Appendix

Methodological Notes: Using fixed effects estimates to remove nonrandom measurement error and adaptation

In multilevel notation, a basic two level model shows teachers' instruction (Y_{jk}), where Teacher j is nested in School k, as a deviation in instructional practice about the school means (β_{0k}) and school mean instructional practice as a deviation from the grand mean (Υ_{00}):

$$\mathrm{Y_{jk}} = \mathrm{B_{0k}} + \mathrm{r_{jk}} \quad [1]$$

$$B_{0k} = \Upsilon_{00} + u_{0k} \quad [2]$$

Our basic ICC (e.g., Tables 1 and 2) is estimated as the variance in school mean instructional practice (β_{0k}), i.e., the variance of μ_{0k} about the grand mean $\Upsilon_{00,}$ divided by the total variance:

$$ICC = \, var\, \mu_{0k}/(var\, \mu_{0k} + var\, r_{0k}) \quad [3]$$

However, in the MET data we can leverage the fact that r_{jk} is in fact itself two components, a within-teacher component (across classes, subscripted now by i, over time) and a between-teacher within school component. In three level data,

$$Y_{ijk} = \pi_{0jk} + e_{ijk} \quad [4]$$

$$\pi_{0jk} = \beta_{00k} + r_{0jk} \quad [5]$$

$$\beta_{00k} = \Upsilon_{000} + u_{00k} \quad [6]$$

The ICC is thus:

$$var\ (\mu_{00k})/\left(var(\mu_{00k}) + var(r_{0jk}) + var\ (e_{ijk})\right) \qquad [7]$$

With data on instructional practice from teachers with different classroom compositions, we can focus on the variation in instruction within-teachers to identify only the effects of measurement bias and adaptation, setting aside selection (as the teacher is held constant). Returning to level-1 of our three-level model, now including an example covariate *X*:

$$Y_{ijk} = \pi_{0jk} + \pi_{100}\left(X_{ijk} - \bar{X}_{ijk}\right) + \cdots e_{ijk} \qquad [8]$$

Estimates of the effect of within-teacher covariates deviated from the teacher mean ($\bar{X}_{ijk}$), here, e.g., π_{100}, capture measurement bias and adaptation by individual teachers to class-mean achievement, etc. However, measurement bias and adaptation also occurs at the teacher level; returning to the basic two level between/within school ICC, we must remove these effects not just from (e_{ijk}), but also from (r_{0jk}). Including various teacher-average class composition covariates, we want to identify the components/portion of each β_{pqk} (the coefficient capturing the effect of teacher characteristic q on student-composition characteristic p varying within teachers) that represents nonrandom measurement error and adaptation:

$$\pi_{0jk} = \beta_{00k} + \textstyle\sum_{q=1}^{Qp} \beta_{pqk}\, X_{qjk} + \cdots r_{0jk} \qquad [9]$$

However, we cannot rely on direct estimates of each β_{pqk} from a two-level model because teachers may select or be assigned to classes within the school. Thus, we use a two-step process, first-estimating the within-person effects from the level-1 fixed-effects equation, then substituting those π_{pjk} for β_{pqk} to generate predicted/adjusted values of teachers' instruction removing the effects of measurement bias and adaptation. This allows us then to re-estimate the association between school level compositional variables and school-mean instructional practice (and R^2 values) created more narrowly by the selection of teachers to schools. However, what remains is still not a “pure” measure of the effect of selection, as other unmeasured school-level variables associated with composition are still present.

Appendix Tables

Table A1. Associations between school compositional variables and instructional practices at the school level, elementary school data (underlying coefficients from Table 4). Standard errors in parentheses.

