

**Supplementary Appendix: Additional Models of Math Gains**

**for**

**PARENTAL NETWORKS, SOCIAL CLOSURE,  
AND MATHEMATICS LEARNING:  
A TEST OF COLEMAN'S SOCIAL CAPITAL  
EXPLANATION OF SCHOOL EFFECTS**

Stephen L. Morgan  
Harvard University

and

Aage B. Sørensen  
Harvard University

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Because learning is not measured perfectly by the NELS, and because Catholic school students had higher tenth grade scores than similar public school students, we estimated two alternative sets of models based on different core assumptions about learning processes.

As written in Appendix B as Equation B-1, we estimated change score models to assess the robustness of our regressor variable estimates. In the change score models we report in this supplement, we dropped all student-level covariates in  $\mathbf{X}_{ij}$ , estimating econometrics-style difference estimates of  $d$ ,  $c$ , and  $\mathbf{a}$  (retaining the stable school-level characteristics,  $\mathbf{X}_j$ , to pick up the non-random distribution of unobserved time-varying determinants of learning across schools). For comparison, Table S-1 presents all of the coefficients for the models 5 and 6 that were presented in Table 3. Table S-2 presents models named 5a and 6a – difference models based on equation B-1 without any student-level covariates. The school-level effects are similar across both models, especially when changes are considered in comparison with standard errors.

In Appendix B, we questioned the equilibrium assumption of the change score method of measuring learning gains. Table S-3 presents models named 5b and 6b based on the estimation of the pseudo-difference-in-difference equation B-6. There are several problems with Models 5b and 6b, and these are detailed in Appendix B. Nonetheless, the school estimates do not differ much for Models 5b and 6b. Thus, any substantive conclusion drawn from the models presented in Table S-3 would be consistent with those suggested by all earlier models.

In sum, we conclude that our findings are not driven to any substantial degree by a chosen math gains model. Parsimony suggests that the change score model presented in Table S-2 is the most attractive candidate. However, our desire to preserve consistency with Coleman's research,

coupled with the theoretical appeal of the Sørensen-Hallinan differential equation approach, prompted us to report covariate-rich regressor variable models such as those presented in Table S-1.

**Table S-1. Models of Math Gains between Tenth and Twelfth Grade with Tenth Grade Score as a Covariate**

	Model 5 -- All Coefficients		Model 6 -- All Coefficients	
	coefficient	s.e.	coefficient	s.e.
<b>Fixed Effects</b>				
Constant	4.316		4.305	
<b>School Level Variables:<sup>a</sup></b>				
Catholic School	1.786	.416	1.693	.388
Social Closure Around School	.026	.130	--	--
X Catholic School	.705	.375	--	--
Parents Work Together	.259	.383	--	--
X Catholic School	-.865	1.163	--	--
Parents Have Adequate Say	.341	.339	.509	.250
X Catholic School	.847	1.188	.328	.823
Friends in School	--	--	.383	.131
X Catholic School	--	--	.101	.390
Parents Know Parents	--	--	-.368	.142
X Catholic School	--	--	.584	.339
School Mean of Mother's Education	.243	.114	.240	.114
School Mean of Father's Education	-.043	.083	-.042	.083
School Mean of Mother's SEI	-.011	.015	-.011	.015
School Mean of Father's SEI	.013	.015	.010	.016
School Mean of Logged Family Income	.210	.195	.204	.191
Suburban, Northeast, Public School	1.290	.315	1.320	.314
Suburban, South, Public School	.903	.276	.943	.274
Suburban, West, Public School	1.360	.326	1.333	.322
Urban, Midwest, Public School	.101	.345	.165	.331
Urban, Northeast, Public School	1.316	.451	1.308	.439
Urban, South, Public School	.998	.336	1.046	.340
Urban, West, Public School	1.439	.343	1.401	.339
Rural, Midwest, Public School	-.748	.310	-.636	.307
Rural, Northeast, Public School	.925	.353	.974	.344
Rural, South, Public School	-.569	.306	-.466	.311
Rural, West, Public School	.197	.413	.248	.410

