

# Proximate Determinants of Literacy and Numeracy Skills in Ghana<sup>†</sup>

Niels-Hugo Blunch

*The George Washington University*

[nblunch@gwu.edu](mailto:nblunch@gwu.edu)

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## **Abstract:**

Previous studies of the determinants of literacy and numeracy skills in Ghana and elsewhere have mostly been limited to considering the proficiency in only one language as well as only considering skills impacts from formal education. Analyzing the impact of formal schooling and non-formal adult basic education in Ghana, this paper addresses both of these issues. To take the possible endogeneity of schooling and adult literacy course participation into account an IV-based estimation strategy is proposed. The results indicate that skills determinants differ across the type of skills examined and also point to differences in skills acquisition related to gender, ethnicity and geographical location. Formal schooling is found to be relatively more efficient in producing skills than non-formal education. An assessment of the impact of the 1996 Education Sector Reform indicates that primary education improved in terms of literacy and numeracy skills production, while other levels of formal education and adult literacy programs are found to have worsened following the reform. The results points towards a strengthening of the quality of formal education above the primary level and of adult literacy programs as an important priority for future education policy in Ghana.

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**Table 6.1 Formal Schooling and Adult Literacy Course Participation Coefficients from OLS and IV/2SLS Literacy and Numeracy Skills Regressions Using Years of Schooling**

	<i>Ghanaian reading</i>		<i>Ghanaian writing</i>		<i>English reading</i>		<i>English writing</i>		<i>Written calculations</i>	
	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>
<i>Full sample:</i>										
Literacy course	0.069***	0.126	0.043**	0.043	-0.056***	0.003	-0.044***	0.022	0.029	-0.100
	[0.022]	[0.119]	[0.019]	[0.126]	[0.013]	[0.098]	[0.012]	[0.102]	[0.027]	[0.134]
Formal schooling	0.056***	0.057***	0.054***	0.049***	0.067***	0.067***	0.066***	0.066***	0.062***	0.069***
	[0.001]	[0.006]	[0.001]	[0.006]	[0.001]	[0.005]	[0.001]	[0.005]	[0.002]	[0.005]
R <sup>2</sup>	0.41		0.39		0.60		0.58		0.59	
<i>Rural sample:</i>										
Literacy course	0.085***	0.128	0.056***	0.089	-0.039***	-0.028	-0.034**	-0.063	0.038	-0.061
	[0.023]	[0.114]	[0.020]	[0.135]	[0.013]	[0.103]	[0.013]	[0.112]	[0.027]	[0.117]
Formal schooling	0.062***	0.065***	0.059***	0.059***	0.072***	0.075***	0.071***	0.074***	0.071***	0.077***
	[0.002]	[0.006]	[0.002]	[0.008]	[0.001]	[0.006]	[0.001]	[0.006]	[0.002]	[0.005]
R <sup>2</sup>	0.48		0.45		0.60		0.58		0.62	
<i>No formal education:</i>										
Literacy course	0.088***	0.174**	0.053***	0.115	-0.014**	0.041	-0.009	0.048	0.085***	-0.024
	[0.022]	[0.083]	[0.016]	[0.075]	[0.007]	[0.072]	[0.007]	[0.071]	[0.033]	[0.110]
R <sup>2</sup>	0.07		0.06		0.12		0.11		0.15	

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 3741 (no formal education). Robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors in brackets under parameter estimates. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.

**Table 6.2 Formal Schooling and Adult Literacy Course Participation Coefficients from OLS Literacy and Numeracy Skills Regressions Pre- and Post Reform For Three Main Analyses Samples Using Years of Schooling**