	CLASS	FFT	MQI	PLATO	Tripod	English Teacher Knowledge	Math Teacher Knowledge
Pct. Hispanic	−.67 (.27)***	−.80 (.26)***	−.50 (.29)*	−.09 (.34)	.58 (.19)***	.01 (.01)	.02 (.01)
Pct. Black	−.93 (.21)***	−.93 (.19)***	−.84 (.19)***	−.65 (.17)***	.50 (.15)***	−.00 (.02)	.02 (.02)
Class-mean math achiev.	.18 (.23)	.23 (.19)	.17 (.24)	.30 (.23)	−.01 (.12)	−.01 (.01)	−.01 (.01)
Class-mean ELA achiev.	−.04 (.24)	−.11 (.18)	−.31 (.26)	−.24 (.22)	.11 (.13)	−.00 (.01)	−.01 (.01)
Pct. Male	−.68 (.31)**	−.50 (.28)*	−.25 (.43)	.10 (.42)	−.58 (.26)**	.02 (.01)	.01 (.01)
Pct. special education	.32 (.37)	.60 (.31)*	.25 (.45)	.47 (.45)	−.11 (.25)	.00 (.01)	.00 (.01)
Pct. English lang. learner	.50 (.32)	.11 (.33)	.26 (.33)	−.18 (.34)	.09 (.25)	−.01 (.01)	−.01 (.02)
Class-mean age	−.07 (.05)	−.03 (.04)	−.02 (.06)	−.00 (.06)	−.14 (.04)***	−.04 (.00)***	−.04(.00)***
Pct. Free/reduced lunch	−.42 (.21)**	−.25 (.20)	−.08 (.20)	−.02 (.21)	−.04 (.15)	.01 (.00)**	.01 (.00)*

* P < .1, ** p < .05, *** p < .01

Table A2. Semi-partial explained variance in instructional practices between schools in separate models with achievement, pct. Free and reduced price lunch status, and pct. Black and Hispanic.[a]

	R^2, Proportion of Between School Explained Variance by Independent Variables		
	1	2	3
Dependent Variable	Math & Read Achieve 09	Pct. FRPL	Pct. Black & Hispanic
Elementary			
CLASS overall composite	.020	.022	.395
FFT overall composite	.026	.066	.356
Overall MQI score	.006	000[b]	.289
Overall PLATO score	.040	000[b]	.229
Tripod 7 Cs composite	.022	.002	.246
English Teacher Knowledge	.010	.000	.397
Mathematics Teacher Knowledge	.004	.018	.373
Middle			
CLASS overall composite	.000[b]	.000[b]	.113
FFT overall composite	.000[b]	.015	.148
Overall MQI score	.099	.028	.144
Overall PLATO score	.015	.001	.049
Tripod 7 Cs composite	.081	.000	.020
English Teacher Knowledge	.018	.056	.141
Mathematics Teacher Knowledge	.037	.064	.105

[a] Controls for average initial achievement in math and reading, pct. male, pct. SPED, pct. ELL, pct. qualifying for free and reduced price lunch, pct. Hispanic, pct. Black and average age always included in calculating semi-partial correlations.
[b] Negative values are computationally possible in multilevel explained variance calculations and are truncated to zero here for consistency with traditional R^2 calculations (see Snijders & Bosker, 1999).

Table A3. Explained variance in instructional practices between schools by achievement, pct. free and reduced price lunch status, and pct. black.[a]

	R^2, Proportion of Between School Explained Variance by Independent Variables		
Dependent Variable	Math & Read Achieve 09	Pct. FRPL	Pct. Black & Hispanic
Elementary			
CLASS			
Behavioral Climate	.187	.066	.387
General Instruction	.324	.040	.567
FFT			
Behavioral Climate	.174	.038	.314
General Instruction	.280	.082	.652
PLATO			
Behavioral Climate	.212	.048	.267
Challenge and Discourse	.179	.000 [b]	.352
Strategy Use	.012	.061	.243
Middle			
CLASS			
Behavioral Climate	.000 [b]	.044	.097
General Instruction	.088	.104	.254
FFT			
Behavioral Climate	.116	.157	.265
General Instruction	.261	.237	.433
PLATO			
Behavioral Climate	.033	.087	.111
Challenge and Discourse	.020	.035	.077
Strategy Use	.000 [b]	.128	.094

[a] Controls for age included in addition to variables listed in column header.
[b] Negative values are computationally possible in multilevel explained variance calculations and are truncated to zero here for consistency with traditional R^2 calculations (see Snijders & Bosker, 1999).