Appendix 1

Data and Attrition

The data used in this paper were collected over five school years from 2005-06 to 2009-10 from a representative sample of government-run rural primary schools in the Indian state of Andhra Pradesh (AP). Since primary school consists of grades one through five, a total of nine cohorts of students are present in our data (with the oldest cohort being in grade five in year one of the project, and the youngest cohort being in grade one in year five). Table A1 shows the number of student observations by grade and year in our core estimation sample.

For students in grades two through five, the estimating sample includes only those who have a test score in the current grade/year and have a test score from the previous grade/year (which is needed to estimate value-added). For first grade students, we include all those who have a test score in grade one and set the normalized lagged test score to zero since there is no previous test (the estimates in Tables 5 through 8 are unchanged even if we exclude first grade). For grades two through five, field teams conducted two rounds of testing at the end of each year (the first test covered competencies from the previous year and the second test covered current year competencies). Since student attendance rates are approximately 70 percent, having two rounds of testing helps considerably with reducing attrition from the sample.[1] However, there is only one round of testing at the end of first grade (since there are no previous grade competencies to be covered). Thus, the grade two sample in any year is smaller than the other grades.[2]

This sample is further limited to observations for which we have student gender data (97 percent) and for specifications that include the teacher characteristics, the sample is restricted to cases where teacher interviews were conducted (which is 88 percent of the sample conditional on having student test data and student and teacher gender data for the year).

Moving across a row in Table A1 (over years), we observe a reduction in student observations. This is because the share of private school enrollment is growing considerably in rural Andhra Pradesh (Pratham 2012) and fewer students are entering the public school system over time. Table A2 tests whether entering cohorts over time differ in relative ability by student gender. We find no differences in grade one test scores over time by student gender suggesting that the ability of girls relative to boys is not changing over time for the later entering cohorts. Thus, our estimates of the gender gap or of the impact of students sharing a teacher's gender are unlikely to be affected by the changing cohort sizes and composition over time.

We next review how attrition from the sample will affect our estimates and interpretation of the gender gap and the effect of 'gender matching'. Attrition is defined as the fraction of students in a given year who are in the potential estimation sample (which comprises of all students who have a valid test score for the previous year), but are not in the final sample because they were absent from the end of year test and thus have no recorded test score for the current year. Grade one students are not included in the attrition analysis because they do not have a test score from the previous year, and we therefore cannot define attrition for first grade. As mentioned earlier, all the results in Tables 5 through 8 are robust to excluding grade one.

From our analysis on student attendance (Table 9), we know that girls are less likely to be absent from school on any given school day. Similarly, we find that girls have lower attrition (3 percent) in the sample used for the value-added calculations (Table A3). But we also see that there is no effect of a student having the same gender as their teacher on the probability of attrition. Thus, our main estimates (presented in Tables 5 through 8) are unlikely to be biased due to the lower attrition of girls from our estimation sample. Furthermore, the differential attrition by student gender will only change our interpretation of the gender matching effect if the

students who attrite are *differentially affected* by shared teacher gender, which is unlikely given the lack of any effect of gender matching on either student attendance (Table 9 – Columns 5 and 6), or on the probability of taking an end of year test conditional on having taken the test at the end of the previous school year (Table A3 – Columns 5 and 6).

1. Student scores are first normalized with respect to each test and then averaged across the two tests to provide a valid normalized test score for any student who took at least one of the two tests.

2. First grade has the highest number of missing students in the end-line, but does not require a baseline; and grades three through five have the benefit of fewer missing data points since they are less likely to have missing test score data from the previous year (where there would have been two rounds of testing).

Table A1
Estimating Sample by Year and Grade

	Year 1	Year 2	Year 3	Year 4	Year 5
Grade 1	14,011	13,030	11,332	11,150	9,194
Grade 2	10,286	8,021	8,322	6,778	6,162
Grade 3	11,496	10,381	10,372	9,757	8,276
Grade 4	14,119	11,430	10,702	11,010	9,711
Grade 5	15,415	14,024	11,801	11,295	10,473

Table A2
Entering Cohorts by Gender

	Dependent Variable: Normalized Test Score	
	(1)	(2)
Female Student	-0.00135	-0.0000674
	(0.0261)	(0.0229)
Year	-0.00532	-0.00540
	(0.0120)	(0.00978)
Female Student * Year	0.0102	0.00725
	(0.00832)	(0.00726)
Observations	66,660	66,660
School Fixed Effects	No	Yes

Notes: (1) Sample limited to students in Grade 1. (2) Standard errors (in parentheses) are clustered at the school level for OLS regressions not including fixed effects, and are clustered at the student level for OLS regressions including fixed effects. (3) Significance levels are as follows: *p < 0.10, **p < 0.05, *** p < 0.01.

