

Table 1

Characteristics of Instructional Vocabulary Programs for Middle School Students

Program	Research	Design	Students	Schools	Time	Unit Length	E.S.	Training	Resources
Word Generation	Authors (2009)	Q	1016	8	30 hrs	15	0.21	summer	free
	Authors (2011)	Q	1571	10	30 hrs		0.06	institute	printable materials
	Authors (2015)	E	1554	28	30 hrs		0.25		
Vocabulary Improvement Program	Carlo, et al., 2004	Q	254	4	9.5 hrs	30 - 45	0.34	biweely	For Purchase 39.95
Peer-Assisted Learning for English Language Learners: Application to Middle-School Social Studies Classes	Vaughn et al. 2009	E	381	2	52.5	50 (ss)	0.53		class text and video
	Vaughn et al. 2009	E	507	2	52.5	50 (ss)	0.413		class and video
Project QuEST (Quality English and Science Teaching)	August et al. 2009	E	890	5	30 hrs	45 min	0.369	5 full day	district science text and supplemental
Language Workshop	Townsend & Collins, 2009	E	37	1	25 hrs	75 min	0.83	Researcher delivered with aide	
ALIAS (Academic Language Instruction for All Students)	Lesaux, Kieffer, Faller, & Kelley, 2010	Q	476	7	54 hrs	45 min	0.39	Individualized Coaching	

Table 2

School Demographics and Grade Level Contributions of Vocabulary Data for each School by Treatment Conditions

Treatment Condition	District	School Code	Total Enrollment	Percent Free and Reduced Lunch	Percent Proficient by Grade			Valid Contributions by Grade Level			Total Contributions	Clusters Contributed
					Grade 6	Grade 7	Grade 8	Grade 6	Grade 7	Grade 8		
Control Schools	1	1	331	82%	63%	76%	53%	14	<i>10</i>	13	27	2
	1	3	442	83%	80%	72%	73%	35	43	14	92	3
	1	5	533	81%	62%	69%	n.a.	0	19	14	33	2
	1	6	238	82%	90%	86%	87%	19	29	19	67	3
	1	7	595	68%	85%	79%	89%	56	54	75	185	3
	1	11	320	96%	77%	82%	70%	22	11	15	48	3
	1	13	940	86%	71%	60%	54%	36	0	30	66	2
	1	14	431	82%	85%	74%	49%	34	23	28	85	3
	1	19	326	92%	96%	81%	52%	26	15	16	57	3
	1	20	359	88%	87%	93%	74%	17	8	9	17	1
	1	35	249	86%	57%	47%	44%	7	20	<i>10</i>	20	1
	1	37	613	78%	78%	79%	89%	28	34	28	90	3
	2	31	329	92%	35%	19%	39%	11	13	15	39	3
	2	32*	286	55%	46%	67%	81%	0	0	<i>10</i>	0	0
	3	39	722	69%	65%	73%	73%	214	219	219	652	3
	3	41	257	86%	31%	35%	39%	42	69	75	186	3
	3	44	576	73%	44%	43%	49%	142	137	118	397	3
	3	45	341	80%	14%	21%	18%	0	30	8	30	1
	3	47	1144	56%	68%	71%	70%	294	263	330	887	3
3	49	878	78%	57%	54%	64%	171	188	221	580	3	
Average			488.0	81%	65%	65%	62%	58.4	59.3	63.4	177.9	
Sum			9910					1168	1185	1267	3558	48
Word Generation Schools	1	2	126	76%	11%	13%	19%	0	0	7	0	0
	1	8	405	96%	90%	96%	81%	11	16	0	27	2
	1	9	442	82%	85%	68%	71%	27	39	21	87	3
	1	10	452	79%	81%	63%	58%	32	28	26	86	3
	1	12	505	77%	79%	82%	56%	29	25	27	81	3
	1	15	817	81%	80%	79%	78%	82	74	73	229	3
	1	16	501	89%	64%	69%	63%	23	43	111	177	3
	1	17	328	96%	53%	32%	41%	5	16	14	30	2
	1	18	494	81%	80%	77%	64%	33	37	21	91	3
	1	34	357	93%	69%	75%	63%	5	19	21	40	2
	2	21	680	94%	24%	24%	43%	0	20	0	20	1
	2	22	680	93%	73%	31%	69%	24	30	27	81	3
	2	23	368	91%	32%	52%	58%	16	20	11	47	3
	2	25	317	91%	26%	36%	55%	0	0	43	43	1
	2	26	456	77%	51%	59%	77%	0	0	88	88	1
	2	27	321	74%	60%	73%	82%	0	0	16	16	1
	2	30	297	95%	31%	45%	75%	0	13	13	26	2
	2	32*	286	55%	46%	67%	81%	20	5	0	20	1
	3	38	1171	49%	71%	75%	73%	335	342	339	1,016	3
	3	40	531	80%	42%	44%	47%	114	140	112	366	3
3	42	1179	51%	77%	76%	71%	268	297	327	892	3	
3	43	1024	59%	63%	70%	70%	258	199	164	621	3	
3	46	570	88%	24%	29%	26%	93	41	98	232	3	
3	48	571	70%	46%	47%	44%	92	113	144	349	3	
3	50	329	92%	35%	19%	39%	57	47	55	159	3	
Average			550.3	81%	56%	55%	59%	83.4	85.0	92.7	257.8	
Sum			13207					1524	1564	1758	4824	58

