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## The Relationship Between School Poverty and Student Achievement in Maine.

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# **The Relationships Between School Poverty and Student Achievement in Maine**



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## Executive Summary

The goal of this study was to examine the relationships between school level poverty found in Maine schools and student academic performance. The evidence clearly shows that there is a relationship. As the percent of poverty increases in a school, student performance declines. But the poverty level alone does not explain the wide variations in performance found across the state. The level of poverty in a school is the single best predictor of average student performance, but other factors also play a role in influencing student achievement. Some of these factors include the type of school students are enrolled in, years of teaching experience of the school staff, and the education levels of teachers. Evidence was also found for some higher poverty schools that were defying the odds. Even with higher levels of poverty in their schools, these schools were successful in producing higher levels of student performance.

Two additional characteristics were discovered for student performance in higher poverty schools. First, overall performance differs in K-8 and middle schools. The negative relationship between poverty levels and performance is weaker for K-8 schools. More of the higher poverty K-8 schools are performing better than higher poverty middle schools.

Second, the levels of poverty found in schools not only affected children in poverty but also those not in poverty. Students in higher poverty schools who do not qualify for free or reduced lunches do not perform as well as their cohorts in lower poverty schools. What is unclear are the causes of this lower performance of non-poverty children in higher poverty schools.

Without question, the evidence examined in this study indicates that levels of school poverty and average student achievement are related. The magnitude of the relationship varies, and other factors are related to poverty and achievement, but the single best predictor of performance is school poverty level. The bright news is that there are schools at all levels that defy the odds. Student achievement is better than predicted in spite of school poverty levels. These schools may provide good models for other schools to emulate. In addition, the evidence from this study indicates that there is more to learn about the performance of some types of school configurations (i.e., K-8 schools) and the performance of non-poverty children in higher poverty schools.

# **The Relationships Between Poverty and Student Achievement in Maine Schools**

Maine Education Policy  
Research Institute

University of Southern  
Maine

## **Overview**

What are the relationships between poverty in Maine schools and student academic performance? Do students in higher poverty schools perform poorly on state achievement tests? Is there any connection between Maine's new A-F school grading system and poverty? Are there other factors that are related to poverty and student performance?

At the request of the Joint Standing Committee on Education and Cultural Affairs of the Maine Legislature, the Maine Education Policy Research Institute (MEPRI) has conducted an analysis of poverty and achievement in Maine. MEPRI is a non-partisan research institute funded jointly by the Maine legislature and the University of Maine System, and charged with conducting policy research at the request of the Legislature.

This **Brief** presents the findings from a series of analyses designed to explore the connections between poverty and student achievement in Maine schools. It explores how poverty and performance are related, and examines other school and student characteristics that may be connected to student performance.

## **Background**

***If we do not find ways to reduce the growing inequality in education outcomes---between the rich and the poor---schools will no longer be the great equalizer we want them to be (p.10).***

This was the conclusion reached by one researcher (Reardon, 2013) after examining the income achievement gap in the United States over the last five decades. The income achievement gap refers to the disparity in student achievement between children coming from higher income families and children in lower income families. Historically children from higher income households have scored better on standardized tests than students coming from less affluent households. The gap in performance has existed for decades and

little progress has been made in closing the gap. In fact, the evidence indicates that the gap has only become wider.

After examining the relationship between student performance and family income over the past 50 years, Reardon (2013) found that:

*Among children born in the 1950s, 1960s, and early 1970s, the reading achievement gap between those from high-income families (at the 90th percentile of the income distribution) and those from low-income families (at the 10th percentile) was about 0.9 of a standard deviation. ... [T]his gap began to widen beginning with the cohorts born in the mid-1970s. Among those born 20–25 years later, the gap in standardized test scores was roughly 1.25 standard deviations—40 percent larger than the gap several decades earlier (p.10).*

Further, one in five children in the United States are from households below the poverty line, and among the most developed nations in the world the United States ranks *second highest* in child poverty (UNICEF, 2012).

The effects of the widening income achievement gap and poverty are well documented. Considerable research has been conducted over the years in attempts to understand the causes of the gap and its effects on students. A concise synopsis of the research findings has been compiled by the Tauck Family Foundation (2013).

The Foundation reported that researchers have found:

1. Children from low-income households entering kindergarten and first grade are already significantly behind their more affluent peers in terms of academic knowledge, and cognitive and social skills.
2. Third graders who both live in poverty and read below grade level are three times more likely to drop out of high school than students who have never been poor.
3. Fourth graders from low-income families are likely to be academically three years behind their peers from affluent families.
4. Sixth graders in high-poverty schools who fail math or English or receive an unsatisfactory behavior grade have a 75% chance of dropping out of high school.
5. Students in low-performing schools are five times more likely to drop out of high school than their peers from high-performing schools.
6. High school seniors from low-income families are, on average, four years behind their higher-income peers.

7. Only one out of two students from low-income families graduate high school.
8. Nationally, only 33% of high school students from low-income households go to college and only 8% will complete a degree within six years of matriculation.

This is just a representative sample of the findings of the relationship between poverty and student achievement. Over the years it has become clearer and clearer that the two are connected in some fashion, and that the effects are far reaching. What about here in Maine? How are the two connected? What are the effects on student learning? Do other factors contribute to the gap?

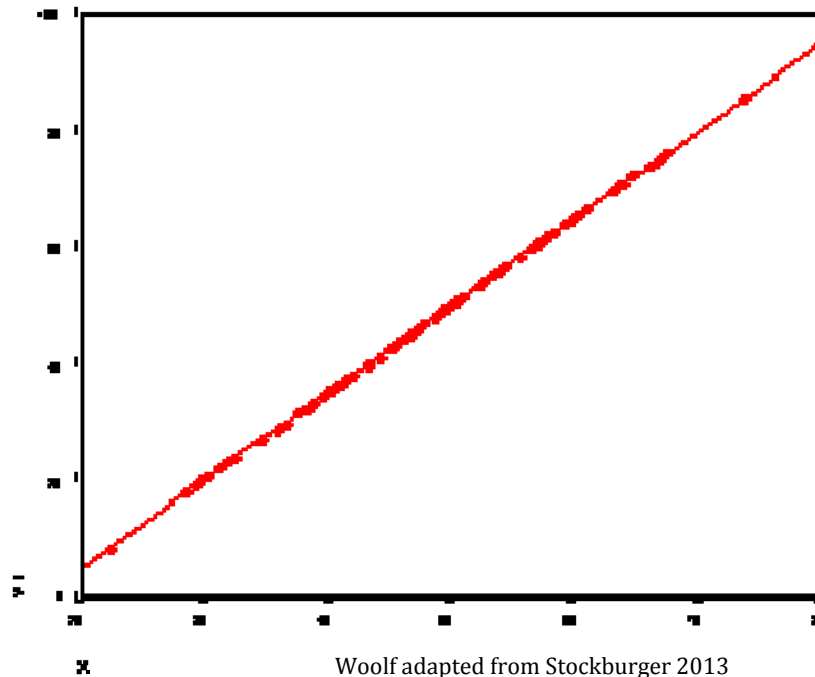
One of the most helpful ways to examine the relationship between poverty and student achievement is to use a standard statistical tool specifically designed to create a coefficient representing the degree of the relationship between two or more variables. This is called a Correlation Coefficient. In the case of Maine, the correlation coefficient would represent the degree of relationship between poverty, as measured by the percent of students in a school who qualify for the free or reduced lunch program, and average student performance on the New England Common Assessment Program (NECAP), a standardized mathematics and reading achievement test administered yearly in Maine, Vermont, and New Hampshire.