	<i>Ghanaian reading</i>		<i>Ghanaian writing</i>		<i>English reading</i>		<i>English writing</i>		<i>Written calculations</i>	
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>
<i>(i) Full sample:</i>										
Literacy course	0.069***	-0.036	0.042**	-0.060	-0.056***	-0.183***	-0.048***	-0.145***	0.042	-0.144*
	[0.021]	[0.080]	[0.019]	[0.059]	[0.013]	[0.049]	[0.013]	[0.046]	[0.026]	[0.075]
Formal schooling	0.055***	0.061***	0.053***	0.060***	0.065***	0.077***	0.064***	0.076***	0.061***	0.066***
	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.003]
R <sup>2</sup>	0.48	0.30	0.45	0.29	0.65	0.48	0.64	0.47	0.62	0.48
Test for structural break, only schooling; F(2, 299) =		6.12***		12.31***		35.48***		35.78***		7.16***
Test for structural break, all coefficients; F(17, 299) =		4.37***		4.28***		8.09***		8.61***		3.31***
<i>(ii) Rural sample:</i>										
Literacy course	0.086***	-0.009	0.057***	-0.054	-0.038***	-0.154***	-0.034**	-0.143**	0.045*	-0.108
	[0.022]	[0.100]	[0.019]	[0.073]	[0.013]	[0.057]	[0.014]	[0.058]	[0.026]	[0.095]
Formal schooling	0.061***	0.066***	0.057***	0.066***	0.069***	0.082***	0.067***	0.081***	0.069***	0.077***
	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.001]	[0.003]	[0.002]	[0.004]
R <sup>2</sup>	0.55	0.35	0.52	0.34	0.66	0.47	0.64	0.46	0.65	0.52
Test for structural break, only schooling; F(2, 189) =		1.49		5.31***		21.05***		20.49***		5.67***
Test for structural break, all coefficients; F(16, 189) =		3.99***		3.94***		5.17***		4.27***		1.99**
<i>(iii) No formal education:</i>										
Literacy course	0.093***	0.031	0.059***	-0.026	-0.005	-0.102***	-0.001	-0.092***	0.101***	-0.050
	[0.022]	[0.081]	[0.017]	[0.041]	[0.006]	[0.033]	[0.006]	[0.029]	[0.031]	[0.088]
R <sup>2</sup>	0.06	0.07	0.04	0.06	0.04	0.09	0.04	0.10	0.09	0.16
Test for structural break, only schooling; F(1, 295) =		0.36		4.12**		15.18***		18.86***		2.29
Test for structural break, all coefficients; F(16, 295) =		1.89**		1.14		3.05***		2.95***		3.27***

Notes: The number of observations is 7562 (pre-reform, full sample), 3555 (post-reform, full sample), 4796 (pre-reform, rural sample), 2194 (post-reform, rural sample), 2798 (pre-reform, no formal education), 943 (post-reform, no formal education). Robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors in brackets under parameter estimates. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.

**Table 6.3 Formal Schooling and Adult Literacy Course Participation Coefficients from OLS Literacy and Numeracy Skills Regressions Pre- and Post Reform for Full and Rural Samples Using Level Completed**

	Ghanaian reading		Ghanaian writing		English reading		English writing		Written calculations	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<i>Full sample:</i>										
Literacy course	0.090***	-0.027	0.061***	-0.054	-0.023**	-0.166***	-0.017	-0.130***	0.072***	-0.122
	[0.021]	[0.078]	[0.019]	[0.057]	[0.012]	[0.048]	[0.012]	[0.045]	[0.026]	[0.074]
Primary	0.294***	0.367***	0.247***	0.345***	0.264***	0.505***	0.236***	0.480***	0.512***	0.556***
	[0.025]	[0.028]	[0.021]	[0.029]	[0.020]	[0.027]	[0.019]	[0.027]	[0.024]	[0.028]
Middle/Jr. Secondary	0.666***	0.576***	0.624***	0.564***	0.812***	0.747***	0.787***	0.736***	0.814***	0.651***
	[0.019]	[0.028]	[0.019]	[0.028]	[0.014]	[0.021]	[0.014]	[0.022]	[0.014]	[0.027]
Secondary and above	0.817***	0.745***	0.784***	0.741***	0.920***	0.852***	0.925***	0.846***	0.834***	0.697***
	[0.020]	[0.031]	[0.024]	[0.032]	[0.012]	[0.021]	[0.011]	[0.023]	[0.017]	[0.028]
Vocational	0.737***	0.359***	0.623***	0.288*	0.927***	0.899***	0.936***	0.912***	0.850***	0.711***
	[0.044]	[0.132]	[0.047]	[0.154]	[0.015]	[0.046]	[0.015]	[0.050]	[0.017]	[0.037]
R <sup>2</sup>	0.52	0.30	0.48	0.29	0.72	0.49	0.70	0.48	0.69	0.51
Test for structural break, only schooling; F(5, 299) =		5.11***		4.44***		21.95***		22.13***		24.91***
Test for structural break, all coefficients; F(20, 299) =		3.83***		2.94***		9.93***		8.35***		9.01***
<i>Rural sample:</i>										
Literacy course	0.101***	-0.010	0.071***	-0.055	-0.016	-0.153***	-0.012	-0.142**	0.058**	-0.097
	[0.022]	[0.100]	[0.019]	[0.073]	[0.013]	[0.056]	[0.013]	[0.057]	[0.025]	[0.097]
Primary	0.283***	0.366***	0.236***	0.354***	0.223***	0.469***	0.203***	0.449***	0.499***	0.593***
	[0.031]	[0.035]	[0.024]	[0.036]	[0.021]	[0.031]	[0.021]	[0.031]	[0.030]	[0.033]
Middle/Jr. Secondary	0.701***	0.599***	0.651***	0.600***	0.807***	0.765***	0.776***	0.759***	0.829***	0.706***
	[0.022]	[0.031]	[0.024]	[0.032]	[0.018]	[0.029]	[0.019]	[0.029]	[0.015]	[0.030]
Secondary and above	0.840***	0.843***	0.806***	0.830***	0.945***	0.910***	0.941***	0.909***	0.868***	0.770***
	[0.023]	[0.035]	[0.028]	[0.042]	[0.013]	[0.024]	[0.014]	[0.028]	[0.016]	[0.031]
Vocational	0.720***	0.428**	0.552***	0.448**	0.936***	0.906***	0.937***	0.925***	0.903***	0.739***
	[0.081]	[0.178]	[0.107]	[0.181]	[0.024]	[0.060]	[0.025]	[0.063]	[0.016]	[0.056]
R <sup>2</sup>	0.58	0.36	0.54	0.35	0.72	0.48	0.70	0.47	0.69	0.54
Test for structural break, only schooling; F(5, 189) =		5.88***		3.72***		17.01***		14.68***		15.00***
Test for structural break, all coefficients; F(19, 189) =		3.89***		3.07***		7.55***		5.19***		6.49***

