Washington State LASER West Valley Study Results

Dennis Schatz
Pacific Science Center
200 Second Avenue North
Seattle, WA 98109

Peter D. Finch, Assistant Superintendent
West Valley School District
8902 Zier Road
Yakima, WA 98908

Dave Weaver & Margaret Beam
RMC Research Corporation
522 SW Fifth Avenue, Suite 1407
Portland, OR 97204

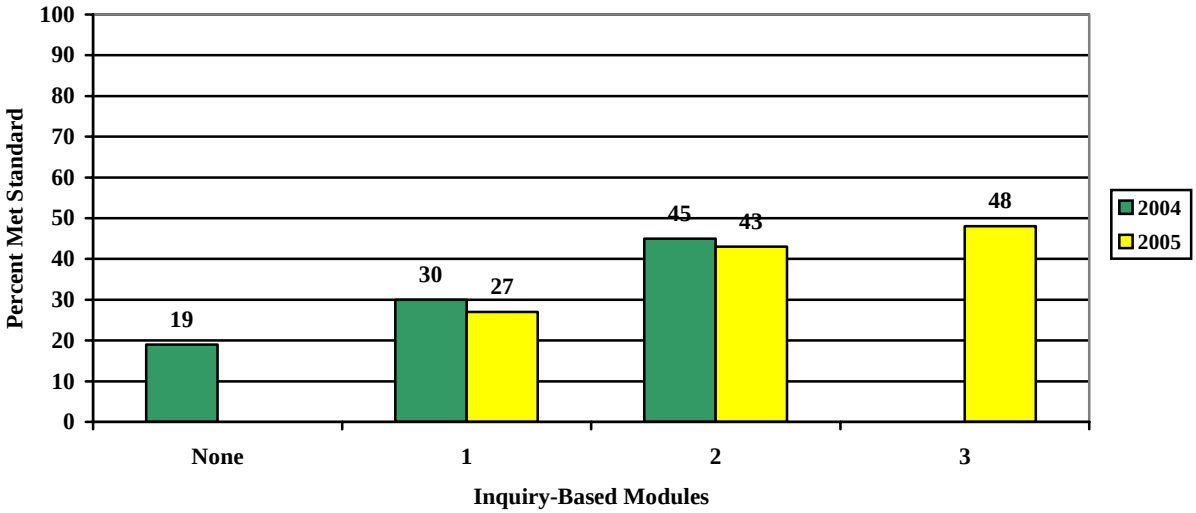
November 2005

Background

Washington State LASER began operating in Washington State in 1999, and the first Strategic Planning Institute occurred in June of that year. Six more Institutes have taken place since then and currently 131 school districts, representing more than 60% of the students in the state, are at various stages of implementing an inquiry-base science program in their schools. More information about Washington State LASER activities and its 9 Regional Alliances can be found at www.WaStateLASER.org.

West Valley School District (WVSD) in Yakima, Washington, one of the districts participating in the South Central LASER Regional Alliance, conducted a phased implementation of inquiry-based science instructional materials prior to the administration of the science Washington Assessment of Student Learning (science WASL) in spring 2004 and spring 2005. Teachers received 2 days of professional development on the use of the instructional materials and constructivist learning theory in preparation for the use of the materials with students. Peter Finch, the Assistant Superintendent, collected data on the number of modules students experienced and their performance on the science WASL in 2004 and 2005. Finch noticed that the more inquiry-based science instructional modules students experienced, the better they seemed to perform on the science WASL (see Exhibit 1).

Exhibit 1—WVSD Grade 5 Science WASL Results by Number of Modules



These results were brought to the attention of Dennis Schatz, the LASER Project Director, who in turn forwarded them to RMC Research for comment. Finch, Schatz, and Dave Weaver of RMC Research participated in a telephone conference and decided that RMC Research would perform further analysis on the data to compensate for the effects of other variables in order to attribute the findings to the inquiry-based instructional materials (LASER module). Peter Finch prepared Grade 5 student-level data files that indicated the number of modules each student experienced, his or her science WASL scores, and information on demographics and other factors including whether the student was eligible for free or reduced-price lunch, was an English language learner, or received special education services. The remainder of this report summarizes the findings.