A correlation coefficient may range from -1.00 to +1.00, with values closer to 1.00 representing stronger relationships, and values closer to 0 representing little or no relationships between variables. The signs (+ or -) depict the direction of the relationship. A plus (+) value indicates that as one variable increases the other variable also increases. For example, as the temperature increases, ice cream sales increase. A minus (-) value indicates the opposite; as one variable increases the other variable decreases. As the temperature decreases, heating bills increase.

Figure 1 depicts what is called a perfect positive relationship (i.e., the correlation coefficient= +1.00). If this represented the relationship between warmer weather and ice cream sales, and each dot representing a specific temperature and sales level, then all the dots would end up in a straight line. In this case, if one knew the exact temperature one could predict the exact amount of ice cream sales and be accurate in the prediction 100% of the time.



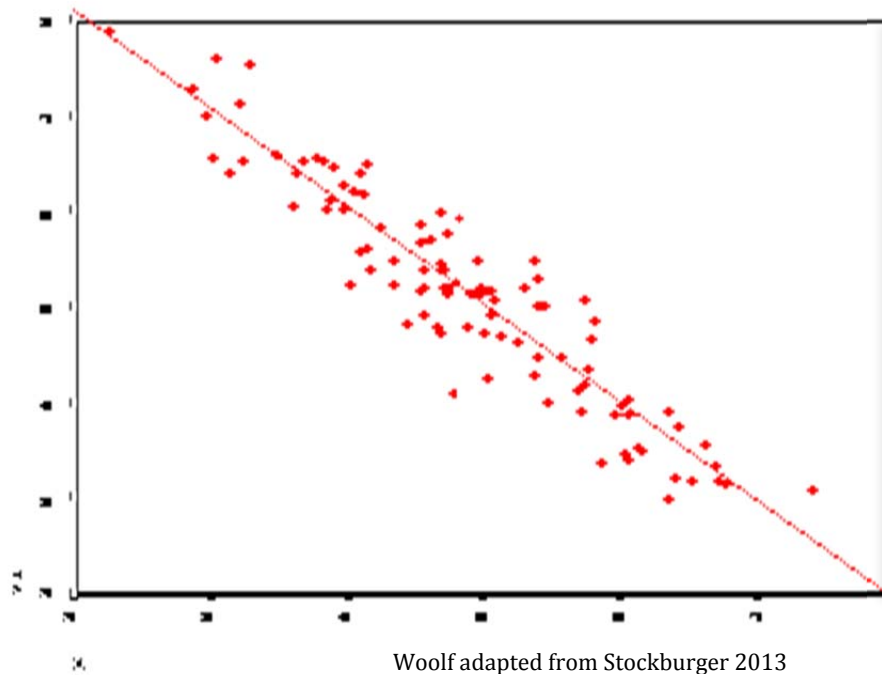
**Figure 1: Perfect Positive Correlation (+1.00)**



In reality, few situations result in perfect relationships (i.e., a correlation coefficient=1.00). Each increase in degrees of heat does not always translate into equal increases in ice cream sales. For example, if one were to graph the relationship temperature declines and increased heating bills, one would find a negative relationship, one that is almost perfect, but in some cases the colder weather might not always result in higher heating bills. This relationship might look like that in Figure 2, where a majority of the dots fall in a straight line, but not all of them. The straight line is called the “line of best fit”, a line closest to the most dots.

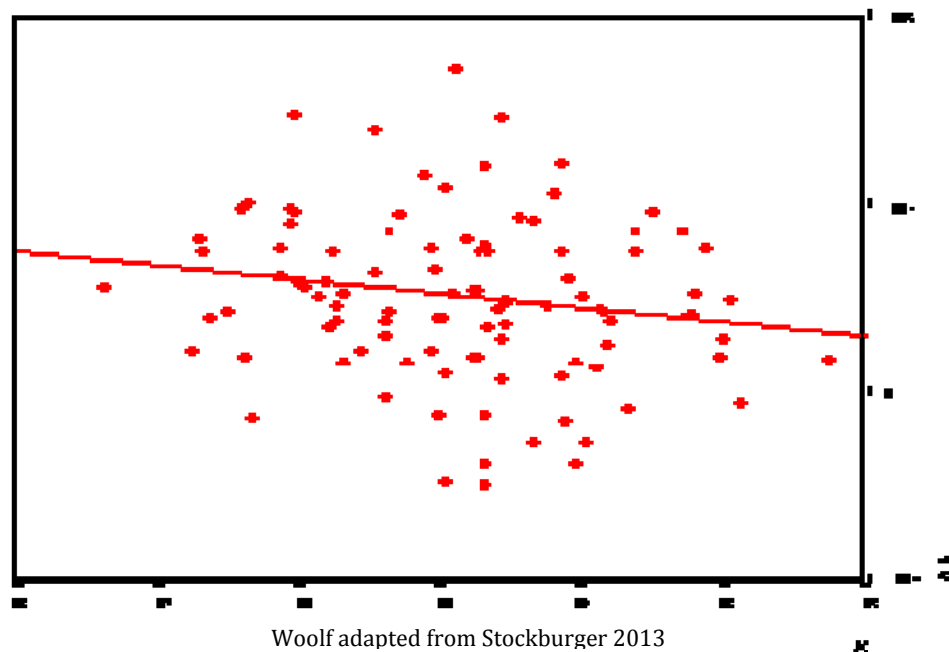
The line of best fit represents the prediction line. As may be seen from the figure, predicting heating bills from the temperature would not always result in a correct prediction (i.e., sometimes the actual intersection of the two variables would produce a dot not on the line). How accurate would the prediction be in this case? The equation for determining this would produce a degree of accuracy equal to 90% ( $\text{Accuracy} = -.95^2 \times 100\%$ ). In statistical language this means that 90% of the variance in heating bills may be explained by the colder temperatures.