Notes: The number of observations is 7562 (pre-reform, full sample), 3555 (post-reform, full sample), 4796 (pre-reform, rural sample), 2194 (post-reform, rural sample). Robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors in brackets under parameter estimates.  
\*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.

**Table 6.4 Pre- and Post Reform Period Literacy and Numeracy Skills Incidence**

	<i>Ghanaian reading:</i>	<i>Ghanaian writing:</i>	<i>English reading:</i>	<i>English writing:</i>	<i>Written calculations:</i>
<i>Full sample:</i>					
Pre-reform	0.420	0.382	0.464	0.449	0.573
Post-reform	0.526	0.502	0.639	0.617	0.731
Difference	0.106***	0.120***	0.175***	0.168***	0.159***
<i>Rural sample:</i>					
Pre-reform	0.378	0.344	0.374	0.363	0.486
Post-reform	0.455	0.436	0.560	0.528	0.671
Difference	0.077***	0.092***	0.186***	0.166***	0.185***
<i>No formal education:</i>					
Pre-reform	0.041	0.029	0.018	0.015	0.098
Post-reform	0.032	0.037	0.012	0.029	0.125
Difference	-0.009	0.007	-0.006	0.014	0.027

Notes: The number of observations is 7562 (pre-reform, full sample), 900 (post-reform, full sample), 4796 (pre-reform, rural sample), 543 (post-reform, rural sample), 2798 (pre-reform, no formal education), 215 (post-reform, no formal education). Estimations and t-tests incorporate survey weights and clustering. \*\*\*: statistically significant at 1 percent.

**Table 6.5 Pre- and Post Reform Period Formal and Non-Formal Educational Attainment**

	Literacy course	Years of schooling	No education	Primary	Middle/Jr. Secondary	Secondary and above	Vocational
<i>Full sample:</i>							
Pre-reform	0.077	6.055	0.408	0.126	0.332	0.117	0.017
Post-reform	0.020	7.067	0.242	0.149	0.440	0.164	0.005
Difference	-0.058***	1.012***	-0.166***	0.024	0.108***	0.047***	-0.012***
<i>Rural sample:</i>							
Pre-reform	0.101	4.988	0.485	0.131	0.302	0.077	0.005
Post-reform	0.020	6.096	0.299	0.171	0.442	0.083	0.005
Difference	-0.081***	1.108***	-0.186***	0.041*	0.140***	0.006	0.000
<i>No formal education:</i>							
Pre-reform	0.139						
Post-reform	0.059						
Difference	-0.081***						

Notes: The number of observations is 7562 (pre-reform, full sample), 900 (post-reform, full sample), 4796 (pre-reform, rural sample), 543 (post-reform, rural sample), 2798 (pre-reform, no formal education), 215 (post-reform, no formal education). Estimations and t-tests incorporate survey weights and clustering. \*: statistically significant at 10 percent, \*\*\*: statistically significant at 1 percent.

