Analysis of Impact of Prior Exposure to a Reading Passage on the Grade 4 English Language Arts Examination

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Executive Summary

Two studies were performed on the Grade 4 English Language Arts (ELA) results to determine if students had gained an advantage on the test by prior exposure to one of the reading passages in instructional materials. The analyses indicate that no unfair advantage gained by prior exposure to a reading passage on the Grade 4 English Language Arts examination could be detected.

Study 1

The first study analyzed scale scores for a sample of the state's population. The differences between the whole scale score and a scale score without the exposed part of the test were compared for exposed schools and schools matched by 1998 grade 3 reading passing rates and community types. No differences were found.

Study 2

The second study predicted performance on the exposed section of the test on the basis of performance on all other parts of the test and the 1998 grade 3 reading passing rates. Actual performance was subtracted from predicted performance. These differences, called residuals, were compared for students from exposed schools and for the matched unexposed schools. Again, no differences were found.

Conclusion

There was no indication of unfair advantage on the Grade 4 ELA in relation to prior exposure to a reading passage.

Overview of the Studies

When the Grade 4 English Language Arts (ELA) examination was administered in January 1999, some of the students claimed they were familiar with three of the reading passages on the test. In fact, one passage had been published in a supplement to an anthology. Other passages in the anthology were on similar topics of two other reading passages, but were not the same passages. As an attempt is made to assess students on materials that are similar to or the same as those encountered in the classroom, the possibility increases that some children will have seen the test materials.

This report analyzes whether the prior exposure of some children conferred an unfair advantage on them. The study is designed to complement opinions of an expert panel on the impact of prior exposure to reading materials. These opinions are contained in a separate report. Two empirical studies are reported here.

The analyses reported were conducted on two separate data files received from CTB/McGraw-Hill. The first file, used for Study 1, contained test results from the first seven BOCES cleaned and analyzed by CTB McGraw Hill. Two analyses have been conducted on the first file, gauging whether there was any differential advantage accrued by exposure to a supplement of an anthology that contained one of the passages used on the ELA. The second file contained item by item performance for all students and is the basis for Study 2.

Study 1:
Exposure Analysis Using Scaling Procedures

Scaling Analyses

For the first study, the items were scaled, and a test scale score was generated based on performance on all of the test. Another score was generated on the same scale using all of the test items other than those related to the exposed passage.

The analyses took advantage of two forms of matching: matching the part test scale score (unexposed) to the whole test scale score (exposed) and matching schools that had the anthology supplements to schools that did not. There is no analysis of the actual degree of usage of the anthologies.

Statistical Treatment

Two analyses on the first data file followed from these procedures:

1. The difference between the part and whole scale scores were computed and the distribution of these differences was estimated. The standardized differences for each school (Z's) were squared and summed for the exposed schools and calculated as chi-square distributions;

2. A general linear regression was performed in which the part or whole scale scores and the exposed or matched school were repeated measures and the third grade Degrees of Reading Power (DRP) passing rates, divided into thirds of the state distribution, was a blocking variable.

Matching Procedures

Schools were matched at the district level by the passing rates on the 1998 Grade 3 Degrees of Reading Power (DRP) and by community type. Schools were also matched by county, wherever possible. The average DRP passing rate for the districts of exposed schools was 0.896 (n=52) and for the non-exposed match schools it was 0.885 (n=52). (F (1,94) = 0.07, ns). This shows that the matching procedures were effective.

Because some schools were matched to schools outside of the first seven BOCES that were scored, the matches reported are not as close as they would be for the State as a whole. However, even with the sample remaining from the first seven BOCES, mean reading scores of exposed schools (n=45) mean = 94.5) and the matched schools (n=51, mean = 94.7) were very close (F (1,190)=0.0, ns). Note the analysis of the sample is at the school level, not the student level. The DRP passing rates are at the district level. The correlations among the DRP passing rates, the part scale score, and the whole scale scores are shown in Table 1. The relationship shows the adequacy of the DRP passing rate to match schools.

The first study involves putting the part of the test that was not exposed, that is, all of the test except the questions related to the exposed passage, on the same score scale as the whole test and then determining if the whole test and part test are different for the children who had access to the reading passage. The second study involves using performance on all exposed parts of the test to predict performance on the exposed part and then evaluating whether or not the observed performance was different beyond chance levels. Both studies used the matched comparison group to gauge the degree of any advantage.