**Figure 2: Very High Negative Correlation (-0.95)**



If there were little or no relationship between two variables the graph might look like Figure 3. In this case, predicting one variable from the other is virtually impossible and almost always inaccurate because only 6% of the variance is explained.

**Figure 3: Small Negative Correlation Coefficient (-.25)**

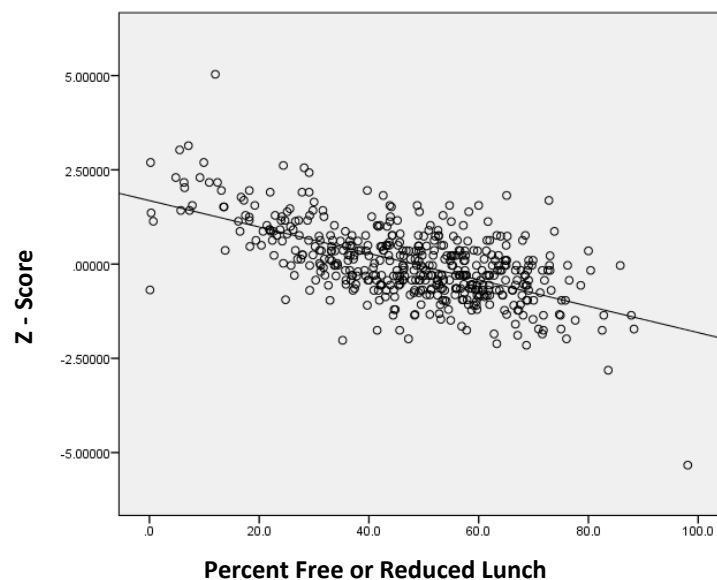


## Findings

Given this brief overview of correlations, what are the correlations between school poverty levels and student performance in Maine? Figure 4 reports the correlation found between these two variables when all Maine schools (elementary, K-8, middle, and high school) are included. The vertical line represents student performance in terms of z-scores, a method for creating equivalent scores across multiple grade levels. The horizontal line represents the percent of pupils who qualify for free or reduced lunches in each school.

Several pieces of important information are shown in Figure 4. First, the “line of best fit” slopes down from left to right in the figure. This means that there is a negative relationship between poverty and achievement in Maine schools. As poverty levels increase in a school, student achievement goes down. Second, the correlation coefficient represented in the graph is  $-.5874$ . This correlation coefficient is considered to be a moderate one, meaning that in a majority of cases, as the poverty level increases,

**Figure 4: Correlation Between Poverty and Achievement For All Schools**



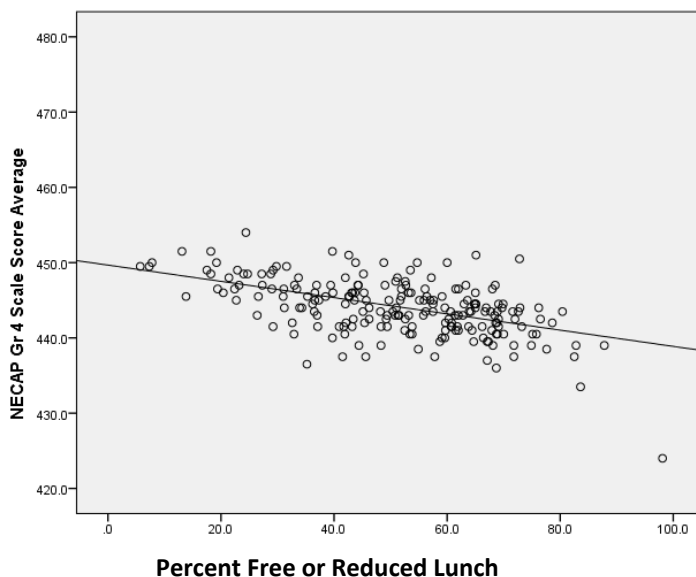
decreased. But this is not true in all cases. In fact, if one tried to predict the achievement level for a school only knowing the poverty level in that school, one would only be correct 35% of the time ( $\text{Accuracy} = -.5874^2 \times 100\%$ ). In essence only 35 percent of the variance or difference in student performance among the schools is accounted for by the poverty level in the schools. Other variables, in addition to poverty, play an important role in explaining

differences in student achievement.

Third, some schools with similar poverty levels to other schools are faring better than others. Schools denoted by dots above the prediction line are schools in which student performance is better than predicted given their poverty levels. Other schools with similar poverty levels are doing worse than predicted. These are schools denoted by dots below the prediction line. Thus, when all Maine schools are considered, there is a moderate negative correlation between poverty levels and student performance. As poverty levels increase performance decreases. But this is not always true. Other factors influence achievement and some schools are even doing better than predicted given their poverty levels.

However, while in the aggregate the relationship between poverty levels and student performance is only moderate, the picture is somewhat different at each of the elementary, middle school and high school levels. Figures 5 - 7 show these three school level relationships. First, a review of these reveals that the relationship is always negative

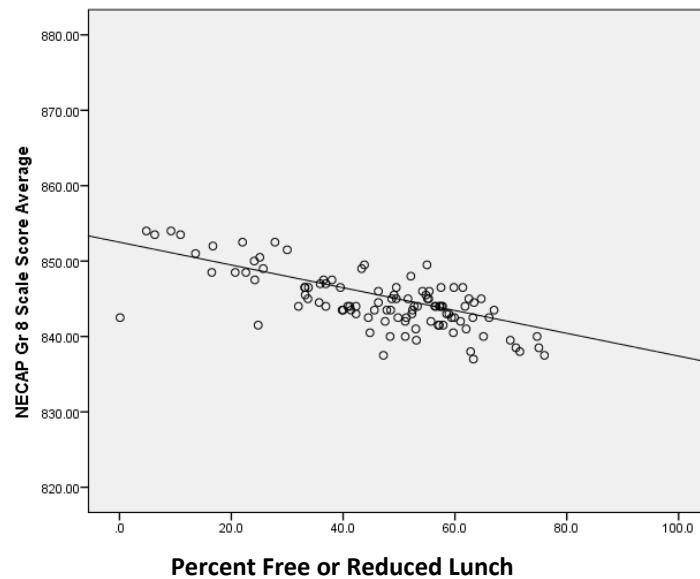
**Figure 5: Correlation of -0.49 Between Poverty and Achievement for K-5 Schools**