Analysis of 2004 Data

RMC Research used one-way analysis of variance (ANOVA) to examine the mean differences in 2004 science WASL scores between groups of students who had experienced no LASER modules, 1 LASER module, and 2 LASER modules. The ANOVA showed significant mean differences (see Exhibit 2) between the group that experienced no LASER and the groups that experienced 1 or 2 modules $F(2, 342) = 6.65$, $p < .001$).

Exhibit 2
Mean 2004 WASL Scores by LASER Science Module Grouping

Module Group	*N*	Mean Score	*SD*	*SE*
No LASER	120	26.18	8.21	0.75
1 Module	170	29.34	8.18	0.63
2 Modules	53	30.38	9.75	1.34
Total	343	28.39	8.59	0.46

Next, RMC Research examined group differences in the percentage of students who met the 2004 science WASL standards. As Exhibit 3 shows, the Chi-Square test results, similar to the ANOVA results, revealed significant differences between the group that experienced no LASER and the groups that experienced 1 or 2 modules χ^2 (2, 346) = 10.74, p= .005).

Exhibit 3
Meeting of Standards on 2004 Science WASL
by LASER Module Grouping

Module Group	*N*	No. Met Standard	Percent
No LASER	122	23	19%
1 Module	171	54	32%
2 Modules	53	22	42%
Total	346	99	29%

RMC Research examined the bivariate correlations of the demographic data and the student assessment results to determine which demographic factors should be included in a model as control variables. The bivariate correlations showed that 3 student demographic factors were significantly correlated with the percentage of students who met the Grade 5 science WASL standards: ethnicity White (White), ethnicity Hispanic (Hispanic), and participation in special education (SPED). The free or reduced-price lunch program data were not in the 2004 data set.

By controlling for the effects of White and SPED (Hispanic was too highly correlated with White) and by examining the 2004 WASL score as the dependent variable, RMC Research conducted a regression analysis to determine the unique contribution of LASER module group to the outcome. This analysis revealed a significant positive relationship between LASER module group and Grade 5 students' 2004 science WASL scores beyond what can be explained by student ethnicity and enrollment in special education (see Exhibit 4).

Exhibit 4
Regression Analysis of LASER Instruction to 2004 Science WASL Score

Variable	β	*t*	*p*
White (0 = non-White, 1 = White)	0.24	4.72	< 0.001
SPED (0 = not SPED, 1 = SPED)	-0.27	-5.35	< 0.001
LASER module group	0.15	3.01	**0.003**
	R^2 = 0.16		
	Adjusted R^2 = 0.15		
	F(3, 339) = 21.55		

Note. By convention, factors with p values less that 0.05 are considered statistically significant.
N = 345 schools.

RMC Research conducted a similar regression analysis controlling for the effects of White and SPED (Hispanic was too highly correlated with White) with the students who met the science standard (Met

Standard) as the dependent variable. This analysis revealed a significant positive relationship between LASER module group and the percentage of Grade 5 students who met the science standard on the 2004 WASL beyond what can be explained by student ethnicity and enrollment in special education (see Exhibit 5).

Exhibit 5
Regression Analysis of LASER Instruction to Met Standard

Variable	β	*t*	*p*
White (0 = non-White, 1 = White)	0.18	3.53	< 0.001
SPED (0 = not SPED, 1 = SPED)	-0.14	-2.64	0.009
LASER module group	0.15	2.96	**0.003**
	$R^2 = 0.08$		
	Adjusted $R^2 = 0.08$		
	$F(3, 342) = 10.31$		

Note. By convention, factors with *p* values less that 0.05 are considered statistically significant. *N* = 345 schools.

Analysis of 2005 Data

RMC Research used one-way ANOVA to examine the mean differences in 2005 science WASL scores between groups of students who experienced 1 LASER module, 2 LASER modules, and 3 LASER modules. As Exhibit 6 shows, the ANOVA revealed significant mean differences between the groups that experienced 1 or 2 LASER modules and the group that experienced 3 modules $F(2, 377) = 10.21$, $p < .001$).

