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The Relationship Between SES and the Multilevel Influence of School and District Size on Student Achievement: A Replication of Two Previous Studies

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The Washington School Research Center (WSRC) is an independent research and data analysis center within Seattle Pacific University. The Center began in July 2000, funded through a gift from the Bill & Melinda Gates Foundation. Our mission is to conduct sound and objective research on student learning in the public schools, and to make the research findings available for educators, policy makers, and the general public for use in the improvement of schools. We believe that sound data and appropriate data analysis are vital components for the identification of school and classroom practices related to increased student academic achievement.

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A Technical Report For
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Introduction

School and district size have been considered by many educators to be important factors for school success. In the past the trend toward larger schools was fueled by the belief that larger schools were not only more economical, but also offered better education for most students. However, more recently many have come to believe that when it comes to schools, bigger is not necessarily better, and that greater achievement for all children can be gained when education takes place in smaller schools.

A number of studies have examined the relationship between school size and academic achievement after controlling for socio-economic status (SES). Among other findings, studies have suggested that smaller schools result in more positive student attitudes towards school, improved student teacher interactions, smaller class size, and higher achievement. However, the study of the relationship between school size and academic achievement is complicated since there are often many factors that may influence student school performance. One such factor is school poverty or SES, often determined by the percentage of students eligible for free and reduced lunch. The negative relationship between SES and school achievement is well established. Another complicating factor is that schools of various sizes exist within school districts of various sizes making it unclear whether it is school size, district size, or some combination thereof that makes the most significant difference.

Bickel and Howell (2000) studied the joint effects of school and district size in Georgia while controlling for SES by using a multi-level data analysis procedure. While the results of this study were not consistent for all grade levels, Bickel and Howell (2000) did find a pattern of

significant relationships between school achievement and two levels of interactions - school size and district poverty and school poverty and district size. Overall, small schools in small districts showed the strongest achievement scores for less affluent students, while large schools in large districts were most beneficial for more affluent students.

Bickel and Howley (2000) examined the “equity effects” for various combinations of school and district size. Equity effects refer to the relationship between SES and achievement for four different school and district configurations (large schools in large districts, small schools in large districts, large schools in small districts, and small schools in small districts). They found that small schools in small districts had the smallest percentage of variance related to poverty, suggesting that the greatest opportunity for achievement equity occurs for students in those schools.

Abbott, Joireman, and Stroh (2002) replicated the Georgia study with similar data for the schools in the state of Washington. Though the achievement measures used in the Washington study were different, the pattern of results was similar to the Georgia study. Both the joint effects analysis and “equity effects” exploration parts of the Georgia study were replicated in the Washington state study.

Review of Literature

The relative advantages and disadvantages of school size in education have received much attention the educational literature. While much of this attention has focused on the benefits of reducing class size (Finn, 2002), the purported benefits of small and large size schools have also been the topic of much recent policy discussion. The trend towards larger schools is a historically recent one (Wasley, 2002). For much of American school history, small schools have dominated educational practice and schools were often associated with individual communities. This is a trend that began to change in the latter part of the twentieth century, a movement fueled by the belief that larger schools could provide better education while at the

same time reducing the costs of maintaining small schools in small districts (Wasley, 2002; Wasley et al., 2000). This was especially true for secondary education (Allen, 2002).

More recently the benefit of larger schools has come under question and the idea that smaller schools may benefit student outcomes (especially those from disadvantaged groups) has gained momentum. Critics of larger schools argue that the consolidation of small rural districts (and schools) results in the loss of community identity and participation (Robertson, 2001), lowered achievement for students of color and those from lower SES groups (Wasley, 2002), increased violence, student anonymity, reduced personal interactions between students and teachers, increased absenteeism, lower graduation rates and reduced parent involvement.

Some studies of public schools seem to support these beliefs. For example, a study of 264 elementary schools found that not only did smaller schools result in higher achievement, but also resulted in teachers taking more responsibility for student academic performance and concern for student social development (Lee & Loeb, 2000). A second study conducted in Chicago schools found a significant positive relationship between school size and a number of desirable student outcomes such as school attendance, academic performance, student effort, graduation rates, and overall satisfaction among teachers, student and parents (Walsey et al, 2000).

While research suggests benefits associated with smaller schools, a study by Bickel and Howley (2000) suggested that this relationship may not be as clear as it first appears. This comprehensive study of student achievement in Georgia examined the joint effects of school size, district size, SES, and ethnicity on school achievement in the 8^{th} and 11^{th} grades. Bickel and Howley found that while the joint effects of smaller schools and smaller districts seem to benefit schools with higher numbers of low SES students, the same does not seem be true for schools that are more affluent. The same study found that larger schools seem to benefit students who attend schools that are more affluent.

In a replication of Bickel and Howley's Georgia study, Abbott et al. (2002) found similar results for 4th and 7th grade students in the state of Washington. The results of the Washington State study partially replicated the finding of the Georgia study in that district size did have an effect by increasing the negative relationship between school poverty and student achievement. However, unlike Bickel and Howley's Georgia study, the Washington state study did not find that district poverty significantly affected the negative relationship between school size and student achievement (though there was a trend for larger schools to be more beneficial in more affluent districts).

The failure of the Washington study to replicate all the findings of the Georgia study may be partially explained by the fact that the two studies used different measures of achievement. Therefore, the current study attempted to replicate both the Washington study and the Georgia study by using measures of achievement that were similar to those used in both studies.

Method

Replication Study

The current study is a replication of both the Georgia and Washington State studies on the relationship between school size and district size with school achievement while controlling for poverty. The Georgia study used 8th grade Iowa Test of Basic Skills results and 11th grade Georgia High School Graduation Test performance scores. In contrast, the Washington State study analyzed the 2001 results from the 4th and 7th grade Washington Assessment of Student Learning (WASL), a statewide assessment of expected learning outcomes for all students. The focus of this study examines aggregated individual school building results for the state of Washington on the 2002 3rd and 6th grade Iowa Test of Basic Skills (ITBS) and 2002 4th and 7th grade achievement data for the WASL.

The data in both the Georgia and previous Washington State studies were analyzed using the Hierarchical Linear Modeling technique, a procedure that allows for the analysis of multiple level data (school level and district level). The HLM technique attempts to identify the joint effects of school and district size on school achievement while controlling for the effects of poverty. The same procedures are used in this study.

Current Study Data

The data used for the analysis in this study are 3rd and 6th grade ITBS math and reading scores and 4th and 7th grade WASL math and reading scaled scores for the 2002 school year, as provided by Washington State's Office of the Superintendent of Public Instruction. The 3rd and 6th grade ITBS scores used for the study were NCE scores for math and reading and were reported as school averages.

The current data analysis used most of the schools in Washington, though schools were excluded when there were less then 10 students for any grade level or subject area. Non-traditional schools such as those labeled "Alternative" were also excluded because of the

unique characteristics of these schools. Finally, a small number of schools were not included because poverty information was not available.

