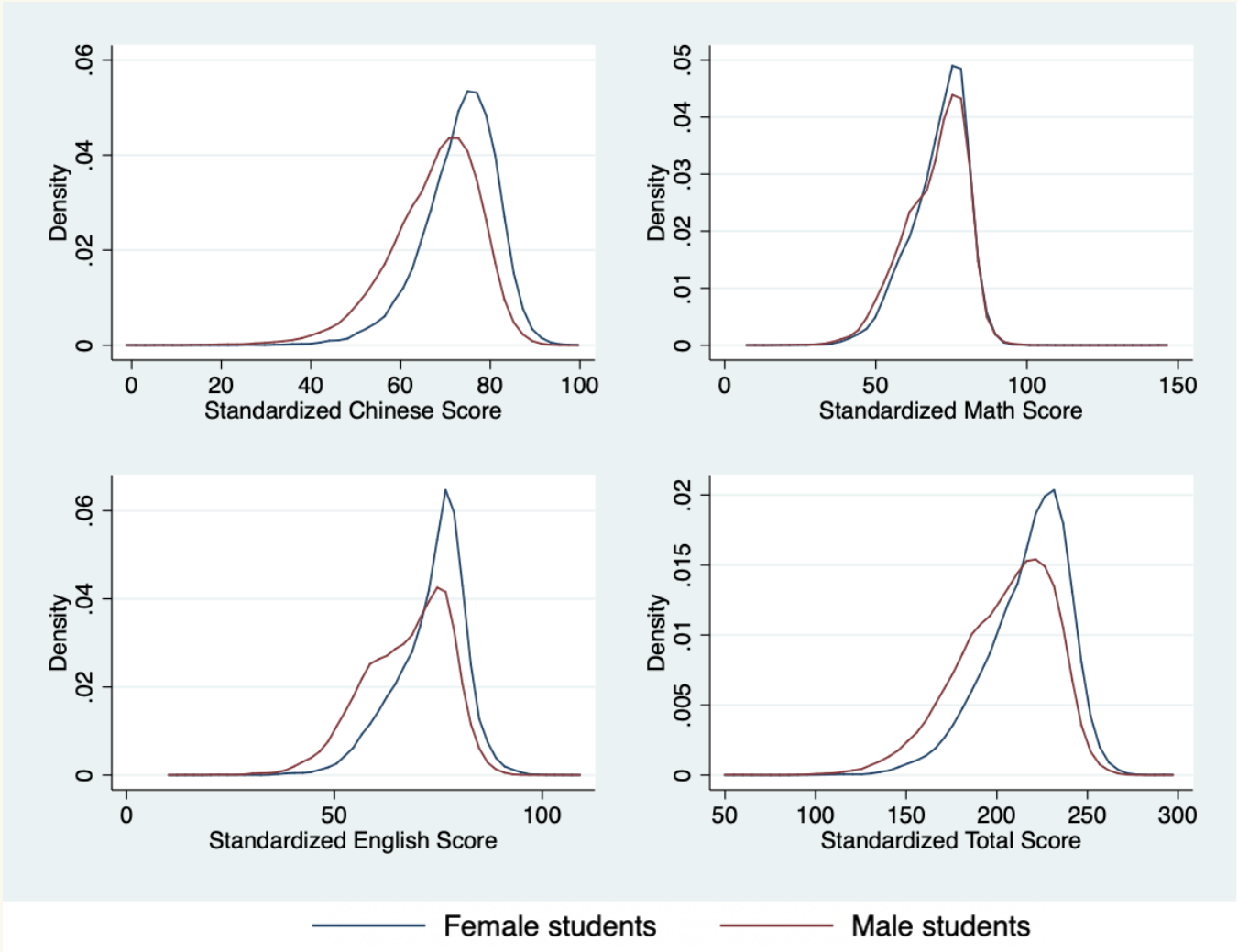
Standardized Grades by Gender



Heterogeneity by Gender

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
		FEMALE		
School FSS	−0.8606**	−1.9118***	−1.3908***	−4.1185***
	(0.4369)	(0.4991)	(0.4510)	(1.1749)
School FOS	−2.3369**	-1.3217	−2.7144**	−6.6234**
	(1.1771)	(1.3431)	(1.2228)	(3.1847)
Observations	8,707	8,703	8,702	8,692
		MALE		
School FSS	−0.9334	−0.2798	−0.7889	−1.8571
	(0.5756)	(0.5543)	(0.5742)	(1.4485)
School FOS	-1.1992	-0.0068	-1.6545	-3.0099
	(2.0050)	(1.9299)	(2.0197)	(5.1129)
Observations	8,902	8,893	8,891	8,864

Note: Standard errors in parentheses. Standard errors are clustered at class level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Mechanisms: Time Allocation