Note that, because exposed schools were matched on the basis of district level variables like community type, all of the schools of the matching nonexposed districts were included in the analyses. However, among the exposed districts, only the schools specifically known to have the anthology supplement were included in the analyses, because it could not be reliably determined which other schools in the exposed districts might have used the supplement.

The data from the exposed schools and the matching schools were then weighted by the numbers of students tested and averaged across the whole district. This produced a one to one match of exposed and non-exposed districts.

Results

Z-score. The sum of Z-squared for the 45 exposed schools was 47.89. At 45 degrees of freedom, the critical value would be 61.63. Therefore there was no significant difference between the part and whole scale scores for exposed schools, indicating no support that the exposure affected scores. Similarly, the sum of the Z-squared scores for the matched schools was 47.11, also not significant.

General Linear Regression: Means are shown in Table 2. Most important is the failure to achieve statistical significance in the interaction of exposed schools compared to not exposed schools and the difference between mean part scale scores and mean whole scale scores ($F(1,84)=3.23$,ns).

Conclusion

These data do not support any conclusion that exposure to the anthology supplement conferred an unfair advantage on the Grade 4 ELA.

Table 1

Correlation[1] Among 1998 Grade Three Reading Passing Rates,
Mean Part (Not Including Items on Exposed Passage)
Scale Scores and Mean Whole (Including Items on Exposed Passage)
Scale Scores on the 1999 Grade Four English Language Arts Examination

			Correlations	
Variable	School	Mean	ELA Part	ELA Whole
Grade 3 Passing Rates	Exposed	.94	.75	.75
	Match	.95	.79	.79
	All	.95	.77	.77
Grade 4 ELA Part	Exposed	653.72	-	1.00
	Match	651.62	-	1.00
	All	652.61	-	1.00
Grade 4 ELA Whole	Exposed	654.00	1.00	-
	Match	651.69	1.00	-
	All	652.77	1.00	-

[1]Spearman correlations were used to control for the non-interval properties of the Grade 3 passing rates.

Table 2

Mean Part and Whole Scale Scores on the Grade Four
English Language Arts Examination, by Grade 3 Passing Rate,
and by Condition of Exposure to the Anthology Supplement

School Condition	Grade 3 Passing Level	Part Scale Score	Whole Scale Score	Mean for Both
Exposed	0.00 - 0.90	637.7	637.9	637.8
	0.91 - 0.96	652.1	652.4	652.3
	0.97 - 1.00	662.3	662.6	662.5
	All	653.7	654.0	651.7
Not Exposed	0.00 – 0.90	633.9	634.0	633.9
	0.91 – 0.96	649.2	649.3	649.2
	0.97 – 1.00	664.7	664.6	664.6
	All	651.6	651.7	653.9
All	0.00 – 0.90	635.9	636.1	636.0
	0.91 – 0.96	650.4	650.5	650.4
	0.97 – 1.00	663.1	663.5	663.4
	All	652.6	652.8	652.0

Study 2:
Exposure Analysis Using Multiple Regression

Overview

The purpose of this study was to determine whether exposure to a passage published in instructional materials used in some schools gave an unfair advantage on the Grade 4 English Language Arts (ELA) examination to students who were exposed to the passage. For this analysis, a data file was used that was provided by the test contractor, CTB/McGraw-Hill. The file contained the responses of students to all of the 28 multiple-choice questions related to the reading passages, as well as four holistically scored questions and three analytically scored questions.

Second Data Set: Regression

A second data set was received from CTB/McGraw-Hill containing the item level responses of all fourth grade students. The multiple-choice responses were first converted to values of one, correct, or zero, incorrect. They were then summed according to stimulus or passage. Table 3 presents the mean sums of the multiple-choice, open-ended, and analytically scored questions.

The matching procedures were as described in the study 1. In fact, a small number of schools in New York City that had bought the supplement to the anthology did not have comparable matching schools by reading scores or community type elsewhere in the State. A preliminary analysis of covariance in which the previous year's reading passing rate was the covariate[1], was employed to determine whether these schools were different than the matched cohorts.