Table A3
Attrition and Gender

	Dependent Variable: Indicator of Attrition					
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Attrition by Gender Matching					
Female Student * Female Teacher	-0.00657	-0.00620	-0.00871*	-0.00322	-0.00546	-0.00546
	(0.00527)	(0.00488)	(0.00474)	(0.00480)	(0.00475)	(0.00507)
Female Student	-0.0322***	-0.0335***	-0.0308***			
	(0.00380)	(0.00334)	(0.00323)			
Female Teacher	0.00870	0.0155**	0.00476	-0.00555	0.00304	0.00468
	(0.00687)	(0.00604)	(0.00554)	(0.00530)	(0.00555)	(0.00625)
Observations	132,671	132,671	132,671	132,671	132,671	116,473
Male Student Attrition Mean	0.223	0.223	0.223	0.223	0.223	0.223
Female Student Attrition Mean	0.188	0.188	0.188	0.188	0.188	0.188
	Panel B: Attrition by Ability and Student Gender					
Lag Test Score	-0.0365***	-0.0377***	-0.0351***	-0.0363***	-0.0350***	-0.0354***
	(0.00288)	(0.00230)	(0.00212)	(0.00215)	(0.00212)	(0.00234)
Female Student	-0.0363***	-0.0377***	-0.0361***	-0.0172***	-0.0177***	-0.0223***
	(0.00281)	(0.00234)	(0.00226)	(0.00393)	(0.00388)	(0.00437)
Female Student * Lag Test Score	0.00837***	0.00827***	0.00476**	0.00567**	0.00481**	0.00638**
	(0.00277)	(0.00243)	(0.00233)	(0.00237)	(0.00232)	(0.00264)
Observations	149,970	149,970	149,970	149,970	149,970	115,592
Teacher Characteristics	No	No	No	No	No	Yes
School Fixed Effects	No	Yes	No	Yes	No	No
School*Grade Fixed Effects	No	No	Yes	No	Yes	Yes
Grade Fixed Effects by Student Gender	No	No	No	Yes	Yes	Yes

Notes: (1) Student Attrition is calculated as an indicator for being absent for the test in a given year and having taken the test the preceding year. (2) Grade 1 students are excluded because they do not have a test score prior to enrollment in school. (3) Year 1 students who drop out of the sample in the first year are excluded. (4) Standard errors (in parentheses) are clustered at the school level for OLS regressions not including fixed effects, and are clustered at the student level for OLS regressions including fixed effects. (5) Significance levels are as follows: *p < 0.10, **p < 0.05, *** p < 0.01.

Table A4
Impact of Female Teachers on the Learning Gains of Female Students (Pooled Across Math and Language)
with Student Characteristics (Table 5 with Student Characteristics)

	Dependent Variable: Normalized Test Scores					
	(1)	(2)	(3)	(4)	(5)	(6)
(β_1) Female Student * Female Teacher	0.0490***	0.0463***	0.0439***	0.0450***	0.0425***	0.0433***
	(0.0108)	(0.00998)	(0.00935)	(0.00995)	(0.00929)	(0.00976)
(β_2) Female Student	-0.0297***	-0.0282***	-0.0240***			
	(0.00756)	(0.00669)	(0.00622)			
(β_3) Female Teacher	-0.0260	-0.0127	-0.0119	-0.0112	-0.0112	-0.0185
	(0.0189)	(0.0155)	(0.0161)	(0.0155)	(0.0160)	(0.0187)
$\beta_1 + \beta_3$	0.023	0.034**	0.032**	0.034**	0.031**	0.025
F-stat (H_0: $\beta_1 + \beta_3 = 0$)	1.71	5.18	4.28	5.11	4.10	1.83
$\lambda_g * \beta_1 + \beta_3$	-0.001	0.011	0.010	0.012	0.010	0.004
F-stat (H_0: $\lambda_g * \beta_1 + \beta_3 = 0$)	0.00	0.58	0.48	0.66	0.48	0.04
Observations	207,819	207,819	207,819	207,819	207,819	181,468
Student Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Teacher Characteristics	No	No	No	No	No	Yes
School Fixed Effects	No	Yes	No	Yes	No	No
School*Grade Fixed Effects	No	No	Yes	No	Yes	Yes
Grade Fixed Effects by Student Gender	No	No	No	Yes	Yes	Yes

Notes: (1) Regressions include student's previous year's test score as an independent variable and all student characteristics listed in Table 1, Panel A. (2) "Teacher Characteristics" are salary, age, experience, teacher absence, class enrollment size and indicators for caste, teacher status, education, training, native to school location, marital status, union status, and a multi-grade class. (3) Standard errors (in parentheses) are clustered at the school level for OLS regressions not including fixed effects, and are clustered at the school-year level for OLS regressions including fixed effects. (4) Significance levels are as follows: *p < 0.10, **p < 0.05, *** p < 0.01.