DESCRIPTIVE STATISTICS

	N	Mean	St. Dev.	Min	Max
School assignments	16,472	16.4237	9.1297	0	51.0000
Extra assignments	15,015	2.9421	4.3559	0	19.8333
Cram schools	13,767	0.4529	1.2751	0	8.6667
Sports	15,459	4.2886	4.1226	0	19.8333
Reading (not textbooks)	16,260	5.9795	4.7364	0	23.8333
Watching TV	15,602	5.4000	4.8031	0	25.2333
Internet and video games	16,198	3.6361	4.4778	0	26.2500
Housework	15,792	5.2040	4.5413	0	24.8167

RESULTS

	School assignments	Extra assignments	Cram schools	Sports
	(1)	(2)	(3)	(4)
School FSS	−0.3463	−0.3069	0.0208	−0.1675
	(0.3659)	(0.1899)	(0.0566)	(0.1786)
School FOS	−3.1983***	−0.0389	−0.0215	−1.3362**
	(1.1309)	(0.5454)	(0.1656)	(0.5719)
Observations	15,761	14,337	13,107	14,782
	Reading (not textbooks)	Watching TV	Internet and video games	Housework
	(5)	(6)	(7)	(8)
School FSS	0.0966	0.7370***	0.3675*	−1.1379***
	(0.1970)	(0.2081)	(0.1916)	(0.2078)
School FOS	1.0323*	0.6670	1.2510**	−2.3730***
	(0.5885)	(0.6280)	(0.5565)	(0.6119)
Observations	15,553	14,920	15,491	15,122

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Mechanisms: Activities and Behaviors

DESCRIPTIVE STATISTICS

	N	Mean	St. Dev.	Min	Max
Number of hobbies	18,415	1.6096	1.1279	0	7
Museums and zoos (friends)	17,908	1.9293	1.0242	1	5
Movies, games and shows (friends)	17,863	2.2887	1.2686	1	5
Join in class/school activities	18,338	2.7546	1.0126	1	4
Late for classes	18,414	1.2489	0.6136	1	4
Absence from class	18,408	1.0878	0.4211	1	4
Romantic relationship	18,306	1.2375	0.4909	1	3
Sleeping time	18,031	7.9817	1.2376	4	12.9333

RESULTS

	Number of hobbies	Museums and zoos	Movies, games and shows	Join in class/school activities
	(1)	(2)	(3)	(4)
School FSS	0.0562	0.1171***	0.1816***	0.0276
	(0.0442)	(0.0394)	(0.0496)	(0.0391)
School FOS	−0.1794	0.5171***	0.6210***	0.2965***
	(0.1290)	(0.1212)	(0.1512)	(0.1125)
Observations	17,589	17,119	17,074	17,516
	Late for classes	Absence from class	Romantic relationship	Sleeping time
	(5)	(6)	(7)	(8)
School FSS	−0.0390	0.0273	−0.0325	−0.2415***
	(0.0243)	(0.0168)	(0.0200)	(0.0457)
School FOS	0.0503	0.0120	0.1648***	−0.0020
	(0.0705)	(0.0485)	(0.0571)	(0.1352)
Observations	17,588	17,582	17,481	17,238

Mechanisms: Class and School Environment

DESCRIPTIVE STATISTICS

	N	Mean	St. Dev.	Min	Max
Nice classmates	18,350	3.2747	0.7969	1	4
Easy to get along with classmates	18,355	3.1748	0.8340	1	4
Good class atmosphere	18,330	3.1404	0.8717	1	4
Close to people in school	18,216	2.9406	0.9211	1	4
Bored of school	18,267	1.6668	0.8644	1	4
Desire to transfer	18,376	1.5058	0.8662	1	4

RESULTS

	Nice classmates	Easy to get along with classmates	Good class atmosphere
	(1)	(2)	(3)
School FSS	0.0751**	0.0975***	0.1835***
	(0.0313)	(0.0330)	(0.0348)
School FOS	−0.0826	0.0431	−0.0917
	(0.0913)	(0.0954)	(0.1007)
Observations	17,528	17,532	17,511
	Close to people in school	Bored of school	Desire to transfer
	(4)	(5)	(6)
School FSS	0.1866***	−0.1325***	−0.1159***
	(0.0363)	(0.0344)	(0.0343)
School FOS	0.1180	0.1500	0.1608
	(0.1029)	(0.0987)	(0.0991)
Observations	17,400	17,446	17,551

Implications

- Being popular negatively impacts the middle school students' academic performance.
- Being popular with the opposite gender has a larger negative effect than being popular with the same gender.
- Specifically, an additional same-gender friend reduces the standardized total score by 3.6113 points. An additional opposite-gender friend reduces the standardized total score by 5.2456.
- The effects of friends are more strongly correlated with verbal or language test scores than with math test scores.

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Implications (cont'd)

- Younger students are more severely impacted by making friends.
- The negative impacts of making friends mostly occur when building friendship, rather than maintaining friendship.
- Female students are more vulnerable to friendships building and maintenance.
- The main avenue of the negative effects can be explained by the "crowding out effect of time".
- The increased probability of being in a romantic relationship associated with opposite-gender friends and better feelings about schools associated with same-gender friends explain why the effect of being popular with opposite gender is larger.


Thank You !