The descriptive summaries for the data used in this study are summarized in Tables 1 and 2. Table 1 is a descriptive summary of the 3rd and 6th grade variables (ITBS), and Table 2 reports the same summary data for the 4th and 7th grade variables (WASL). In addition to the ITBS results for the 3rd and 6th grades and WASL scores for the 4th and 7th grades, the percent of students qualifying for Free and Reduced Lunch (F/R) are reported as indicators of socioeconomic status for both school and district levels. As was done in both the Georgia and previous Washington study, spansize (average number of students per grade) is used as the measure of school size, while enrollment (total number of students per district) is reported as the value for district size.

Table 1. Descriptive ITBS Statistics for 3rd and 6th Grades

			N	Mean	SD
3rd Grade	**School Level**	% F/R Lunch	1042	39.59	22.66
		spansize	1042	68.45	26.83
		Math NCE Score	1042	57.89	8.58
		Reading NCE Score	1042	52.70	7.42
	District Level	% F/R Lunch	256	39.91	19.47
		Enrollment	256	3,933.20	6,308.22
6th Grade	**School Level**	% F/R Lunch	696	36.94	20.77
		spansize	696	107.42	85.66
		Math NCE Score	696	53.86	7.58
		Reading NCE Score	695	52.42	6.96
	District Level	% F/R Lunch	256	39.52	19.06
		Enrollment	256	3,960	6,325.3

Table 2. Descriptive WASL Statistics for 4th and 7th Grades

			N	Mean	SD
4th Grade	**School Level**	% F/R Lunch	1047	39.69	22.83
		spansize	1047	77.30	31.73
		Math Scale Score	1047	400.09	13.89
		Reading Scale Score	1047	407.11	7.27
	District Level	% F/R Lunch	255	39.42	19.16
		Enrollment	255	3,948.06	6,316.13
7th Grade	**School Level**	% F/R Lunch	415	36.47	19.88
		spansize	415	180.97	115.12
		Math Scale Score	415	372.12	17.20
		Reading Scale Score	415	394.61	6.79
	District Level	% F/R Lunch	251	39.49	19.02
		Enrollment	251	4,000.75	6,652.37

Results

Model 1 – The Joint Effects of School Size and District Poverty on Achievement

Tables 3 and 4 summarize the data analyses for the joint effects of school size and district poverty on achievement as measured by the ITBS and the WASL. Table 3 reports the results of the data analysis for 3rd and 6th grade ITBS scores, and Table 4 presents the same for 4th and 7th grade WASL scores.

School Size and District Poverty – ITBS. The results for the 3rd grade ITBS scores indicate similar significant results for both reading and math. Not surprisingly, both reading and math scores reflect significant negative relationships with district poverty (*B*s = -0.255457 and -0.227119, *p*s < .001). However, there was no significant relationship between school size and achievement (reading and math scores). Both of these results are consistent with the results reported in the Georgia study and previous Washington State study. The results also indicate a significant interaction between school size and district poverty (*B*s = -0.002267 and -0.002538), *p*s < .001), which is consistent with the Georgia study but not with the previous Washington study.

The 6th grade ITBS results reported in the lower half of Table 3 are similar to those reported for the 3rd grade scores. Significant relationships between district poverty and school achievement was found for both reading and math (*B*s = -.258537 and -0.227119, *p*s < .001). As was the case with 3rd grade scores, no significant relationship was found between school size and the reading or math ITBS scores. The 6th grade data analysis results also found a significant interaction between school size and school poverty on both reading and math (*B* = -0.001611, *p*s < .000 and *B* = -0.001573, *p*s < .05), which is again similar to the Georgia study but not the previous Washington study.

Table 3. Summary of HLM Runs – Model 1 – Effects of School Size and District Poverty on Math and Reading Achievement in 3rd and 6th Grades (ITBS)

		B	*SE*	*t*	*df*	*p*-value
3rd Grade	**Reading**					
	Intercept	51.29	0.25	204.98	254	0.00
	School Size	-0.01	0.01	-0.56	254	0.57
	District Poverty	-0.26	0.01	-17.52	254	0.00
	SS x DP	-0.00	0.00	-4.07	254	0.00
	Math					
	Intercept	56.38	0.31	181.09	254	0.00
	School Size	.02	0.02	1.21	254	0.23
	District Poverty	-0.25	0.02	-13.42	254	0.00
	SS x DP	-.00	0.00	-3.83	254	0.00
6th Grade	**Reading**					
	Intercept	50.77	0.25	202.87	251	0.00
	School Size	-0.02	0.01	-1.18	251	0.24
	District Poverty	-0.26	0.01	-17.38	251	0.00
	SS x DP	-0.00	0.00	-2.44	251	0.00
	Math					
	Intercept	52.06	0.31	165.56	252	0.00
	School Size	-0.00	0.02	0.41	252	0.68
	District Poverty	-0.23	0.02	-12.55	252	0.00
	SS x DP	-0.00	0.00	-2.31	252	0.02

In order to further examine the significant interaction between school size and district poverty the relationships were plotted for districts in 25th percentile (light line) and 75th percentile (dark line) for poverty. The relationships between school size and district poverty are clearly evident in the plots that are presented in Figures 1 through 4. It appears from the plots in

Figures 1 through 4 that larger schools are more beneficial to achievement in districts with low levels of poverty and smaller schools are more beneficial in less affluent districts.

Figure 1. 3rd Grade Reading Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) – ITBS

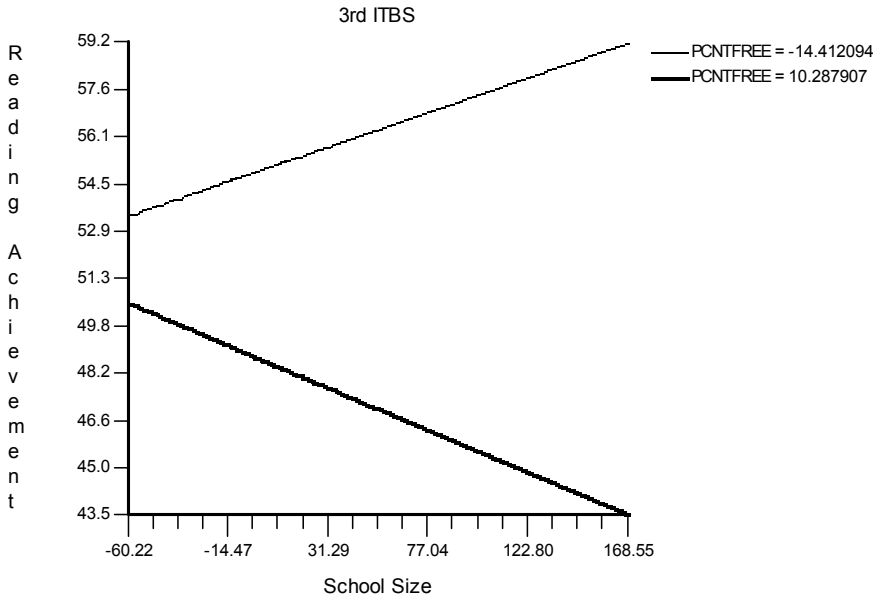


Figure 2. 3rd Grade Math Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) – ITBS