**Table S-1 continued on next page**

**Table S-1 continued****Student Level Variables:<sup>b</sup>**

IRT Math Score in 10th Grade	-.106	.006	-.107	.006
Mother's Education	-.011	.040	-.012	.040
Father's Education	.143	.036	.144	.036
SEI Score of Mother's Occupation	.004	.007	.004	.007
SEI Score of Father's Occupation	.005	.008	.005	.008
Natural Logarithm of Family Income	.033	.074	.033	.074
Mother only	.532	.183	.527	.184
Father only	1.504	.445	1.529	.446
Mother and stepfather	.355	.233	.358	.233
Father and stepmother	.935	.509	.921	.509
Other family type	.414	.427	.429	.426
Family data missing	1.255	.821	1.218	.826
Black Male	-1.094	.332	-1.050	.332
Hispanic Male	.186	.311	.175	.310
Asian Male	1.050	.430	1.011	.428
White Female	-.882	.141	-.875	.142
Black Female	-1.001	.290	-.957	.292
Hispanic Female	-.925	.321	-.941	.321
Asian Female	.570	.366	.549	.366
Native American	.310	.670	.327	.670
Probability of Inclusion in Analytic Sample (orthogonal)	1.127	.112	1.133	.112
Square of probability (orthogonal)	.332	.066	.332	.066
Cube of probability (orthogonal)	.032	.058	.035	.059

**Random Effects**

School Level Variance	0.917	0.226	0.878	0.23
Student Level Variance	28.109	0.851	28.114	0.852
-2*loglikelihood	57623.7		57615.44	

Notes: N = 9241 students in 898 schools. Data are weighted. Robust standard errors are calculated with MLwiN's implementation of White's sandwich variance estimator. Source: National Education Longitudinal Study of 1988.

<sup>a</sup>All school level variables are entered as grand-mean centered fixed effects except the Catholic school indicator variable and its interactions with other school level predictors.

<sup>b</sup>All student level variables are entered as grand-mean centered fixed effects except the socioeconomic status covariates which are entered as group-mean centered fixed effects.

**Table S-2. Change Score Models of Math Gains between Tenth and Twelfth Grade**

	Model 5a		Model 6a	
	coefficient	s.e.	coefficient	s.e.
<b>Fixed Effects</b>				
Constant	4.299		4.288	
<b>School Level Variables:<sup>a</sup></b>				
Catholic School	1.329	.436	1.368	.414
Social Closure Around School	.104	.125	--	--
X Catholic School	.600	.378	--	--
Parents Work Together	.255	.381	--	--
X Catholic School	-.174	1.380	--	--
Parents Have Adequate Say	.298	.343	.453	.253
X Catholic School	.806	1.424	.773	.849
Friends in School	--	--	.407	.132
X Catholic School	--	--	-.058	.399
Parents Know Parents	--	--	-.318	.139
X Catholic School	--	--	.673	.352
Suburban, Northeast, Public School	.748	.313	.769	.311
Suburban, South, Public School	.775	.276	.817	.274
Suburban, West, Public School	.281	.301	.240	.297
Urban, Midwest, Public School	-.120	.334	-.054	.324
Urban, Northeast, Public School	.730	.399	.721	.391
Urban, South, Public School	.610	.355	.652	.339
Urban, West, Public School	.487	.325	.437	.324
Rural, Midwest, Public School	.006	.292	.136	.294
Rural, Northeast, Public School	1.186	.364	1.241	.354
Rural, South, Public School	.019	.285	.149	.293
Rural, West, Public School	-.036	.403	.016	.398
<b>Random Effects</b>				
School Level Variance	0.971	0.235	0.931	0.237
Student Level Variance	29.392	0.876	29.398	0.877
-2*loglikelihood	58038.91		58031.43	

Notes: N = 9241 students in 898 schools. Data are weighted. Robust standard errors are calculated with MLwiN's implementation of White's sandwich variance estimator. Source: National Education Longitudinal Study of 1988.