Exhibit 6
Mean 2005 Science WASL Scores by LASER Science Module Grouping

Module Group	*N*	Mean Score	*SD*	*SE*
1 Module	164	27.58	9.16	0.72
2 Modules	174	30.37	9.53	0.73
3 Modules	46	34.28	9.19	1.36
Total	380	29.64	9.56	0.49

Next, RMC Research examined group differences in the percentage of students who met the 2005 science WASL standards. Exhibit 7 shows that the Chi-Square test revealed significant differences between the group that experienced 1 LASER module and the groups that experienced 2 or 3 modules χ^2 (2, 380) = 9.62, $p = .008$).

Exhibit 7
Meeting of Standards on 2005 Science WASL by LASER Module Grouping

Module Group	*N*	Met Standard	Percent
1 Module	164	46	28%
2 Modules	170	71	42%
3 Modules	46	22	48%
Total	380	139	37%

RMC Research examined the bivariate correlations of the demographic data and the student assessment results to determine which demographic factors should be included in a model as control variables. The bivariate correlations showed that 4 student demographic factors were significantly correlated with the percentage of students who met the science WASL standards: ethnicity White (White), ethnicity Hispanic (Hispanic), participation in special education (SPED), and eligibility for free or reduced-price lunch (FRL).

By controlling for the effects of White, SPED, and FRL (Hispanic was too highly correlated with White) and by examining the 2005 WASL score as the dependent variable, RMC Research conducted a regression analysis to determine the unique contribution of LASER module group to the outcome. This analysis revealed a significant positive relationship between LASER module group and Grade 5 students' 2005 science WASL scores beyond what can be explained by student ethnicity, enrollment in special education, and eligibility for free or reduced-price lunch (see Exhibit 8).

Exhibit 8
Regression Analysis of LASER Instruction to 2005 Science WASL Score

Variable	β	*t*	*p*
White (0 = nonwhite, 1 = white	0.18	4.04	< 0.001
SPED (0 = not SPED, 1 = SPED)	-0.34	-7.60	< 0.001
FRL (0 = not FRL, 1 = FRL)	-0.16	-3.55	< 0.001
LASER module group	0.18	4.16	< 0.001
	$R^2 = 0.23$		
	Adjusted $R^2 = 0.27$		
	$F(4, 375) = 36.20$		

Note. By convention, factors with *p* values less that 0.05 are considered statistically significant. *N* = 379 schools.

RMC Research conducted a similar regression analysis controlling for the effects of White, SPED, and FRL (Hispanic was too highly correlated with White) with the students who met the science standard (Met Standard) as the dependent variable. This analysis revealed a significant positive relationship between LASER module group and the percentage of Grade 5 students who met the science standard on the 2005 WASL beyond what can be explained by student ethnicity, enrollment in special education, and eligibility for free or reduced-price lunch (see Exhibit 9).

Exhibit 9
Regression Analysis of LASER Instruction to Met Standard

Variable	β	*t*	*p*
White	0.18	3.52	< 0.001
SPED	-0.17	-3.47	0.001
FRL	-0.14	-2.70	0.007
LASER module group	0.13	2.59	0.010
	$R^2 = 0.13$		
	Adjusted $R^2 = 0.12$		
	$F(4, 375) = 14.03$		

Note. By convention, factors with *p* values less that 0.05 are considered statistically significant.
$N = 379$ schools.

Conclusion

In both the 2004 and 2005 data sets, there was a significant positive relationship between LASER module group and the percentage of Grade 5 students who met the science WASL standard beyond what can be explained by student ethnicity and enrollment in special education. Eligibility for free or reduced-price lunch was also controlled for in 2005. Because the percentage of students eligible for free or reduced-price lunch does not change substantially from year to year, we can assume that eligibility for free or reduced-price lunch had a similar effect in 2004. These results strongly support the assertion that the more inquiry-based instruction students experience the more likely they are to meet the science standards assessed with the WASL.