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**APPENDIX A: Full Set of Results for OLS and IV/2SLS Regressions, Including Specification Tests.**

**Table A1 Formal Schooling and Adult Literacy Course Participation Coefficients from OLS and IV/2SLS Skills Regressions Using Years of Schooling**

	<i>Ghanaian reading</i>		<i>Ghanaian writing</i>		<i>English reading</i>		<i>English writing</i>		<i>Written calculations</i>	
	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>	<i>OLS</i>	<i>IV</i>
<i>Full sample:</i>										
Literacy course	0.069***	0.126	0.043**	0.043	-0.056***	0.003	-0.044***	0.022	0.029	-0.100
	[0.022]	[0.119]	[0.019]	[0.126]	[0.013]	[0.098]	[0.012]	[0.102]	[0.027]	[0.134]
Formal schooling	0.056***	0.057***	0.054***	0.049***	0.067***	0.067***	0.066***	0.066***	0.062***	0.069***
	[0.001]	[0.006]	[0.001]	[0.006]	[0.001]	[0.005]	[0.001]	[0.005]	[0.002]	[0.005]
R <sup>2</sup>	0.41		0.39		0.60		0.58		0.59	
<i>Rural sample:</i>										
Literacy course	0.085***	0.128	0.056***	0.089	-0.039***	-0.028	-0.034**	-0.063	0.038	-0.061
	[0.023]	[0.114]	[0.020]	[0.135]	[0.013]	[0.103]	[0.013]	[0.112]	[0.027]	[0.117]
Formal schooling	0.062***	0.065***	0.059***	0.059***	0.072***	0.075***	0.071***	0.074***	0.071***	0.077***
	[0.002]	[0.006]	[0.002]	[0.008]	[0.001]	[0.006]	[0.001]	[0.006]	[0.002]	[0.005]
R <sup>2</sup>	0.48		0.45		0.60		0.58		0.62	
<i>Urban sample:</i>										
Literacy course	0.016	0.059	0.009	-0.196	-0.114***	0.12	-0.082***	-0.025	0.095	0.338**
	[0.062]	[0.237]	[0.054]	[0.262]	[0.032]	[0.273]	[0.030]	[0.211]	[0.062]	[0.151]
Formal schooling	0.048***	0.036***	0.047***	0.032***	0.060***	0.062***	0.060***	0.062***	0.048***	0.056***
	[0.002]	[0.007]	[0.002]	[0.008]	[0.002]	[0.007]	[0.002]	[0.007]	[0.003]	[0.008]
R <sup>2</sup>	0.30		0.28		0.53		0.52		0.48	
<i>No formal education:</i>										
Literacy course	0.088***	0.174**	0.053***	0.115	-0.014**	0.041	-0.009	0.048	0.085***	-0.024
	[0.022]	[0.083]	[0.016]	[0.075]	[0.007]	[0.072]	[0.007]	[0.071]	[0.033]	[0.110]
R <sup>2</sup>	0.07		0.06		0.12		0.11		0.15	
<i>Primary or higher:</i>										
Literacy course	0.075	0.078	0.068	-0.002	-0.162***	-0.126	-0.138***	-0.139	-0.067*	-0.066
	[0.049]	[0.219]	[0.051]	[0.251]	[0.037]	[0.272]	[0.038]	[0.268]	[0.037]	[0.145]
Formal schooling	0.045***	0.019	0.046***	0.018	0.050***	0.026***	0.053***	0.032***	0.024***	0.013*
	[0.002]	[0.014]	[0.002]	[0.013]	[0.003]	[0.009]	[0.003]	[0.010]	[0.002]	[0.007]
R <sup>2</sup>	0.13		0.14		0.21		0.22		0.11	

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 3741 (no formal education), 7376 (primary or higher). Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.