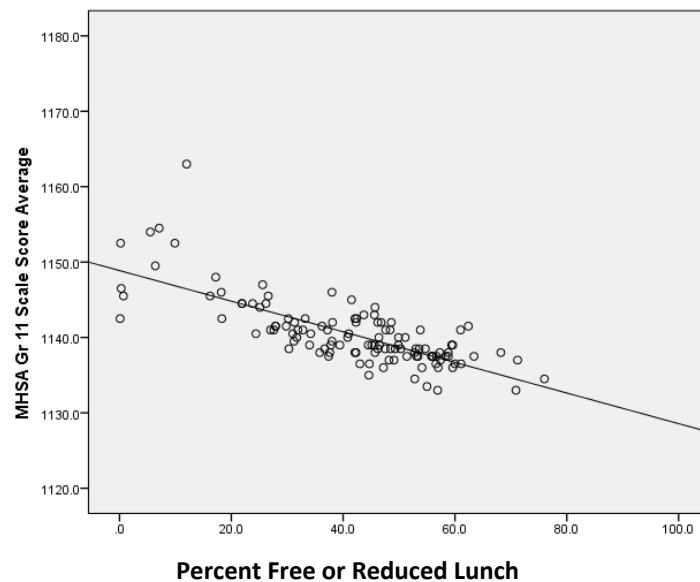
at each school level. As poverty levels go up, performance goes down. Second, and at each school level, some schools are doing better than predicted and some worse. Some schools are represented by dots above the prediction line, while other schools are below the line. Third, the relationships between poverty levels and performance become stronger with

each school level.

**Figure 6: Correlation of -0.64 Between Poverty and Achievement for Middle Schools**



**Figure 7: Correlation of -0.79 Between Poverty and Student Achievement for High Schools**



The correlation coefficients for the three school grade levels appear in Table 1. The correlation goes from -.493 at the elementary level to -.637 in middle schools and to -.790 in high schools. The  $R^2$  column reports the prediction accuracy value. The prediction accuracy is only about 25% at the elementary level, but increases to a little over 60% at the high school level. These correlations are a strong indicator that the impacts of poverty are

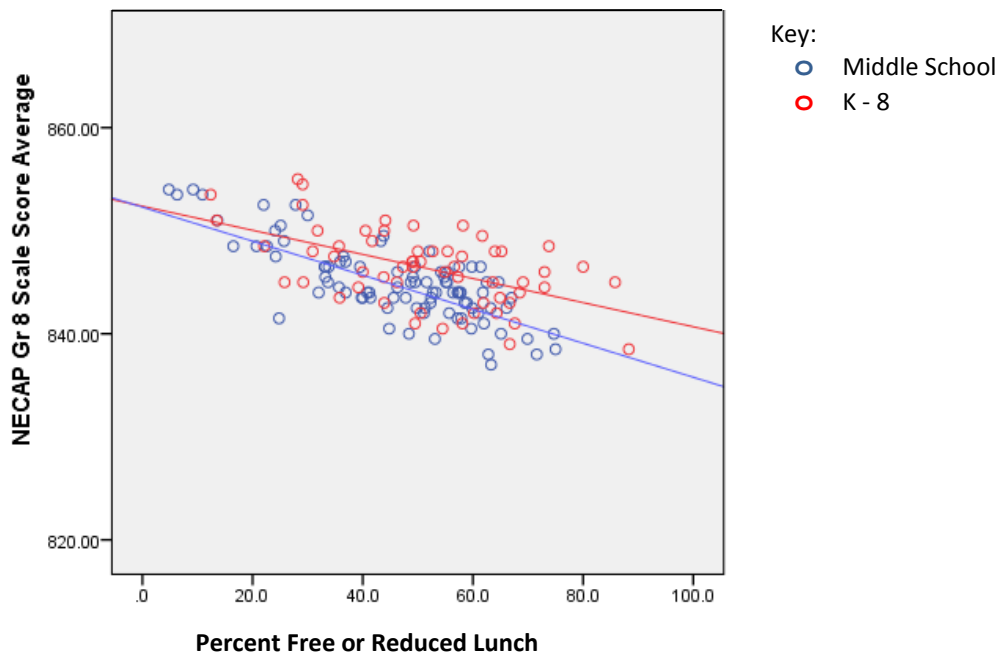
**Table 1. Increasing Strength of Relation Between Poverty and Performance in Higher Grades**

	Correlation with Free & Reduced Lunch Percentage	R <sup>2</sup>
Grade 4 NECAP	-.493	.243
Grade 8 NECAP	-.637	.405
Grade 11 MHSA	-.790	.624

stronger at higher grade levels, and in all likelihood, that the effects of poverty are cumulative. School poverty levels and performance are more strongly related at each increase in school level.

A secondary analysis of the 8<sup>th</sup> grade performance surfaced an important distinction between K-8 schools and middle schools. Figure 8 presents the data for both K-8 schools and middle schools. The red dots and red prediction line are for K-8 schools and the blue

**Figure 8. K – 8 and Middle School Poverty and Achievement**



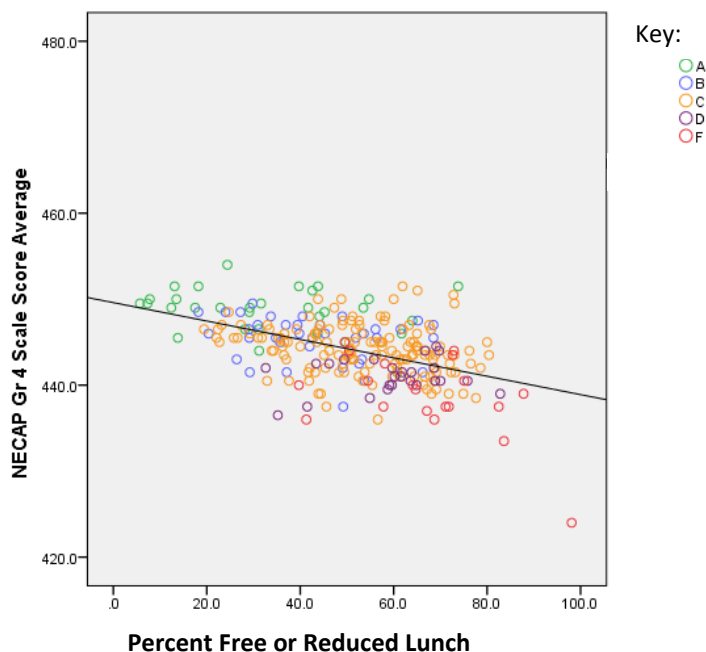
dots and blue line represent middle schools. Both types of these schools include grades 8 but as may be seen in the figure, 8<sup>th</sup> graders in K-8 schools overall scored better than their peers in middle schools, and a higher percent of the K-8 schools performed better than predicted (i.e., schools that ended up above the prediction line). What is particularly

noteworthy here is the fact that K-8 schools and middle schools have similar poverty rates, 51% and 47% respectively. Thus, it appears that the connection between poverty and 8<sup>th</sup> grade performance is somewhat weaker in K-8 schools in comparison to the middle schools. As shown in Table 1 above, the correlation coefficient at the middle school level is  $-.637$  while the coefficient at the K-8 schools is  $-.542$ . Student achievement in these K-8 schools is slightly less related to the school poverty level than in middle schools.

