

RAISE Results for Three Years

The purpose of this report is to summarize the results from three years of the Reading Accommodations and Interventions for Students in Emergent Literacy (RAISE) project. Data were analyzed for each year and aggregated across all years. The dependent variables were (a) total NVLA, (b) Conventions of Reading (CVR), (c) Phonemic Skills (PhonSk), and (d) PPVT. All the scores are reported as raw scores (i.e., number correct).

All data were screened for outliers, missing data, normality, homogeneity of regression lines (for ANCOVA) and other assumptions. While some of the assumptions were violated (e.g., homogeneity of variances), having equivalent sample sizes helps protect (robust) against bias results in the inferential statistics. Outliers greater than 5 standard deviations away from the means were deleted from the analyses (only one participant in the 2nd year control group). No attempt was made to correct for inflated Type I error due to multiple testing for fear of reducing the statistical power.

The posttest means, standard deviations, sample sizes, and effect sizes are reported in Table 1. For all the outcome measures the treatment group means were higher than the control group. Results of analysis of covariance (ANCOVA) using the pretest score as a covariate found statistically significant differences in 9 out of 16 tests. Based on Cohen (1988) recommendations for interpreting effect sizes, most of the effect sizes would be considered small. Since there is no context for interpreting the magnitude of these effect sizes for this student population we might consider this study as setting the context for evaluating effect sizes for all future studies.

The second group of analyses examine the gain scores (posttest minus pretest) for all the outcome measures. The gain score means, standard deviations, and effect sizes are reported in Table 2. Again, the treatment group had higher mean gain scores across all measures except for CVR (2nd year). Eight of the 16 *t*-tests results suggested statistically significant results. The effects sizes for the total NVLA and PhonSk ranged from moderate to large. The effect sizes for CVR and PPVT were small to moderate.

An outlier-resistant estimator of effect size was calculated using the median gain scores and median absolute deviation (MAD). Hedges and Olkin (1985) provided the following formula for calculating the effect size based on the median,

$$d = \frac{Mdn_{exp} - Mdn_{cont}}{S_{bwc}}, \text{ where}$$

$$S_{bwc} = \frac{n^{1/2} \left[\sum a_i (Y_i - Md_c)^2 (1 - Z_i^2)^4 \right]^{1/2}}{\left| \sum a_i (1 - Z_i^2) (1 - 5Z_i^2) \right|}.$$

The median and outlier-resistant estimator of effect sizes are reported in Table 3. The experimental median was higher than the control group median across all measures and all years. The effect sizes estimated from the median tended to be higher than the effect sizes reported in Table 2.

The last set of analyses used Fisher's permutation tests, which answers the question, "How often would this happen by chance?" Computer-implemented permutation test is the gold standard whereas ANOVA are an approximation (Higgins, 2004). In these analyses the gain scores are randomly reassigned (without replacement) to two ad hoc groups, the difference between the ad hoc groups in mean gain scores are calculated, another random reassignment executed, and so on, 100,000 times to create a distribution of the sampling error expected under chance. The percentile of the observed mean gain score difference is calculated. One minus the percentile is analogous to the *p* value. The results of the analyses are reported in

Table 4. The actual gain score difference exceeded chance for the NVLA total, PhonSk, and PPVT. The difference on conventions of reading between the treatment and control groups did not exceed chance.

Conclusions

There appears to be a consistent pattern across all three years that the treatment group exceeded the control group. The largest effect sizes were found in the total NVLA and PhonSk.

Table 1
*Posttest Means, Standard Deviations, Effect Sizes (d),
and Standard Error of Effect Sizes for Treatment and Control Groups Across Three Years*