The analysis (F ($df = 2,53223$) $= 3.41$, $p<.05$) revealed that these unmatched, but exposed schools score significantly higher on the test overall. Adjusted scale means were 639.43 for these unmatched exposed schools, 627.93 for matched exposed schools, and 626.54 for matched comparison schools. These higher scores accounted for the inability to match these schools to others on the basis of 1998 reading scores and community type. For this reason, these schools were included in further analyses to determine whether the higher scores were related to exposure on the one passage that appeared in the instructional material or some other undetermined factor such as a generally more sensitive instructional program that led to the children's exposure to a wide range of reading materials.

[1]Actually an arc sine transformation of the passing rate was used to meet normality assumptions.

Table 3

Mean Sums for Multiple Choice Sections
and Cluster and Analytical Scores

	Matched Exposed	Matched Unexposed	Unmatched Exposed
Multiple Choice			
One	5.46	5.28	5.52
Two	3.56	3.44	3.61
Three	1.60	1.50	1.62
Four	3.03	2.80	3.11
Five	2.70	2.39	2.76
Six	4.38	3.93	4.45
Cluster Scores	8.14	7.50	8.17
Analytic Scores	3.97	3.67	3.99
Grade 3 Reading*	1.20	1.09	1.22
Scale Score	639.58	633.31	645.98

*Arcsine transformation of grade 3 passing rate on the reading test

Analyses

Three analyses were performed. Each was based on multilinear regression to predict the performance on the exposed section from all other sections of the test. In the first, the regression was based on three groups, the exposed (n = 12,543) and matched (n = 37,438) groups, and the exposed unmatched group (n = 3,333). The second analysis was based only on the regression from the matched exposed and unexposed groups. The third analysis was based only on the regression from the unexposed matched group, to control for the effects of possible contamination from exposure on the regression coefficients. Table 4 shows the results of the regression analyses.

Residual Analyses

Three analyses of the regression residuals followed. The residuals were the actual scores on the exposed section minus the scores predicted for the same section based on the regression analysis.

The first residual analysis, using the three types of schools showed that the mean residual of students from the matched exposed schools (0.00) was not significantly higher than either that of the students from the matched unexposed schools (-0.00) or the unmatched exposed schools (0.02) ($F(df = 2,53322) = 1.60$, ns). It is most important to note that students from the matched exposed schools did not score higher than any of the other groups given their performance on unexposed sections of the Grade 4 ELA.

The second analysis, comparing only students from matched exposed and unexposed schools (based on the residuals for those two groups only) also failed to detect differences in the mean residuals (means of 0.00 and -0.00, respectively) (F (df = 1,49896) = 0.30, ns). Again, there is no evidence of advantage related to prior exposure.

Finally, a third analysis was made of the data. The regression equation was based only on the matched unexposed schools, to avoid any possible contamination in the regression coefficients themselves through exposure to the passage. These uncontaminated coefficients were applied to the matched exposed and non-exposed groups. Again, the mean residuals were not significantly different (both means were 0.00) (F (df = 1,49896) = 0.28, ns), indicating no evidence of advantage related to prior exposure.

Conclusion

Analyses were undertaken to investigate whether the performance on test questions related to a reading passage that students were exposed to before the administration of the Grade 4 ELA unfairly enhanced their performance. No evidence of unfair advantage was found.

Table 4

Multilinear Regression Coefficients* of Exposed Section Onto Unexposed Multiple Choice (Mc), analytically-scored (An) and Cluster Scored (Cl) Sections, for Grade 4 ELA

Variable	Matched Exposed (1)	Matched Unexposed (2)	Unmatched Exposed (3)	Groups 1 & 2	Groups 1, 2, & 3
MC_1	0.35	0.39	0.45	0.39	0.38
MC_2	0.20	0.19	0.14	0.19	0.19
MC_3	0.07	0.07	0.08	0.07	0.07
MC_4	0.04	0.04	0.02	0.04	0.04
MC_5	0.02	0.02	0.02	0.02	0.02
An	0.06	0.06	0.03	0.06	0.06
Clus	0.04	0.05	0.04	0.05	0.05
Grade 3 Read	0.25	0.16	-0.01	0.16	0.18
Intercept	2.56	2.48	2.82	2.48	2.49
R-Square	0.39	0.39	0.37	0.39	0.39

*These coefficients can be used to predict performance on the exposed section as follows: $y = 0.39\ MC_1 + 0.19\ MC_2 + 0.07\ MC_3 + 0.04\ MC_4 + 0.02\ MC_5 + 0.06\ An + 0.05\ Clus + 0.16\ G3 + 2.48$.