Turning for a moment to Maine's new school grading system, the question becomes what are the connections between school poverty levels and school grades. In spring 2013 the Maine Department of Education released a new school grading system where grades of A-F were assigned to Maine schools depending upon the school's performance on the NECAP. Many were quick to point out the apparent relationship between the grade a school earned and their letter grade.

An analysis of the grading system completed for this study supports this contention, but also reveals that the relationship is more complex. Figure 9 plots each elementary school in terms of its poverty level and its assigned grade. Similar figures for the middle

**Figure 9. Grade 4 School Letter Grades**



school and high school levels appear in Appendix A. The color of each dot denotes the

school's grade in the new grading system. As may be seen in the figure, schools earning a letter grade of A (green) tend to be schools with lower levels of poverty (i.e., more clustered to the left in the figure) and schools earning grades of D (purple) and F (red) tend to be clustered to the right and representing higher poverty rates.

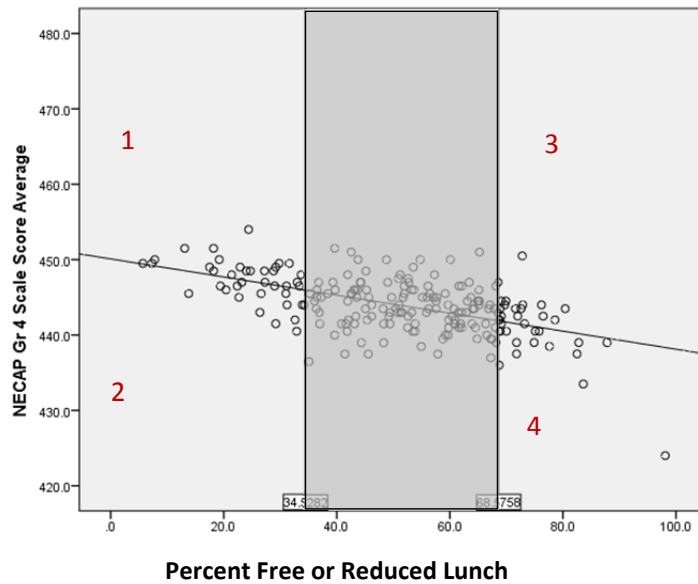
However, two other phenomena are important to point out from the figure. First, there are some schools that do not reflect the general pattern. In other words, some schools have lower poverty levels and still earned grades of C or D, and some schools have higher poverty levels but still earned grades of A or B. Second, some schools, regardless of their poverty levels are earning better grades than might be expected (i.e., they are above the line) and others are not earning grades as high as one might expect (i.e., they are below the line). These phenomena suggest that the current system might be more meaningful if poverty was factored in when assigning grades. But it also suggests that factors other than poverty may be playing key roles in determining school performance.

What are some of these other factors that may be related to school performance? The data used in this study were disaggregated further in order to determine the relationships between other selected variables and school performance. To accomplish this school poverty was examined at two levels. Lower and higher levels of poverty were defined as schools with poverty levels one standard deviation above and one standard deviation below the state average, a practice often used in research to more clearly isolate the effects of variables. School performance was also examined at two levels. Schools performing better or worse were defined as schools found above and below the prediction line.

Figure 10 shows these two levels of disaggregation visually for elementary schools. Similar figures for middle and high schools appear in Appendix B. The vertical lines inside the figure mark the poverty level standard deviation lines. Schools to the left of the 34.5 poverty line have average poverty levels at or below 34.5%. Schools to the right of the second vertical line are schools with 68.5% or higher poverty levels. As described in earlier figures, dots above the prediction line represent schools performing better than expected



**Figure 10: Profile of Grade 4 Disaggregated Data**



and those below the line are schools performing worse than expected. In essence, the data in this study was broken down so that four different groups of schools could be compared:

1. *lower* poverty schools performing *better* than expected
2. *lower* poverty schools performing *worse* than expected
3. *higher* poverty schools performing *better* than expected
4. *higher* poverty schools performing *worse* than expected

Once the data was disaggregated in this fashion, several additional characteristics of schools were examined. These included school variables often thought to influence student performance, as well as two additional student variables. However, the analyses had to be limited to variables for which there was statewide data available. These variables were:

#### School Variables

1. school size
2. per pupil valuations
3. per pupil expenditures, expenditures by categories of spending
4. percent of special needs students
5. teacher-student ratios
6. teacher experience and education levels

In addition, two student level variables were explored. These were:

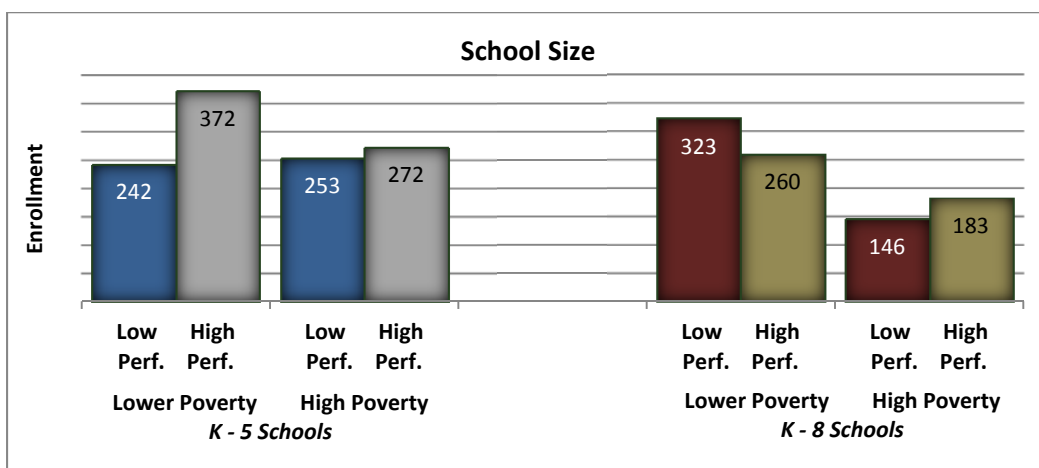
## Student Variables

1. school average daily attendance
2. qualifying for free or reduced lunch.