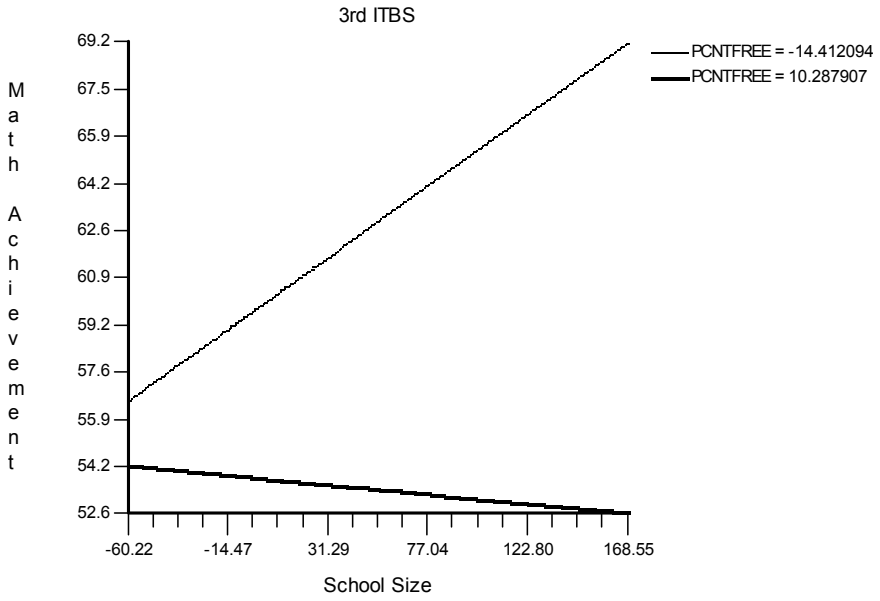


Figure 3. 6th Grade Reading Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) – ITBS

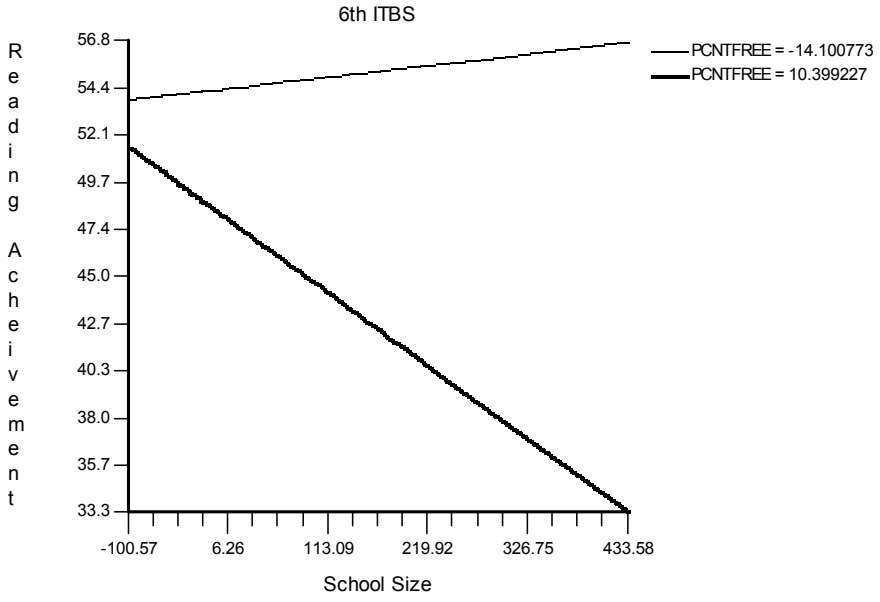
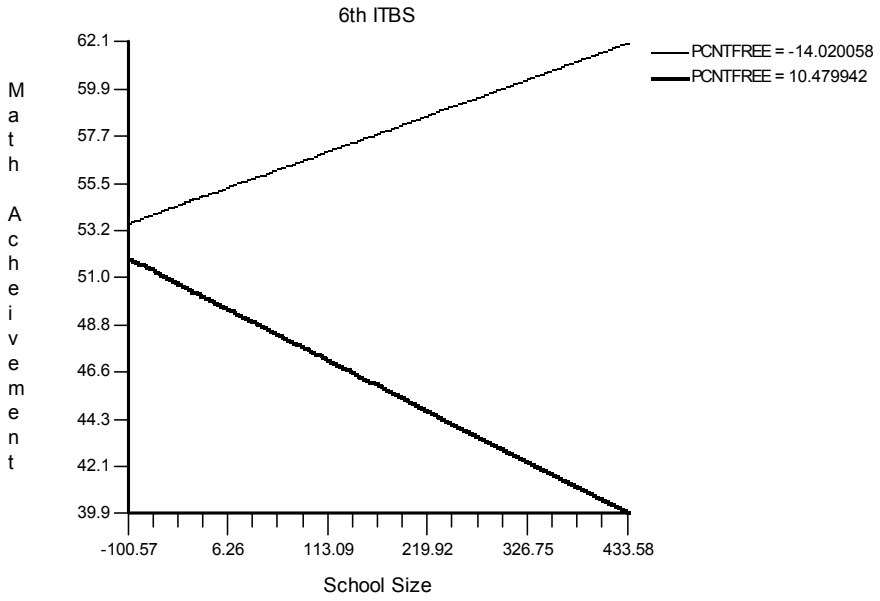


Figure 4. 6th Grade Math Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) – ITBS



School Size and District Poverty – WASL. Table 4 reports the results of the data analysis for 4th and 7th grade WASL scores. The results indicate significant relationships between district poverty and WASL scores in reading and math for both 4th grade (*B*s = -0.223201 and -0.362838, *p*s < .001) and 7th grade (*B*s = -0.226956 and -0.0550544, *p*s < .001). There was no significant association with school size for any of the 4th or 7th grade WASL scores in reading or math. Finally, the data analysis results for 4th and 7th grade WASL scores did not indicate a significant interaction between school size and district poverty on school achievement, which is consistent with the previous Washington study, but not with the Georgia study or the results reported for the 3rd and 6th grade ITBS scores reported earlier in this study.