**Table A2 Results from Specification Tests for 2SLS/IV Literacy and Numeracy Skills Regressions, First Stage: F-tests for Exclusion of Identifying Instruments**

	<i>Full sample</i>	<i>Rural sample</i>	<i>Urban sample</i>	<i>No formal education</i>	<i>Primary or higher</i>
<i>Full sample:</i>	F(80, 299) =	F(80, 189) =	F(78, 109) =	F(80, 295) =	F(80, 298) =
Literacy course participation	3.54	6.00	82.91	3.48	2.41
Formal schooling (years)	7.05	7.01	109.51	---	23.09

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 3741 (no formal education), 7376 (primary or higher). Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. All test statistics are statistically significant at 1 percent.

**Table A3 Results from Specification Tests for 2SLS/IV Skills Regressions, Second Stage: Endogeneity and Over-identification Tests**

	<i>Ghanaian reading</i>	<i>Ghanaian writing</i>	<i>English reading</i>	<i>English writing</i>	<i>Written calculations</i>
<i>Full sample:</i>					
<i>Wu (1973)-Hausman (1978)</i>	0.13	0.37	0.23	0.25	1.77
<i>endogeneity test-F(2, 109):</i>	[0.879]	[0.689]	[0.792]	[0.782]	[0.172]
<i>Hansen (1982) J-test for overidentification-<math>\chi^2(78)</math>:</i>	101.348**	103.064**	116.149***	106.040**	103.049**
	[0.039]	[0.030]	[0.003]	[0.019]	[0.030]
<i>Rural sample:</i>					
<i>Wu (1973)-Hausman (1978)</i>	0.18	0.04	0.12	0.27	1.18
<i>endogeneity test-F(2, 189):</i>	[0.840]	[0.961]	[0.887]	[0.764]	[0.309]
<i>Hansen (1982) J-test for overidentification-<math>\chi^2(78)</math>:</i>	87.131	88.260	97.173*	84.103	82.534
	[0.225]	[0.200]	[0.070]	[0.298]	[0.341]
<i>Urban sample:</i>					
<i>Wu (1973)-Hausman (1978)</i>	1.49	1.91	0.72	0.14	2.14
<i>endogeneity test-F(2, 109):</i>	[0.230]	[0.152]	[0.487]	[0.873]	[0.122]
<i>Hansen (1982) J-test for overidentification-<math>\chi^2(76)</math>:</i>	76.991	70.291	75.680	85.374	83.419
	[0.447]	[0.663]	[0.489]	[0.216]	[0.262]
<i>No formal education:</i>					
<i>Wu (1973)-Hausman (1978)</i>	1.30	0.76	0.62	0.69	1.02
<i>endogeneity test-F(1, 295):</i>	[0.254]	[0.384]	[0.432]	[0.408]	[0.315]
<i>Hansen (1982) J-test for overidentification-<math>\chi^2(78)</math>:</i>	75.020	77.017	76.365	70.730	87.490
	[0.575]	[0.510]	[0.531]	[0.708]	[0.217]
<i>Primary or more:</i>					
<i>Wu (1973)-Hausman (1978)</i>	1.78	2.23	3.54**	2.62*	1.18
<i>endogeneity test-F(2, 298):</i>	[0.171]	[0.110]	[0.030]	[0.075]	[0.309]
<i>Hansen (1982) J-test for overidentification-<math>\chi^2(78)</math>:</i>	92.272	84.974	93.569	89.576	87.479
	[0.129]	[0.276]	[0.110]	[0.174]	[0.217]

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 3741 (no formal education), 7376 (primary or higher). P-values in brackets under test-statistics. Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.

## Appendix B: Sensitivity Analyses, Main Analyses Samples: Using Level of Educational Attainment Instead of Years of Schooling

**Table B1 Formal Schooling and Adult Literacy Course Participation Coefficients from OLS and IV/2SLS Skills Regressions Using Level of Schooling Completed**