	Treatment			Control			*	<i>d</i>	<i>se</i>
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>			
NVLA									
Year1	11	76.36	40.49	12	65.75	41.46	*	.26	±.42
Year 2	19	95.42	25.01	17	86.28	52.28		.24	±.33
Year 3	17	88.94	26.47	16	67.06	29.17	*	.79	±.36
Total	47	88.62	30.00	46	74.24	42.80	*	.40	±.21
CVR									
Year1	11	19.00	4.77	12	17.00	5.86		.38	±.42
Year 2	19	22.53	5.92	17	21.78	7.93		.11	±.33
Year 3	17	21.82	6.70	16	15.69	6.23	*	.95	±.37
Total	47	21.45	6.02	46	18.41	7.27		.46	±.21
PhonSk									
Year1	11	57.36	36.54	12	48.75	36.60	*	.24	±.42
Year 2	19	72.89	22.68	17	64.50	45.71		.25	±.33
Year 3	17	67.12	22.05	16	51.38	24.62	*	.67	±.36
Total	47	67.17	26.40	46	55.83	37.00	*	.36	±.21
PPVT									
Year1	11	20.82	15.76	12	18.42	18.31	*	.14	±.42
Year 2	19	29.68	14.78	17	25.61	21.62		.22	±.33
Year 3	17	28.24	20.04	16	23.31	13.86		.29	±.35
Total	47	27.09	17.08	46	22.93	18.19	*	.24	±.21

Note. *indicate ANCOVA was statistically significant at .05 (one-tailed test)

Table 2
*Gain Score Means, Standard Deviations, Effect Sizes (d),
 and Standard Error of Effect Sizes for Treatment and Control Groups Across Three Years*

		Treatment			Control				<i>d</i>	<i>SE</i>
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>			
NVLA	Year1	11	40.27	26.71	12	24.33	13.03	*	.80	±.43
	Year 2	19	45.58	24.04	17	29.12	34.39	*	.56	±.33
	Year 3	17	23.53	18.57	16	13.69	18.79		.53	±.35
	Total	47	36.36	24.51	46	22.36	25.27	*	.56	±.21
CVR	Year1	11	7.18	4.69	12	7.08	4.46		.02	±.42
	Year 2	19	7.63	6.55	17	7.71	8.63		-.01	±.33
	Year 3	17	4.65	6.48	16	1.44	5.14		.55	±.35
	Total	47	6.45	6.17	46	5.31	7.04		.17	±.21
Phon	Year1	11	33.09	24.03	12	17.25	12.31	*	.87	±.44
	Year 2	19	37.95	22.03	17	21.41	27.32	*	.67	±.33
	Year 3	17	18.88	15.82	16	12.25	16.65		.41	±.35
	Total	47	29.91	21.83	46	17.04	20.48	*	.61	±.21
PPVT	Year1	11	6.45	9.03	12	-0.42	8.27	*	.79	±.43
	Year 2	19	14.37	16.40	17	9.76	15.71		.29	±.33
	Year 3	17	10.47	13.78	16	5.94	17.36		.29	±.35
	Total	47	11.11	14.10	46	5.69	15.04	*	.37	±.21

Note. * <.05 (*t*-tests, one-tail)

Table 3

Median Gain Scores and Outlier-Resistant Effect Sizes

		Treatment		Control		<i>ES</i>
		<i>N</i>	<i>Mdn</i>	<i>N</i>	<i>Mdn</i>	
NVLA	Year1	11	45.00	12	24.50	1.69
	Year 2	19	39.00	18	24.00	.38
	Year 3	17	22.00	16	12.00	.70
CVR	Year1	11	8.00	12	7.00	.23
	Year 2	19	9.00	18	5.50	.39
	Year 3	17	5.00	16	3.00	.46
Phon	Year1	11	37.00	12	16.00	1.75
	Year 2	19	32.00	18	20.00	.52
	Year 3	17	15.00	16	12.00	.24
PPVT	Year1	11	6.00	12	-1.50	.90
	Year 2	19	14.00	18	3.50	.61
	Year 3	17	11.00	16	5.00	.42

Note. The outlier was included in these analyses.

Table 4

Fisher's Permutation Test

	Actual Difference Between Experimental and Control Groups Gain Scores	<i>p</i> <i>value</i>		Observed statistics from simulation at the 95%tile
NVLA	14.01	<.01	*	8.83
CVR	1.13	.20		2.26
PhonSk	12.87	<.01	*	7.50
PPVT	5.71	.03	*	4.96

*Note. * Difference between experimental and control groups is greater than the simulated distribution at the 95 percentile.*