Note: Although 44 schools began the study, only 44 schools (106 grade level clusters) contributed data. Some grade-level teams had very little data to contribute and are not included in HLM analysis (Table 4) as we describe in footnote ii. School 32 participated as both control and Word Generation school where, eighth graders were in the control condition and sixth graders in the treatment condition. School 37 was assigned to TX but did not implement at all and is analyzed as a control schools. Two other schools assigned to control (24 and 36) and one other school assigned to treatment (33) dropped out of the study and did not provide data. Italicized numbers in the valid contribution by grade level column indicate contribution by within school grade level team of less than ten.

Table 3

Academic, General Vocabulary and Reading Comprehension Test Scores by Treatment Status and Estimated Effect Sizes (Treatment on the Treated)

Outcome Measure	Overall Sample Mean			Control Sample Mean				Word Generation Sample Mean				$\delta T - \delta C$	Within Group Pooled Standard Deviation	Effect Size Calculated by	Effect Size Calculated by HLM	<i>p</i> -value
	Pretest	Post test	<i>n</i>	Pretest	Post test	<i>n</i>	δC	Pretest	Post test	<i>n</i>	δT					
School Mean																
Academic Vocabulary	18.46 (3.07)	20.34 (3.52)	45	18.35 (2.67)	19.63 (3.26)	20	1.27	18.55 (3.41)	20.90 (3.68)	25	2.35	1.08	8.33	0.130	0.094	<i>p</i> < 0.05
General Vocabulary	508.90 (13.15)	517.15 (13.23)	44	507.41 (12.56)	515.96 (12.32)	19	8.55	510.03 (13.72)	518.04 (14.07)	25	8.01	-0.54	36.74	-0.015	-0.002	<i>n.s.</i>
Reading Comprehension	510.82 (13.82)	514.29 (15.48)	44	509.89 (12.54)	512.03 (17.57)	19	2.14	511.52 (14.94)	516.02 (13.80)	25	4.50	2.36	38.42	0.061	0.070	<i>n.s.</i>

Note: Within group pooled standard deviation was calculated at the individual level based on pretest scores of treatment and control students who completed pre and post assessments of vocabulary (n = 4796, SD = 8.45) (n = 3670, SD = 8.15)

Table 4. Hierarchical Linear Models Predicting Students' Academic and General Vocabulary and Reading Comprehension Scores from Pretest Scores and from Pretest Scores Controlling for School Level Covariates and Student Grade Level