	<i>Ghanaian reading</i>		<i>Ghanaian writing</i>		<i>English reading</i>		<i>English writing</i>		<i>Written calculations</i>	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
<i>Full:</i>										
Literacy course	0.077***	0.205	0.050***	0.092	-0.042***	0.074	-0.030***	0.099	0.041	-0.023
	[0.022]	[0.134]	[0.019]	[0.135]	[0.012]	[0.107]	[0.012]	[0.109]	[0.027]	[0.148]
Primary	0.335***	0.348***	0.298***	0.295**	0.387***	0.532***	0.359***	0.497***	0.551***	0.566***
	[0.019]	[0.131]	[0.019]	[0.135]	[0.017]	[0.088]	[0.017]	[0.092]	[0.016]	[0.094]
Middle/JSS	0.631***	0.874***	0.598***	0.774***	0.783***	0.885***	0.763***	0.901***	0.756***	0.825***
	[0.017]	[0.094]	[0.018]	[0.099]	[0.012]	[0.069]	[0.012]	[0.074]	[0.014]	[0.063]
Secondary and above	0.793***	0.630***	0.767***	0.551***	0.900***	0.831***	0.902***	0.825***	0.796***	0.864***
	[0.018]	[0.132]	[0.022]	[0.141]	[0.011]	[0.090]	[0.011]	[0.088]	[0.016]	[0.084]
Vocational	0.693***	0.366	0.587***	-0.232	0.919***	0.859***	0.922***	0.839**	0.827***	1.555***
	[0.045]	[0.516]	[0.047]	[0.544]	[0.014]	[0.310]	[0.015]	[0.340]	[0.017]	[0.344]
R <sup>2</sup>	0.43		0.41		0.64		0.62		0.64	
<i>Rural:</i>										
Literacy course	0.088***	0.186	0.059***	0.144	-0.033***	0.015	-0.027**	-0.028	0.038	-0.002
	[0.023]	[0.118]	[0.020]	[0.133]	[0.012]	[0.110]	[0.013]	[0.118]	[0.027]	[0.131]
Primary	0.328***	0.390**	0.295***	0.313**	0.347***	0.580***	0.325***	0.571***	0.556***	0.631***
	[0.025]	[0.160]	[0.023]	[0.155]	[0.020]	[0.118]	[0.020]	[0.121]	[0.019]	[0.091]
Middle/JSS	0.662***	0.747***	0.629***	0.683***	0.789***	0.837***	0.767***	0.816***	0.786***	0.873***
	[0.020]	[0.083]	[0.022]	[0.096]	[0.016]	[0.063]	[0.016]	[0.067]	[0.013]	[0.060]
Secondary and above	0.838***	0.744***	0.810***	0.694***	0.942***	0.873***	0.940***	0.907***	0.849***	0.751***
	[0.021]	[0.165]	[0.027]	[0.183]	[0.011]	[0.126]	[0.011]	[0.119]	[0.016]	[0.124]
Vocational	0.668***	0.488	0.531***	0.024	0.936***	0.989*	0.941***	0.815	0.878***	1.463**
	[0.075]	[0.809]	[0.092]	[0.819]	[0.025]	[0.577]	[0.025]	[0.737]	[0.019]	[0.601]
R <sup>2</sup>	0.49		0.47		0.63		0.61		0.65	
<i>Urban:</i>										
Literacy course	0.033	0.01	0.022	-0.273	-0.079**	0.116	-0.05	0.032	0.129*	0.311**
	[0.058]	[0.212]	[0.052]	[0.220]	[0.032]	[0.219]	[0.031]	[0.197]	[0.072]	[0.136]
Primary	0.338***	0.193	0.297***	0.197	0.477***	0.499***	0.440***	0.384***	0.516***	0.487***
	[0.029]	[0.212]	[0.030]	[0.187]	[0.029]	[0.115]	[0.030]	[0.145]	[0.032]	[0.128]
Middle/JSS	0.567***	0.683***	0.538***	0.639***	0.782***	0.889***	0.765***	0.830***	0.681***	0.775***
	[0.030]	[0.143]	[0.029]	[0.127]	[0.018]	[0.096]	[0.017]	[0.110]	[0.032]	[0.079]
Secondary and above	0.742***	0.650***	0.719***	0.594***	0.881***	0.959***	0.888***	0.990***	0.717***	0.962***
	[0.029]	[0.113]	[0.032]	[0.124]	[0.017]	[0.066]	[0.018]	[0.066]	[0.034]	[0.082]
Vocational	0.665***	0.731**	0.575***	0.597*	0.923***	1.265***	0.933***	1.517***	0.752***	1.063***
	[0.056]	[0.297]	[0.054]	[0.323]	[0.020]	[0.191]	[0.023]	[0.230]	[0.034]	[0.250]
R <sup>2</sup>	0.32		0.3		0.59		0.58		0.56	