### **Additional School Variables**

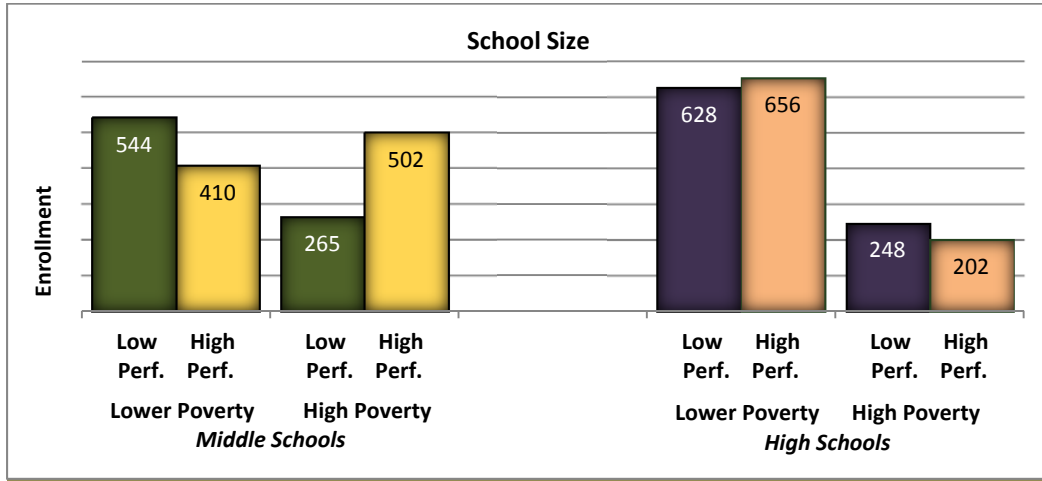
The size of a school, in terms of student enrollment, is often thought to have an impact on student achievement. Figures 11-12 report the data for school size, by school levels, poverty levels, and by predicted performance. School size is reported on the vertical axis, and school levels by poverty levels and predicted performance are reported along the horizontal axis. For example, in K-5 schools the average size of the schools in low poverty schools that do not perform as well as predicted is 242 pupils, whereas the average size of

**Figure 11: K-5 and K-8 School Size Relationships**



these low poverty schools that are performing better than predicted is 372 pupils. The bar graphs for the other three types of schools in Figures 10-11 are read in a similar fashion.

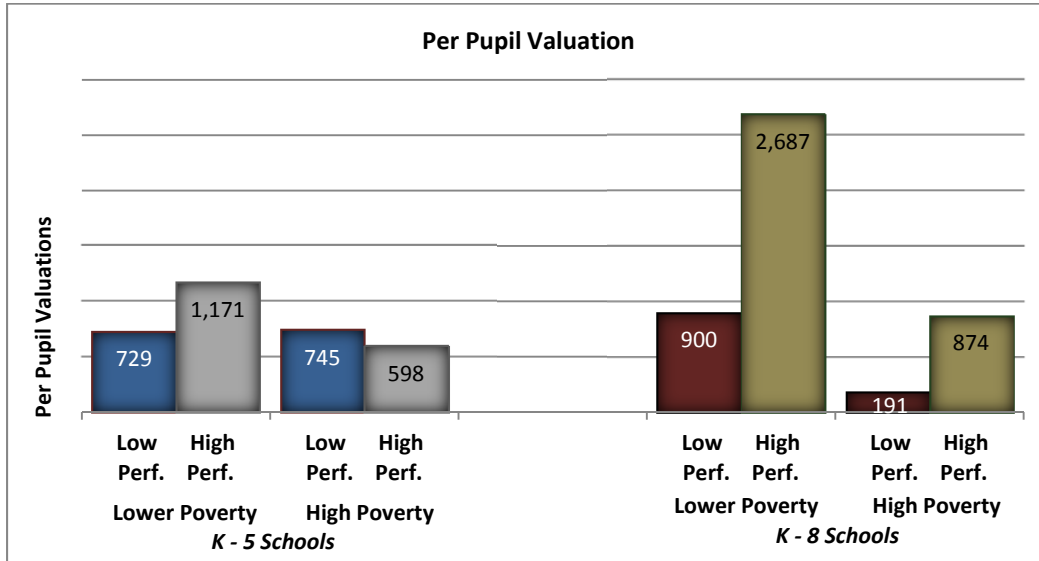
**Figure 12: Middle and High Schools Relationships**



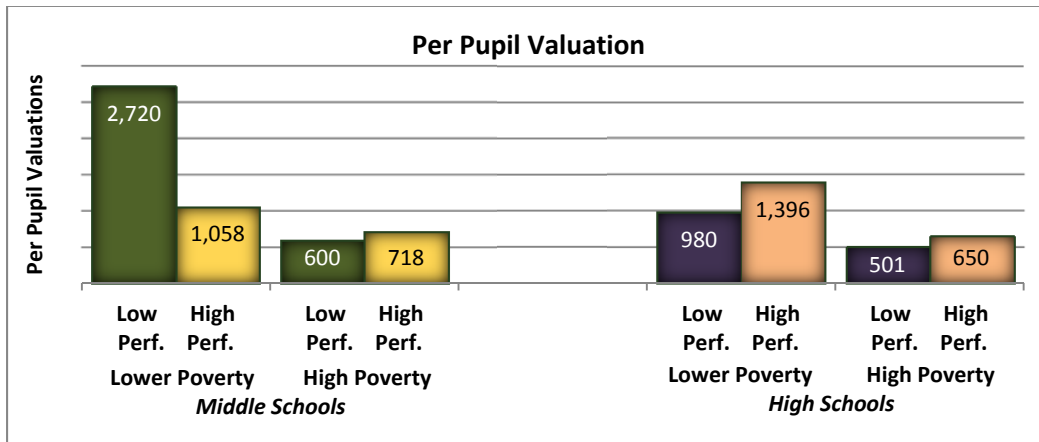
Overall, the school sizes in higher performing schools, both in lower and higher poverty level schools, are higher than other types of schools. However, trends are mixed, with smaller enrollments also occurring at higher performing schools at some grades and poverty levels. Thus, additional analysis is needed before the relationship between school size, poverty levels and student performance is clearer.

A second area that was explored was the relationship between school poverty levels, per pupil valuations, and student performance. Per pupil valuations are one way to measure community wealth. Higher per pupil valuations would, at least ostensibly, denote a wealthier community. Figures 13-14 depict the relationship of community wealth to performance. In all but two cases, lower poverty schools, both those performing better than predicted and even those performing worse than predicted, have higher per pupil valuations. This is not too surprising given that school poverty levels are directly related to community property wealth.