Table 4. Summary of HLM Runs – Model 1 – Effects of School Size and District Poverty on Math and Reading Achievement in 4th and 7th Grades (WASL)

		B	*SE*	*t*	*df*	*p*-value
4th Grade	**Reading**					
	Intercept	405.81	0.25	1608.99	253	0.00
	School Size	0.01	0.01	0.64	253	0.52
	District Poverty	-0.22	0.02	-14.64	253	0.00
	SS x DP	-0.00	0.00	-0.92	253	0.36
	Math					
	Intercept	397.94	0.57	703.58	253	0.00
	School Size	0.03	0.02	1.15	253	0.25
	District Poverty	-0.36	0.03	-10.39	253	0.00
	SS x DP	-0.00	0.00	-1.40	253	0.16
7th Grade	**Reading**					
	Intercept	393.85	0.28	1396.02	249	0.00
	School Size	0.01	0.01	0.70	249	0.48
	District Poverty	-0.23	0.02	-14.78	249	0.00
	SS x DP	-0.00	0.00	-0.29	249	0.77
	Math					
	Intercept	370.16	0.73	504.80	249	0.00
	School Size	0.01	0.02	0.47	249	0.64
	District Poverty	-0.55	0.04	-13.37	249	0.00
	SS x DP	-0.00	0.00	-0.65	249	0.52

Even though the interactions were not significant, the relationship between school size and school achievement were still plotted for districts in the 25th percentile (light line) and 75th percentile (dark line) for school poverty. Figures 5 through 8 present these plots, which all suggest that the achievement gap between more and less affluent districts appear to be

reduced in smaller schools. However, the plots in Figures 5 through 8 also seem to indicate that while larger schools appear to be more beneficial to achievement in both affluent and less affluent districts, the benefit seems to be greater in more affluent districts.

Figure 5. 4th Grade Reading Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) –WASL

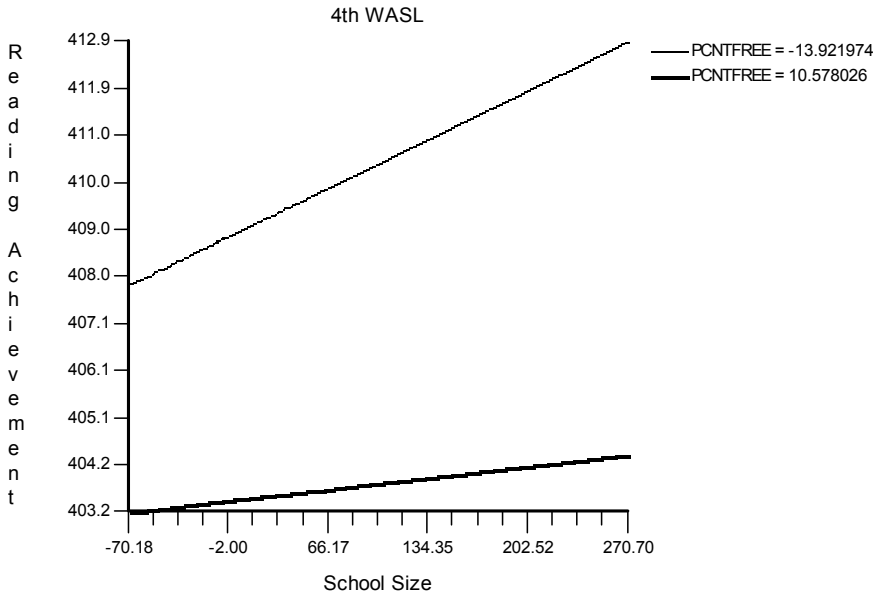


Figure 6. 4th Grade Math Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) –WASL

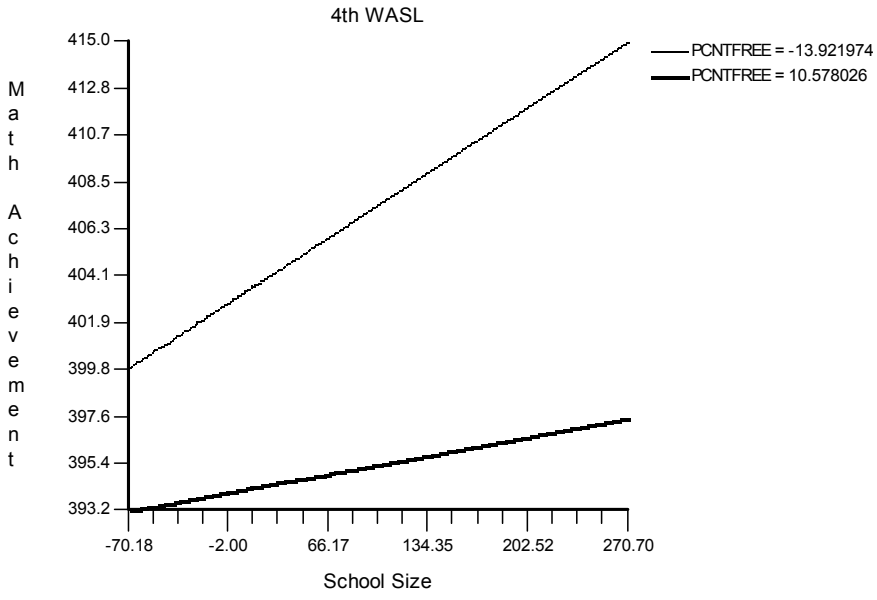


Figure 7. 7th Grade Reading Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) –WASL

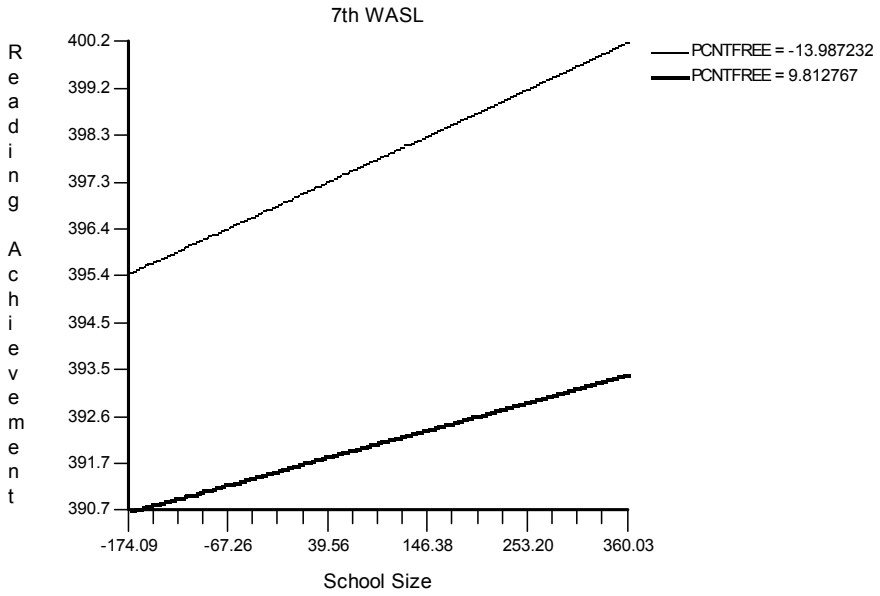
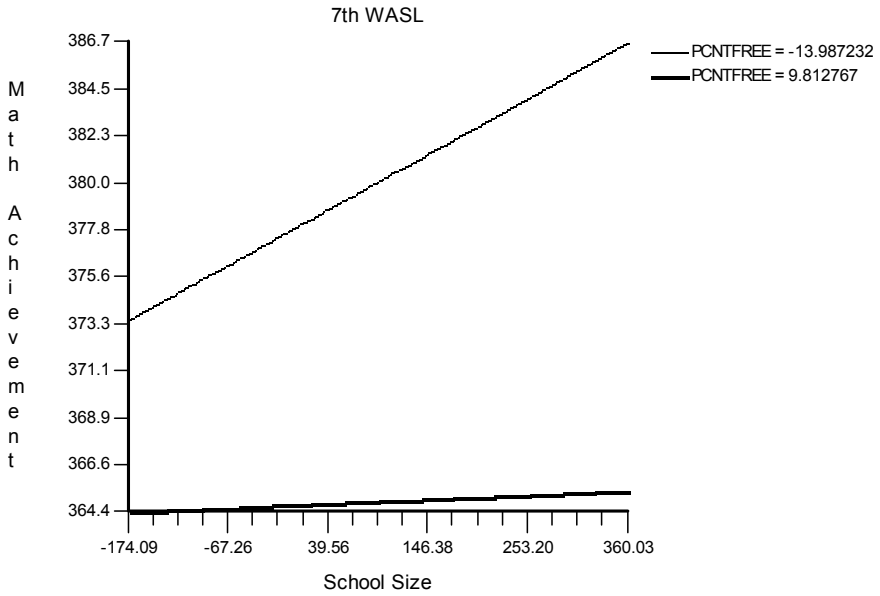