Outcome	Academic Vocabulary			General Vocabulary			Reading Comprehension		
	Model 1A	Model 1B	Model 1C	Model 2A	Model 2B	Model 2C	Model 3A	Model 3B	Model 3C
	Without Covariates	With Covariates	With Interactions	Without Covariates	With Covariates	With Interactions	Without Covariates	With Covariates	With Interactions
	RQ1	RQ1	RQ2	RQ1	RQ1	RQ2	RQ1	RQ1	RQ2
Treatment (RO1)	0.931* (0.421)	0.780* (0.395)	5.135* (2.221)	-0.0164 (1.210)	-0.0901 (1.158)	20.55** (6.592)	1.74 (2.096)	2.671 (1.783)	33.94*** (8.529)
Academic Vocabulary									
School Mean Score (Uncentered)	1.095*** (0.072)	0.915*** (0.185)	1.016*** (0.184)	1.022*** (0.048)	0.916 (0.555)	1.01 (0.564)		0.259 (0.844)	0.849 (0.725)
Teaching Team Score (School Mean Centered)	0.614*** (0.065)	0.204 (0.160)	0.233 (0.160)	0.715*** (0.053)	0.582 (0.500)	1.119** (0.431)		1.09 (0.649)	1.347* (0.599)
Individual Score (Team Mean Centered)	0.779*** (0.008)	0.398*** (0.013)	0.413*** (0.021)	0.849*** (0.006)	0.820*** (0.044)	0.922*** (0.054)		0.756*** (0.052)	0.690*** (0.065)
General Vocabulary									
School Mean Score (Uncentered)		0.0144 (0.059)	0.0332 (0.058)		0.496** (0.178)	-2.057*** (0.350)		0.145 (0.264)	0.262 (0.226)
Teaching Team Score (School Mean Centered)		0.139*** (0.035)	0.136*** (0.035)		0.678*** (0.111)	-0.430** (0.160)		0.295* (0.141)	0.306* (0.131)
Individual Score (Team Mean Centered)		0.0583** (0.003)	0.0584** (0.003)		0.571*** (0.010)	-0.796*** (0.159)		0.146*** (0.012)	0.153*** (0.012)
Reading Comprehension									
School Mean Score (Uncentered)		-0.00312 (0.042)	-0.0103 (0.041)		0.106 (0.128)	0.137 (0.123)	1.023*** (0.078)	0.682*** (0.186)	0.0842 (0.163)
Teaching Team Score (School Mean Centered)		0.0274 (0.030)	0.0249 (0.030)		-0.104 (0.095)	-0.138 (0.080)	0.736*** (0.056)	0.297* (0.122)	-0.159 (0.117)
Individual Score (Team Mean Centered)		0.0616*** (0.003)	0.0617*** (0.003)		0.194*** (0.010)	0.193*** (0.010)	0.811*** (0.008)	0.615*** (0.012)	0.140*** (0.036)
Seventh Grade		-0.606 (0.531)	-0.597 (0.528)		0.19 (1.679)	-3.529* (1.454)		7.005** (2.131)	16.23*** (2.081)
Eighth Grade		-1.491* (0.753)	-1.421 (0.748)		1.25 (2.393)	-4.472* (2.118)		4.729 (3.064)	13.30*** (2.887)
District 2		0.778 (0.800)	0.804 (0.774)		0.469 (2.423)	0.808 (2.359)		-3.428 (3.596)	-2.985 (3.035)
District 3		1.718* (0.650)	1.708* (0.627)		1.015 (1.910)	0.688 (1.859)		6.341 (2.889)	5.805* (2.409)
Enrollment (School Level)		0.000658 (0.001)	0.000631 (0.001)		0.00131 (0.003)	-0.00114 (0.003)		0.00184 (0.005)	0.000819 (0.004)
Percent Free and Reduced Lunch (School Level)		0.0277 (0.030)	0.0248 (0.028)		-0.257** (0.086)	-0.293*** (0.084)		0.142 (0.131)	0.0932 (0.109)
Percent Proficiency (School Level)		2.881 (1.894)	2.568 (1.837)		1.186 (5.562)	-2.7 (5.483)		18.40* (8.318)	15.45* (7.026)
School Mean by Student Interactions									
Academic Vocabulary Pretests			-0.000197 (0.001)						
General Vocabulary Pretests						0.00263*** (0.000)			
Reading Comprehension Pretests									0.00338*** (0.000)
Academic Vocabulary Pretest by Treatment Interactions									
RQ2 Individual Academic Vocabulary by Treatment			-0.0196 (0.016)			-0.175** (0.054)			-0.129* (0.064)
RQ3 School Level Academic Vocabulary by Treatment			-0.216 (0.119)			-0.899* (0.353)			-1.580*** (0.459)
Intercept	-0.494 (1.364)	-7.227 (25.280)	-14.59 (24.740)	-3.1 (24.630)	212.1** (75.810)	822.1*** (105.800)	-9.204 (40.120)	57.71 (115.400)	251.6* (98.320)
Residual	0.775 (0.208)	0.277 (0.145)	0.203 (0.134)	5.168* (1.841)	1.417 (1.305)	3.541* (1.126)	19.23*** (5.143)	9.650*** (2.815)	4.083 (1.948)
Level 2 Variance (Classroom)	1.534 (0.202)	1.277 (0.182)	1.263 (0.179)	13.33*** (2.128)	11.58*** (2.078)	4.976*** (1.199)	44.83*** (5.264)	19.86*** (3.024)	15.92*** (2.588)
Level 2 Variance (School)	33.00*** (0.256)	27.52*** (0.218)	27.51*** (0.218)	443.5*** (3.237)	336.7*** (2.668)	334.4*** (2.649)	676.9*** (5.006)	473.6*** (3.750)	462.8*** (3.664)
Number of Schools	43	42	42	43	43	43	43	43	43
Number of Teaching Teams	106	103	103	108	108	108	105	108	108
Number of Students	8,382	8,052	8,052	9,503	8,094	8,094	9,254	8,094	8,094
Deviance	53259.18	49680.26	49674.725	85016.456	70186.315	70102.011	86764.373	72975.285	72767.067