**Figure 13: K-5 and K-8 Schools Per Pupil Valuation Relationships**



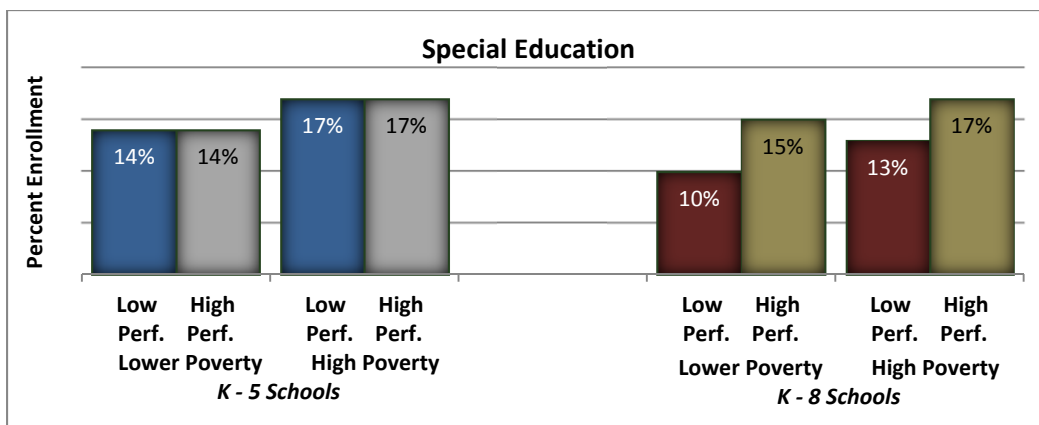
**Figure 14: Middle and High Schools Per Pupil Valuations**



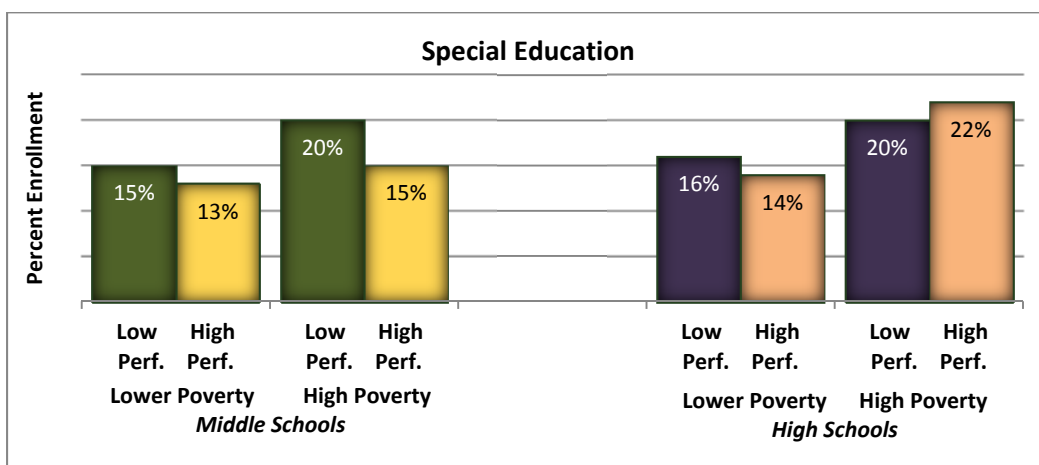
A third area that was explored is an area that is often thought to have an impact on how well a school performs. This is the percent of pupils in a school who have special needs and need special services. Figures 15-16 report special needs rates in schools in terms of the percent of the student population who qualify for special services. As shown in the figures, higher poverty schools have higher percentages of their students with special needs, but there are no consistent results in terms of student performance. For example, lower performing middle school also have higher levels of special needs students, but in the case of K-8 schools higher performing schools have higher levels of students with special needs, regardless of their poverty levels. And in high schools the performance is mixed

between higher and lower poverty schools. Consequently, the relationship between special education rates, poverty and performance is at best inconsistent and unclear.

**Figure 15: K – 5 and K – 8 Schools Special Education Relationships**



**Figure 16: Middle and High Schools Special Education Relationships**



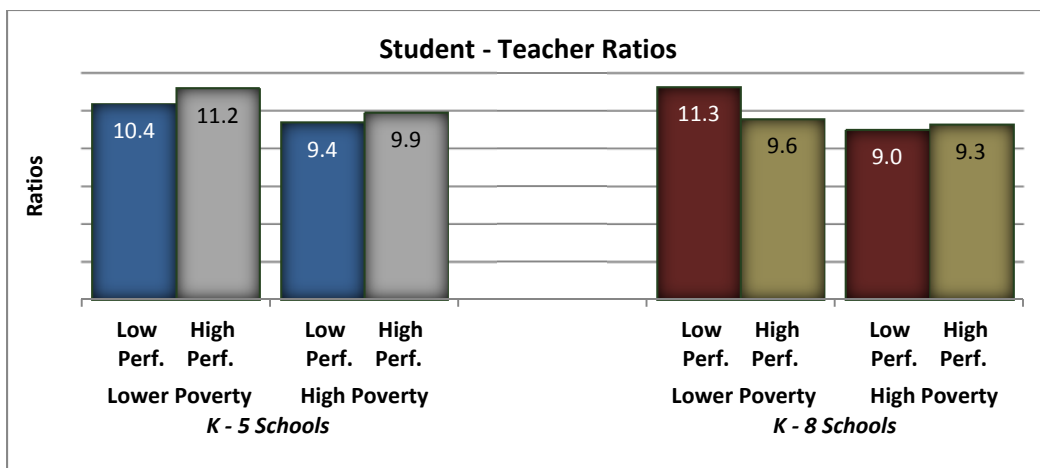
Turning to an analysis of other characteristics found in schools, three were examined: (1) student-teacher ratios; (2) teaching experience; and (3) teacher education levels. All three have been found in some cases to be related in one way or another to student performance.

In the case of student-teacher ratios, student-teacher ratios are often thought to be a key ingredient in determining student achievement. However, the national research is somewhat mixed. In many cases researchers have not found a strong connection between ratios and student performance. The exceptions are in cases where the difference in ratios is very large (e.g., 35:1 ratios versus 15:1 ratios). Some researchers have found that more

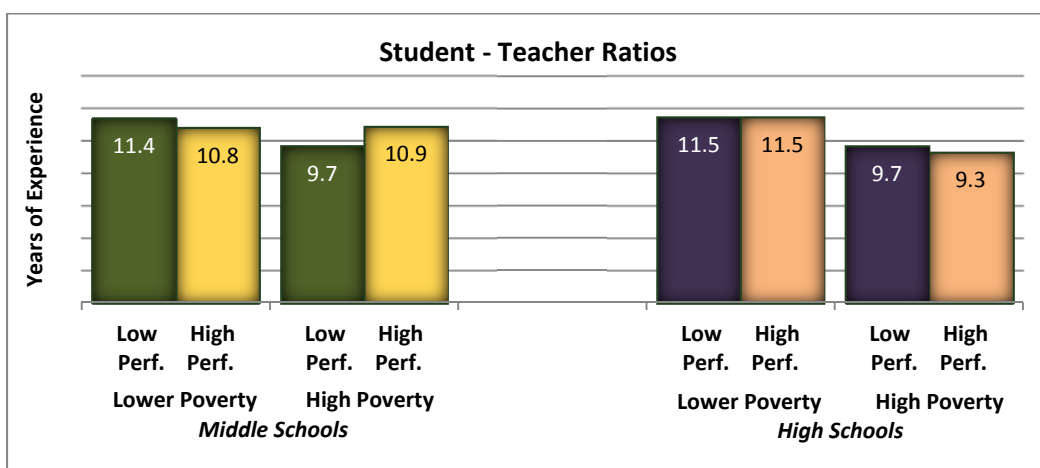
favorable ratios benefit certain types of students. The most notable study in this area is the Tennessee STAR study, where an experimental research design was used to examine the impacts of more favorable student-teacher ratios in early elementary grades. The researchers found that the lower ratios helped improve academic learning, particularly for students from low income minority households.