Figure 8. 7th Grade Math Achievement as a Function of School Size (Spansize) and District Poverty (25th and 75th Percentiles) –WASL



School Size and District Poverty – Summary. The results for model 1 data analysis replicate either the Georgia study or the previous Washington study depending on whether 3rd and 6th grade ITBS results or 4th and 7th grade WASL scores were used in the data analysis.

The main difference is that both the current study and the Georgia study found significant interaction between school size and district poverty on school achievement when using ITBS results, while both the current study and previous Washington study found no such interaction for the 4th and 7th grade WASL scores.

Model 2 – The Joint Effects of School Poverty and District Size Achievement

Tables 5 and 6 summarize the data analysis for the joint effects of school poverty and district size on achievement as measured by the ITBS and the WASL. Table 5 reports the results of the data analysis for 3rd and 6th grade ITBS scores and Table 6 presents the same for 4th and 7th grade WASL scores.

School Poverty and District Size – ITBS. The results presented in Table 5 indicate somewhat inconsistent results for the joint effects of school poverty and district size on reading and math achievement as measured by the ITBS. As expected school poverty is a significant (*p*s < .001) predictor of math and reading ITBS scores for both the 3rd and 6th grades. However, only the 3rd grade math scores show a significant relationship with district size (*p*s < .05). Significant (*p*s < .05) interaction effects for school poverty and district size are evident for 3rd grade reading and math scores and 6th grade reading scores. The interaction effects for 6th grade math scores were not significant, though marginally so. The pattern of significant interaction effects is similar to those for the 8th grade results in the Georgia study and those in the previous Washington study in which all of the interaction effects were significant.

Table 5. Summary of HLM Runs – Model 2 – Effects of School Poverty and District Size on Math and Reading Achievement in 3rd and 6th Grades (ITBS)

		B	*SE*	*t*	*df*	*p*-value
3rd Grade	**Reading**					
	Intercept	52.07	0.41	126.91	254	0.00
	School Poverty	-22.42	1.78	-12.57	254	0.00
	District Size	0.00	0.00	1.62	254	0.11
	SP x DS	-0.00	0.00	-3.34	254	0.00
	Math					
	Intercept	56.84	0.45	125.10	254	0.00
	School Poverty	-25.42	1.84	-13.78	254	0.00
	District Size	0.00	0.00	2.42	254	0.02
	SP x DS	-0.00	0.00	-3.18	254	0.00
6th Grade	**Reading**					
	Intercept	51.22	0.41	124.78	251	0.00
	School Poverty	-21.29	3.29	-6.47	251	0.00
	District Size	0.00	0.00	1.54	251	0.13
	SP x DS	-0.00	0.00	-2.56	251	0.01
	Math					
	Intercept	52.26	0.41	127.47	252	0.00
	School Poverty	-22.04	3.95	-5.57	252	0.00
	District Size	0.00	0.00	1.40	252	0.16
	SP x DS	-0.00	0.00	-1.89	252	0.06

Figures 9 through 12 present the plots for the relationship between school poverty and district size on achievement. All the plots suggest slightly higher achievement for larger schools (dark line) when poverty is lower. Additionally, reading scores for both the 3rd and 6th grade plots show a cross over so that it appears that smaller schools produce better results when

poverty levels are higher. While the plots for 3rd and 6th grade math achievement do not present the same cross over, the visual gap in the plots between larger and smaller districts is no longer evident for schools with higher levels of poverty.

Figure 9. 3rd Grade Reading Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–ITBS

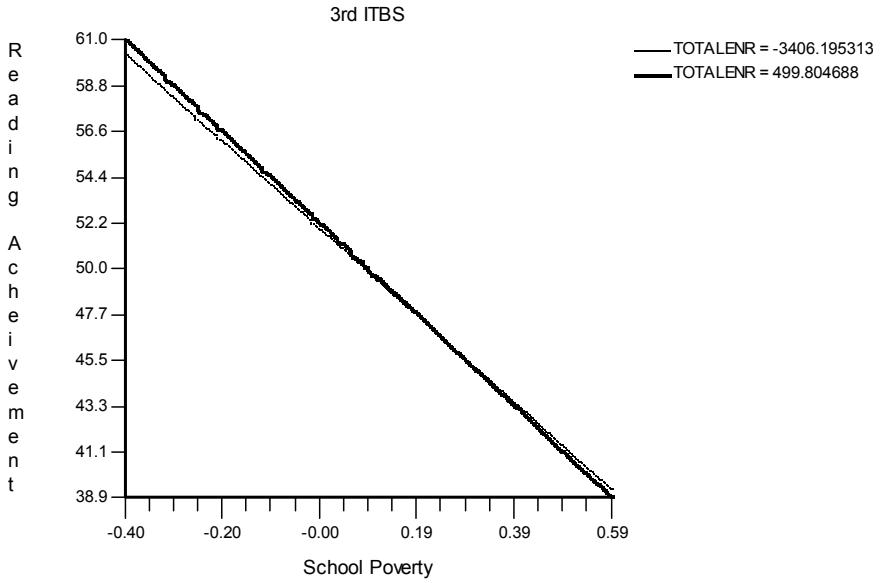


Figure 10. 3rd Grade Math Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–ITBS