Note: * p < 0.05, ** p < 0.01, *** p < 0.001; Standard errors in parentheses; Academic vocabulary measured by the Word Generation multiple choice test; General vocabulary measured with the extended scale scores from level 6 or level 7/9 of the Gates-MacGinitie vocabulary assessment. GRADE 7 indicates if a student is in seventh grade (GRADE7 = 1) or not (GRADE7 = 0). GRADE8 indicates if a student is in eighth grade (GRADE8 = 1) or not (GRADE8 = 0). DISTRICT_2 is a dummy variable used to specify if a student was in district 2 (DISTRICT_2 = 1) or not (DISTRICT_2 = 0). DISTRICT_3 is a dummy variable used to specify if a student was in district 3 (DISTRICT_3 = 1) or not (DISTRICT_3 = 0). District 1 is the reference group.

Table 5. Comparison of Regression and Quantile Regression Analyses

Model	Parameter	Estimate	SE	98% CI		t Value	p Value	
				LB	UB			
1	OLS Regression of General Vocabulary on Pretest WG Vocabulary							
	Academic Vocabulary	2.77	0.04	2.69	2.84	73.58	<.001	
	Intercept	457.86	1.04	455.83	459.89	442.06	<.001	
2	OLS Regression of Reading Comprehension on Pretest WG Vocabulary							
	Academic Vocabulary	2.91	0.04	2.82	3.00	64.66	<.001	
	Intercept	454.28	1.24	451.85	456.71	366.82	<.001	
3	Quantile Regression of General Vocabulary on WG Vocabulary							
	q25 in General Vocabulary	Academic Vocabulary	3.00	0.06	2.88	3.12	48.53	<.001
		Intercept	438.00	1.80	434.48	441.52	243.96	<.001
	q50 in General Vocabulary	Academic Vocabulary	2.81	0.05	2.72	2.91	57.13	<.001
		Intercept	455.59	1.46	452.73	458.45	312.29	<.001
	q75 in General Vocabulary	Academic Vocabulary	2.67	0.09	2.50	2.84	30.71	<.001
		Intercept	473.33	2.34	468.74	477.93	202.04	<.001
	4	Quantile Regression of Reading Comprehension on WG Vocabulary						
		q25 in Reading Comp.	Academic Vocabulary	3.06	0.07	2.93	3.19	46.29
Intercept			434.47	1.65	431.23	437.71	262.84	<.001
q50 in Reading Comp.		Academic Vocabulary	3.00	0.07	2.87	3.13	44.56	<.001
		Intercept	452.00	1.74	448.58	455.42	259.37	<.001
q75 in Reading Comp.		Academic Vocabulary	2.93	0.04	2.84	3.01	70.02	<.001
		Intercept	469.81	0.75	468.34	471.29	626.47	<.001