<sup>a</sup>All school level variables are entered as grand-mean centered fixed effects except the Catholic school indicator variable and its interactions with other school level predictors.

**Table S-3. Models of Math Gains between Tenth and Twelfth Grade with Gains between Eighth and Tenth Grade as a Covariate**

	Model 5b		Model 6b	
	coefficient	s.e.	coefficient	s.e.
<b>Fixed Effects</b>				
Constant	4.324		4.314	
<b>School Level Variables:<sup>a</sup></b>				
Catholic School	1.453	.429	1.425	.388
Social Closure Around School	.089	.133	--	--
X Catholic School	.677	.395	--	--
Parents Work Together	.269	.397	--	--
X Catholic School	.435	1.204	--	--
Parents Have Adequate Say	.249	.349	.417	.255
X Catholic School	1.011	1.181	.805	.787
Friends in School	--	--	.338	.137
X Catholic School	--	--	.072	.395
Parents Know Parents	--	--	-.261	.145
X Catholic School	--	--	.643	.355
School Mean of Mother's Education	.199	.116	.196	.117
School Mean of Father's Education	-.098	.083	-.097	.083
School Mean of Mother's SEI	-.006	.015	-.007	.015
School Mean of Father's SEI	.005	.016	.003	.016
School Mean of Logged Family Income	.182	.193	.182	.190
Suburban, Northeast, Public School	.834	.321	.856	.321
Suburban, South, Public School	.865	.285	.896	.284
Suburban, West, Public School	.434	.323	.404	.320
Urban, Midwest, Public School	-.092	.344	-.045	.335
Urban, Northeast, Public School	.928	.426	.909	.415
Urban, South, Public School	.789	.353	.821	.356
Urban, West, Public School	.628	.342	.587	.342
Rural, Midwest, Public School	-.240	.318	-.143	.317
Rural, Northeast, Public School	1.182	.376	1.219	.368
Rural, South, Public School	-.014	.321	.074	.327
Rural, West, Public School	.094	.417	.130	.413

**Table S-3 continued on next page**

**Table S-3 continued****Student Level Variables:<sup>b</sup>**

IRT Math Score in 10th Grade				
- IRT Math Score in 8th Grade	-.153	.011	-.153	.011
Mother's Education	-.010	.040	-.010	.040
Father's Education	.096	.036	.097	.036
SEI Score of Mother's Occupation	.009	.007	.009	.007
SEI Score of Father's Occupation	.001	.008	.001	.008
Natural Logarithm of Family Income	.065	.075	.065	.075
Mother only	.144	.177	.139	.177
Father only	.516	.445	.532	.446
Mother and stepfather	-.157	.230	-.157	.230
Father and stepmother	.270	.506	.257	.507
Other family type	-.178	.424	-.167	.423
Family data missing	.478	.849	.451	.855
Black Male	-.736	.331	-.702	.330
Hispanic Male	.384	.317	.373	.316
Asian Male	.884	.432	.853	.431
White Female	-.891	.141	-.884	.141
Black Female	-.642	.290	-.611	.292
Hispanic Female	-.617	.325	-.631	.325
Asian Female	.150	.367	.130	.368
Native American	-.267	.709	-.250	.709
Probability of Inclusion in Analytic Sample (orthogonal)	.294	.093	.297	.093
Square of Probability (orthogonal)	.065	.062	.065	.062
Cube of Probability (orthogonal)	-.033	.059	-.030	.059

**Random Effects**

School Level Variance	1.093	0.25	1.069	0.255
Student Level Variance	28.056	0.861	28.059	0.861
-2*loglikelihood	57649.8		57645.22	

Notes: N = 9241 students in 898 schools. Data are weighted. Robust standard errors are calculated with MLwiN's implementation of White's sandwich variance estimator. Source: National Education Longitudinal Study of 1988.

<sup>a</sup>All school level variables are entered as grand-mean centered fixed effects except the Catholic school indicator variable and its interactions with other school level predictors.

<sup>b</sup>All student level variables are entered as grand-mean centered fixed effects except the socioeconomic status covariates which are entered as group-mean centered fixed effects.