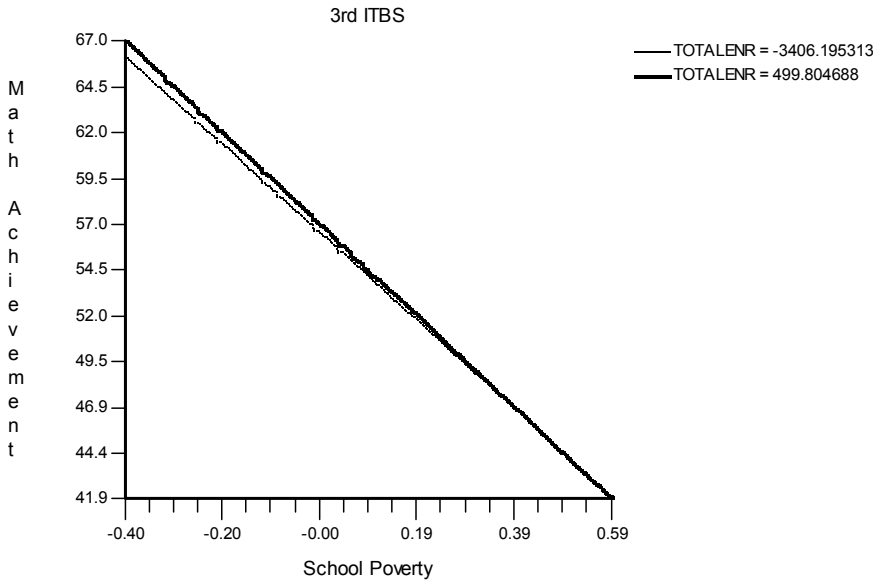


Figure 11. 6th Grade Reading Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–ITBS

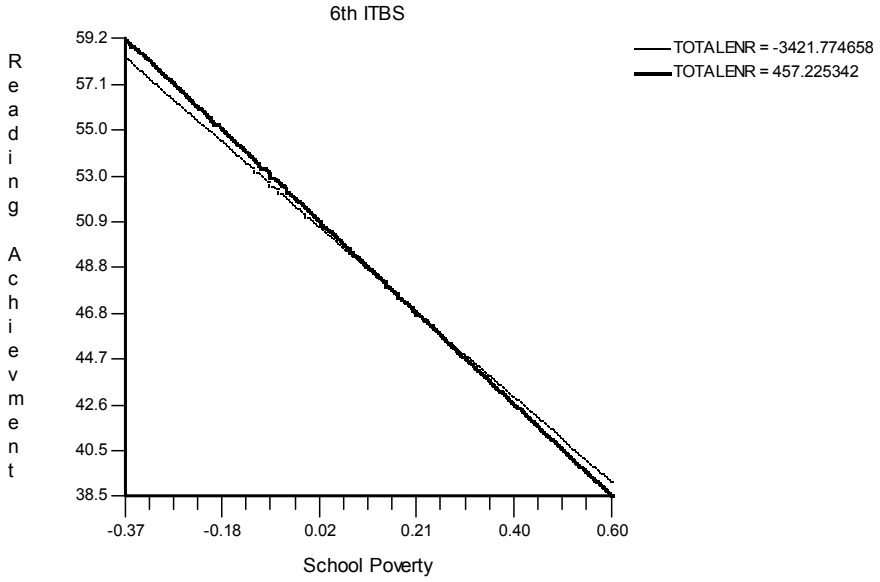
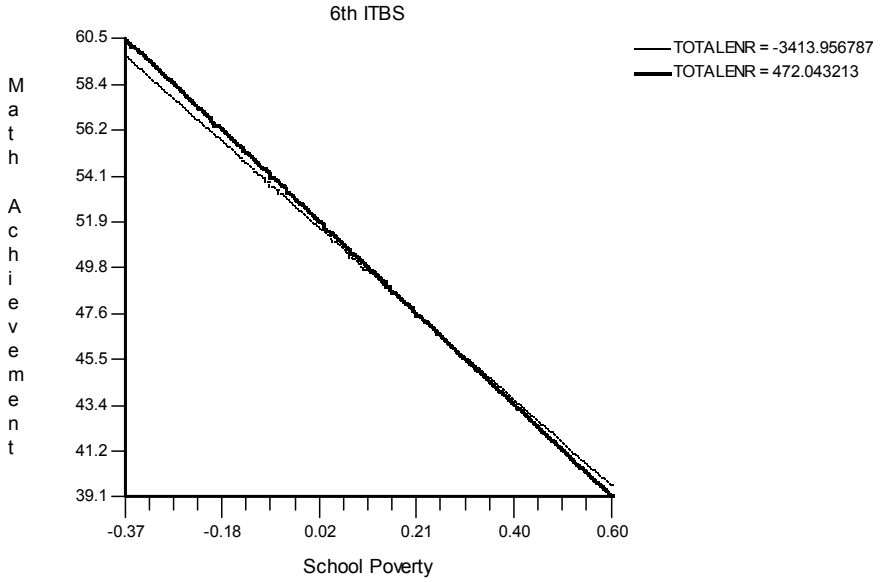


Figure 12. 6th Grade Math Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–ITBS



School Poverty and District Size – WASL. The data analysis results for the 4th and 7th grade WASL scores are summarized in Table 6. As was the case with the 3rd and 6th grade ITBS scores, school poverty was a significant predictor of achievement for reading and math achievement in both the 4th and 7th grades. Additionally, there was also a significant relationship between district size and reading and math achievement for the 4th grade (*p*s < .01) and 7th grade (*p*s < .05) WASL scores. However, the relationship for the interaction between school poverty and district size was significant only for 4th grade math (*p*s < .05). The lack of a significant interaction is not consistent with the previous Washington study in which all the 4th and 7th grade interactions were significant, or the Georgia study results which indicated significant interaction between school poverty and district size for 8th grade ITBS scores.

Table 6. Summary of HLM Runs – Model 2 – Effects of School Poverty and District Size on Math and Reading Achievement in 4th and 7th Grades (WASL)

		B	*SE*	*t*	*df*	*p*-value
4th Grade	**Reading**					
	Intercept	405.95	0.39	1040.31	253	0.00
	School Poverty	-19.14	1.92	-9.99	253	0.00
	District Size	0.00	0.00	2.81	243	0.01
	SP x DS	-0.00	0.00	-1.90	253	0.06
	Math					
	Intercept	398.08	0.76	520.82	253	0.00
	School Poverty	-28.03	4.17	-6.72	253	0.00
	District Size	0.00	0.00	2.56	253	0.01
	SP x DS	-0.00	0.00	-2.26	253	0.02
7th Grade	**Reading**					
	Intercept	394.02	0.40	983.55	249	0.00
	School Poverty	-30.23	5.71	-5.29	249	0.00
	District Size	0.00	0.00	1.99	249	0.05
	SP x DS	-0.00	0.00	-0.01	249	0.99
	Math					
	Intercept	370.31	.99	372.55	249	0.00
	School Poverty	-64.66	13.82	-4.78	249	0.00
	District Size	0.00	0.00	2.31	249	0.02
	SP x DS	-0.00	0.00	-0.79	249	0.43

Though only 4th grade math interaction between school poverty and district size was significant, an examination of the plots in Figures 13 through 16 suggest that larger schools have higher levels of achievement for larger districts when school poverty is low for 4th grade

reading and math, and 7th grade math. The plot for 7th grade reading does not show any benefit for smaller or larger districts for either lower or higher poverty schools.