*Primary or higher:*

Literacy course	0.104**	0.268	0.096*	0.177	-0.115***	0.017	-0.091**	0.031	-0.042	0.002
	[0.049]	[0.257]	[0.052]	[0.289]	[0.036]	[0.213]	[0.037]	[0.203]	[0.036]	[0.161]
Middle/JSS	0.295***	0.542***	0.302***	0.523***	0.393***	0.456***	0.403***	0.526***	0.203***	0.222***
	[0.019]	[0.146]	[0.017]	[0.148]	[0.017]	[0.094]	[0.017]	[0.098]	[0.015]	[0.078]
Secondary and above	0.461***	0.401**	0.475***	0.380**	0.503***	0.415***	0.536***	0.530***	0.242***	0.180**
	[0.021]	[0.171]	[0.023]	[0.169]	[0.021]	[0.101]	[0.021]	[0.119]	[0.018]	[0.081]
Vocational	0.365***	-0.047	0.301***	-0.344	0.534***	0.534*	0.570***	0.619*	0.261***	0.601***
	[0.048]	[0.474]	[0.047]	[0.501]	[0.021]	[0.283]	[0.022]	[0.326]	[0.019]	[0.215]
R <sup>2</sup>	0.16		0.17		0.29		0.3		0.15	

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 7376 (primary or higher). P-values in brackets under test-statistics. Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.

**Table B2 Results from Specification Tests for 2SLS/IV Child Health Regressions, First Stage: F-tests for Exclusion of Identifying Instruments**

	Full sample	Rural sample	Urban sample	Primary or higher
	F(80, 299) =	F(80, 189) =	F(78, 109) =	F(80, 298) =
Literacy course participation	3.54	6.00	82.91	2.41
Primary	62.13	52.07	20.47	26.03
Middle/JSS	6.12	11.92	72.40	56.02
Secondary and above	3.83	5.10	432.24	36.23
Vocational	2.45	1.27	11.34	3.04

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 7376 (primary or higher). Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. All test statistics are statistically significant at 1 percent, except for vocational education, rural sample, which is statistically significant at 10 percent.

**Table B3 Results from Specification Tests for 2SLS/IV Skills Regressions, Second Stage: Endogeneity and Over-identification Tests**

	Ghanaian reading	Ghanaian writing	English reading	English writing	Written calculations
<i>Full sample:</i>					
Wu (1973)-Hausman (1978)	3.00**	2.53**	1.67	2.00*	1.58
endogeneity test~F(5, 299):	[0.012]	[0.029]	[0.142]	[0.079]	[0.166]
Hansen (1982) J-test	86.483	96.396**	93.352*	86.912	81.634
for overidentification~ $\chi^2(75)$ :	[0.172]	[0.049]	[0.074]	[0.164]	[0.281]
<i>Rural sample:</i>					
Wu (1973)-Hausman (1978)	0.56	0.43	0.96	0.93	1.24
endogeneity test~F(5, 189):	[0.731]	[0.828]	[0.443]	[0.463]	[0.294]
Hansen (1982) J-test	85.531	76.457	97.124**	88.773	77.058
for overidentification~ $\chi^2(75)$ :	[0.190]	[0.432]	[0.044]	[0.132]	[0.413]
<i>Urban sample:</i>					
Wu (1973)-Hausman (1978)	3.02**	1.82	0.92	0.99	1.42
endogeneity test~F(5, 109):	[0.014]	[0.114]	[0.468]	[0.425]	[0.222]
Hansen (1982) J-test	74.953	63.362	78.821	79.751	70.062
for overidentification~ $\chi^2(73)$ :	[0.415]	[0.782]	[0.300]	[0.275]	[0.576]
<i>Primary or higher:</i>					
Wu (1973)-Hausman (1978)	3.37***	3.69**	1.27	1.18	1.37
endogeneity test~F(4, 298):	[0.010]	[0.012]	[0.283]	[0.320]	[0.243]
Hansen (1982) J-test	81.056	76.839	86.624	81.316	92.933*
for overidentification~ $\chi^2(76)$ :	[0.325]	[0.452]	[0.190]	[0.317]	[0.091]

Notes: Number of observations is 11117 (full sample), 6990 (rural sample), 4127 (urban sample), 7376 (primary or higher). P-values in brackets under test-statistics. Estimations employ robust Huber-White Sandwich (Huber, 1967; White, 1980) standard errors. \*: statistically significant at 10 percent; \*\*: statistically significant at 5 percent; \*\*\*: statistically significant at 1 percent.