Figure 13. 4th Grade Math Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–WASL

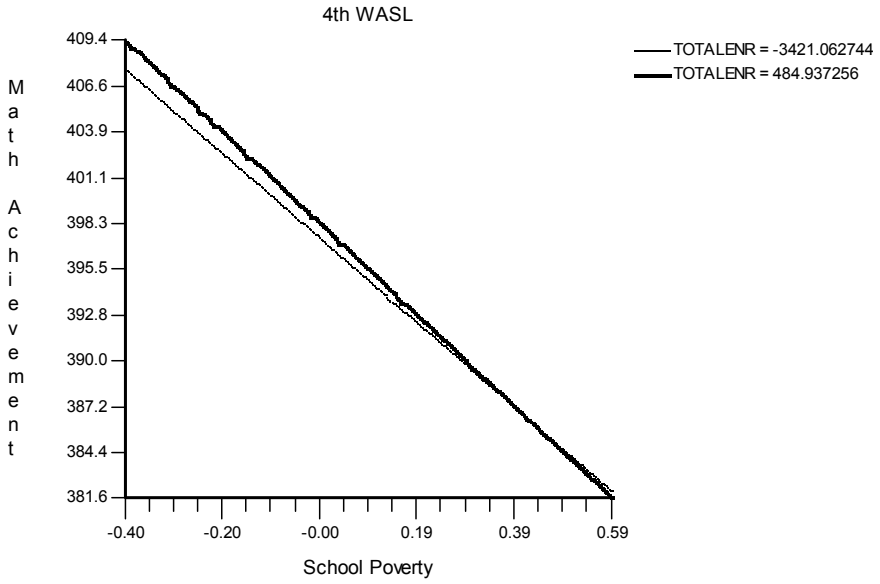


Figure 14. 4th Grade Math Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–WASL

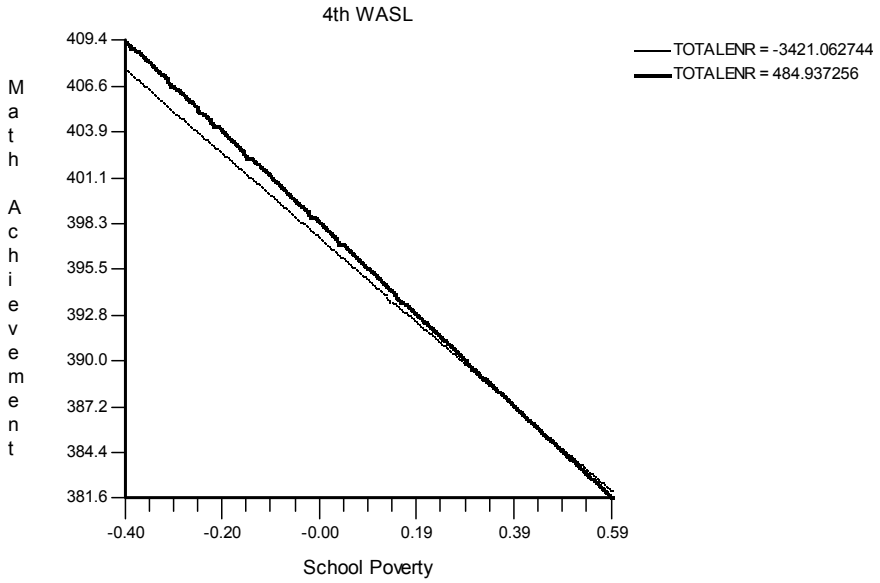


Figure 15. 7th Grade Reading Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–WASL

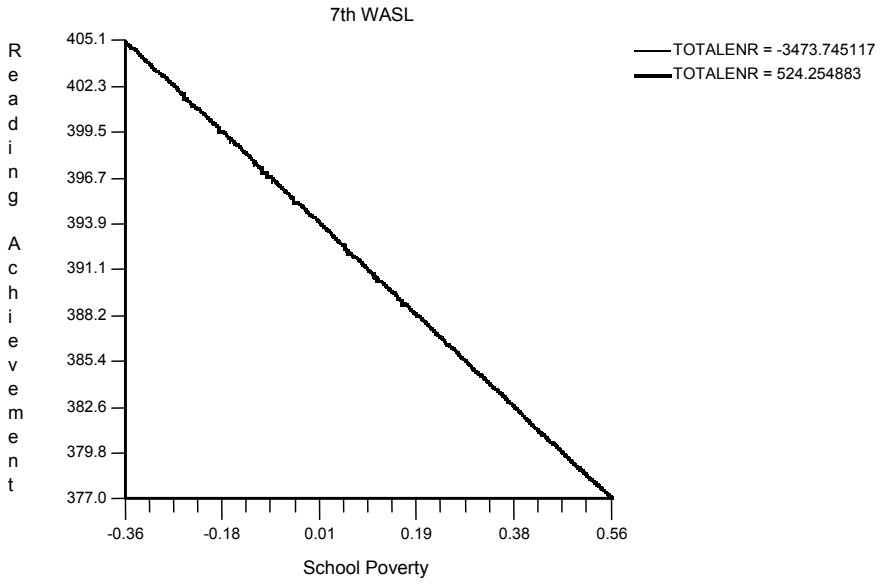
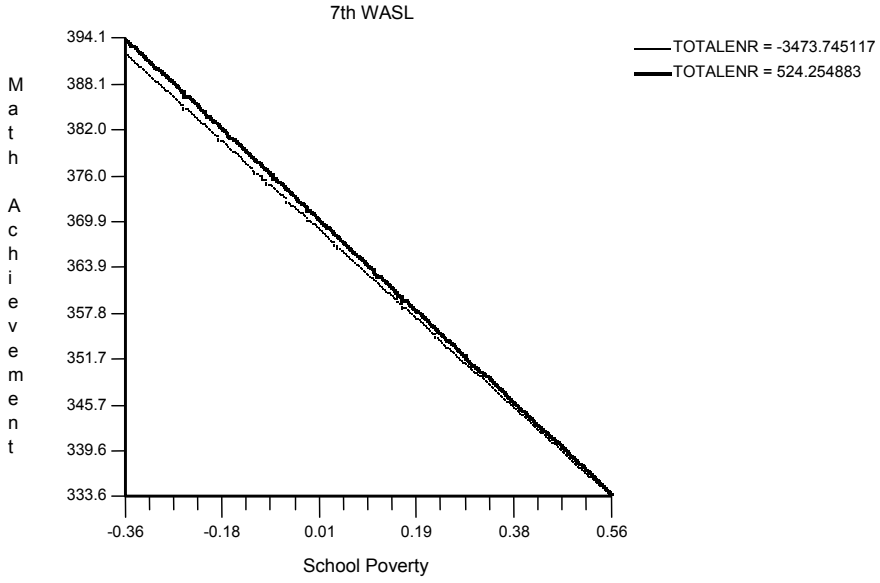


Figure 16. 7th Grade Math Achievement as a Function of School Poverty and District Size (25th and 75th Percentiles)–WASL



School Poverty and District Size – Summary. The results for model 2 data analysis partially replicate both the Georgia study and the previous Washington study depending on whether 3rd and 6th grade ITBS results or 4th and 7th grade WASL scores were used in the data analysis. The main difference is that both the current study and the Georgia study found significant interaction between school size and district poverty on school achievement when using the ITBS. However, though both the current Washington and previous Washington study used WASL scores, the HLM results in the current study did not replicate the finding of the previous study (which did replicate the finding of the Georgia study that there was a significant interaction between school poverty and district size).

Multi-Level Equity Effects

Both the Georgia study and previous Washington study examined equity effects by calculating and reporting squared Pearson correlations (r^2) between achievement (reading and math) and poverty (SES) for four school and district size combinations. The method for exploring these equity effects involved the use of median splits to assign each school to one of four categories; large schools in large districts, small schools in large districts, large schools in small districts, and small schools in small districts. Pearson correlations were then calculated between math and reading achievement, and school poverty as measured by the percentage of students eligible for the federal Free and Reduced lunch program. The correlations were then squared in order to explain the percent of variance in achievement associated with school poverty for each of the four categories.

This procedure produced similar results for both the Georgia study and the previous Washington study in that small schools in small districts consistently had the smallest percent of variance that could be accounted for by poverty. This suggests that the greatest opportunity for achievement equity occurs when students are educated in smaller schools in smaller districts.

The method for examining equity effects was replicated in this study with the 3rd and 6th grade ITBS scores, and the 4th and 7th grade WASL scores (Table 7). The findings were similar to both previous studies in that small schools in small districts consistently showed the smallest amount of variance in achievement (.12 to .40) that was related to poverty. Additionally, the results are similar to the Georgia study since in all but one case the largest amount of variance associated with poverty occurred in large schools in large districts (40% to 70%). The previous Washington study did not find the largest amount of variance to be consistently associated with large schools in large districts. However, the findings for the 7th grade WASL scores are consistent with both studies in that the largest amount of variance was associated with large districts (small or large schools).

Table 7. The Percentage of Achievement Explained by School Poverty as a Function of District and School Size: Multi-Level Equity Effects

3rd Grade NCE Scores—ITBS[1]											
Reading		District				Math		District			
		Large		Small				Large		Small	
		r^2	n	r^2	n			r^2	n	r^2	n
Grade Span	Large	.68	496	.64	26	Grade Span	Large	.56	496	.46	26
	Small	.61	412	.30	108		Small	.45	412	.12	108
4th Grade Scale Scores—WASL[2]											
Reading		District				Math		District			
		Large		Small				Large		Small	
		r^2	n	r^2	n			r^2	n	r^2	n
Grade Span	Large	.51	497	.53	26	Grade Span	Large	.40	497	.32	26
	Small	.49	415	.19	109		Small	.36	415	.08	109
6th Grade NCE Scores—ITBS[3]											
Reading		District				Math		District			
		Large		Small				Large		Small	
		r^2	n	r^2	n			r^2	n	r^2	n
Grade Span	Large	.70	317	.56	29	Grade Span	Large	.51	319	.36	29
	Small	.52	245	.40	104		Small	.41	243	.22	105
7th Grade Scale Scores—WASL[4]											
Reading		District				Math		District			
		Large		Small				Large		Small	
		r^2	n	r^2	n			r^2	n	r^2	n
Grade Span	Large	.65	207	-	0	Grade Span	Large	.60	207	-	0
	Small	.54	81	.29	127		Small	.46	81	.26	127

[1] Median Splits: District = 1395; Span Size = 68.1
[2] Median Splits: District = 1407; Span Size = 76.5
[3] Median Splits: District = 1418.5 (math), 1430 (read); Span Size = 77 (math), 77.1 (read)
[4] Median Splits: District = 1444; Span Size = 190

In summary, the results of the current equity analysis consistently indicates that the smallest amount of variance associated with poverty occurs in small schools in small districts, and the largest amount of variance in achievement associated with poverty occurs in large schools in large districts. Taken together with the previous results reported in Tables 3-6, and the plots in Figures 1-16, it would appear that small schools in small districts results in the greatest equity between low and high poverty schools. However, as will be discussed later, low poverty schools still appear to benefit from larger schools in larger districts.

Discussion and Conclusions

The current study replicated the methods of the Georgia study and the previous Washington study, which sought to find the joint effects of school size, district size, and SES on school achievement. The results of the study indicated a significant interaction between school size and district poverty when ITBS scores were used in the analyses. That is, larger schools were more beneficial in more affluent districts while smaller schools were more beneficial in less affluent districts. This replicated the findings of the Georgia study in which ITBS scores were also used. However, a failure to find a significant interaction between school size and district poverty for the WASL scores used in this study was consistent with the previous Washington state study, which also used WASL scores.

Clearly, the ability to replicate the initial findings in the Georgia study indicating a significant joint effect of school size and district poverty is largely dependent on whether ITBS or WASL scores were used in the analysis. This is consistent with the findings of Joireman and Abbott (2001) in which the ITBS and WASL had different correlations with school poverty. Additionally, the plots for school size and district poverty suggest that while it is not clear whether or not smaller schools are beneficial for less affluent districts, both the ITBS and WASL plots indicate that as schools get larger the gap in achievement between less affluent and more affluent districts grows larger.

Generally, the current study did not replicate the findings of both the Georgia and Washington State studies, which indicated that larger districts increased the negative relationship between school poverty and achievement. Though only one of the WASL results (4^{th} grade math) showed a significant interaction between school poverty and district size, the results for the 3^{rd} and 6^{th} grade ITBS scores replicated the earlier finding of both the previous Washington and Georgia studies that district size does make a difference. The difference in

these findings is a bit puzzling, but may be due to the increase in WASL scores from 2001 to 2002, among other factors.

The “equity effects” findings in the current study replicated the findings of the Georgia and previous Washington State study. As was the case in the previous studies, the smallest percentage of variance explained by poverty was for small schools in small districts, while the largest percentage of explainable variance usually occurred in large schools in large districts. These results support the notion that small schools in small districts are the most beneficial for less affluent students while large schools in large districts are the most detrimental to achievement.

The results of the current study taken together with those reported earlier for the Georgia and initial Washington study suggest that while there does seem to be a relationship between the joint effects of school size, district size, and SES, that relationship is a complicated one. However, it would be inadvisable for educators to conclude that simply changing school size and district configurations will result in more equitable achievement for lower SES students. The results of this and previous studies should encourage researchers to look more closely at those factors that make a difference.

Though regression formulas such as the HLM procedure used in this study can help identify patterns of relationships, they are not helpful for explaining the reasons for those same relationships. Future research should attempt to identify and examine those factors which might help educators better understand why low SES students do better in small schools in small districts, and less well in larger schools, particularly large schools in large districts. For example, is there a difference in teacher behaviors for small schools in small districts when compared those in large schools in large districts? Other possible factors that could be explored are differences in interpersonal relationships, greater opportunity for participation in extracurricular activities, teacher experience, community characteristics, financial resources, or any other combination of these or other factors. Any policy change in school practice related to school and

district size needs to be based on a clearer understanding of those factors that explain the differential results for lower SES students.

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