Figures 17-18 report the student-teacher ratios found in the four types of schools and relative to their poverty levels and student performance. Again, the relationships appear to be mixed. In all cases, higher poverty schools have more favorable ratios. There are fewer students per teacher in these schools. But in terms of performance, a majority of

**Figure 17: K – 5 and K – 8 Schools Student – Teacher Ratios Relationships**



**Figure 18: Middle and High Schools Student – Teacher Ratios Relationships**

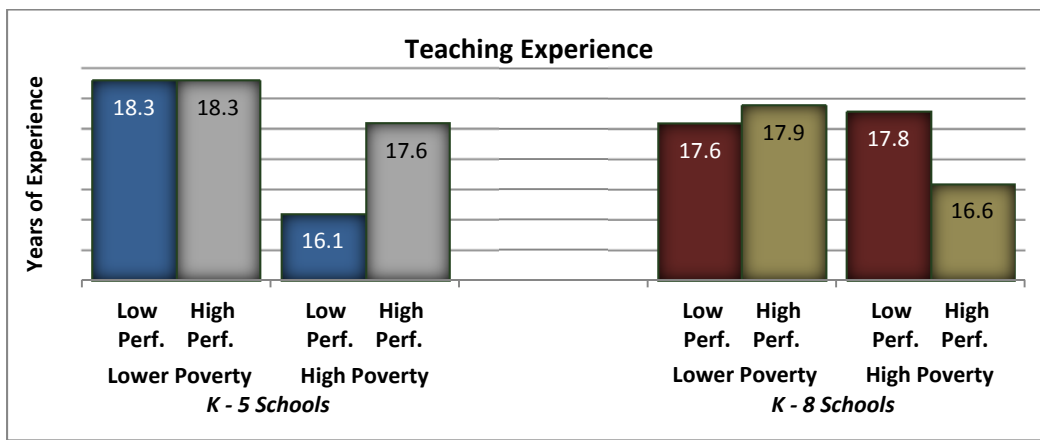


schools performing better than predicted had slightly more students per teacher. Thus, it

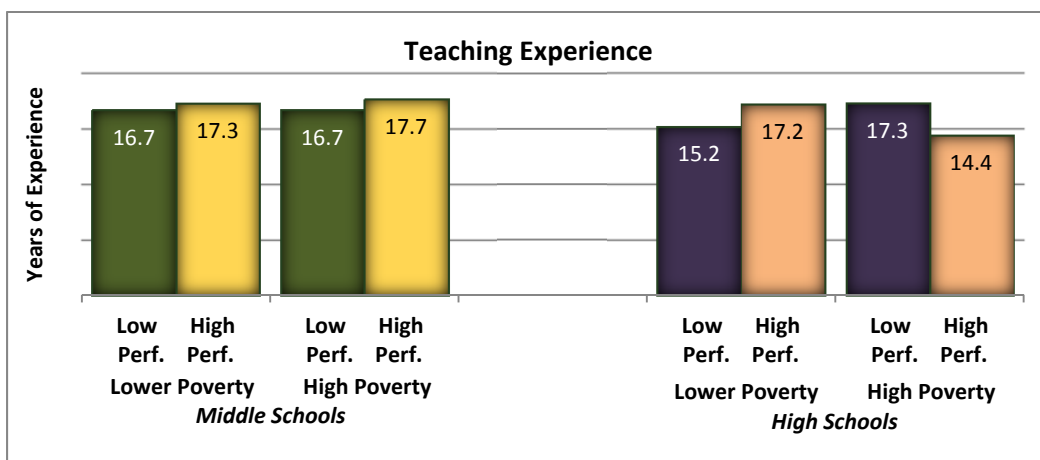
appears that the performance of schools, both higher and lower poverty schools is unrelated to student-teacher ratios found in Maine schools.

Another area where there appears to be little relationship between lower and higher poverty schools is in teachers' years of teaching experience. Some national studies have found a connection between teaching experience and achievement. Performance tends to be higher in schools with more experienced teachers, but the connection is rather weak. It appears this is the case here in Maine. Figures 19-20 report the years of teaching experience for different levels of schools, poverty, and student achievement. At some school levels where schools performing better than predicted have on average slightly

**Figure 19: K – 5 and K – 8 Schools Teaching Experience Relationships**



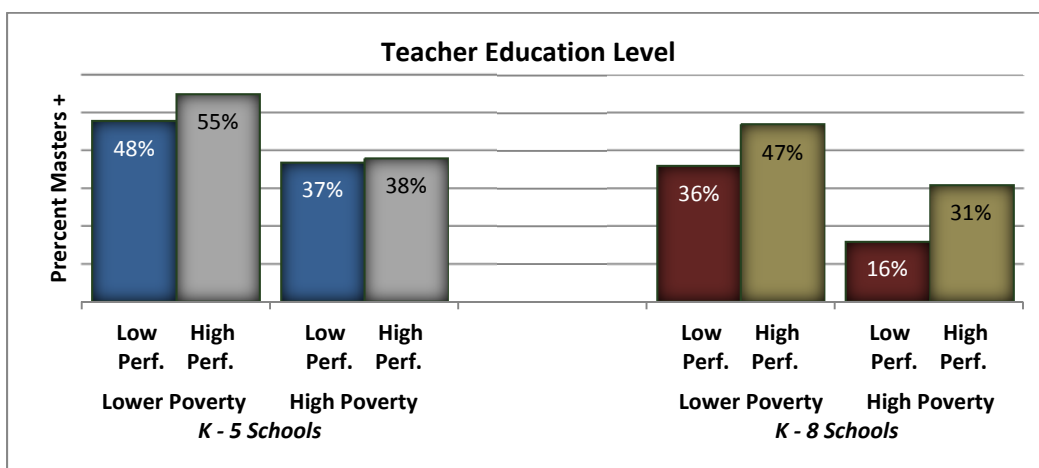
**Figure 20: Middle and High Schools Teaching Experience Relationships**



more experienced teachers, but not in all cases.

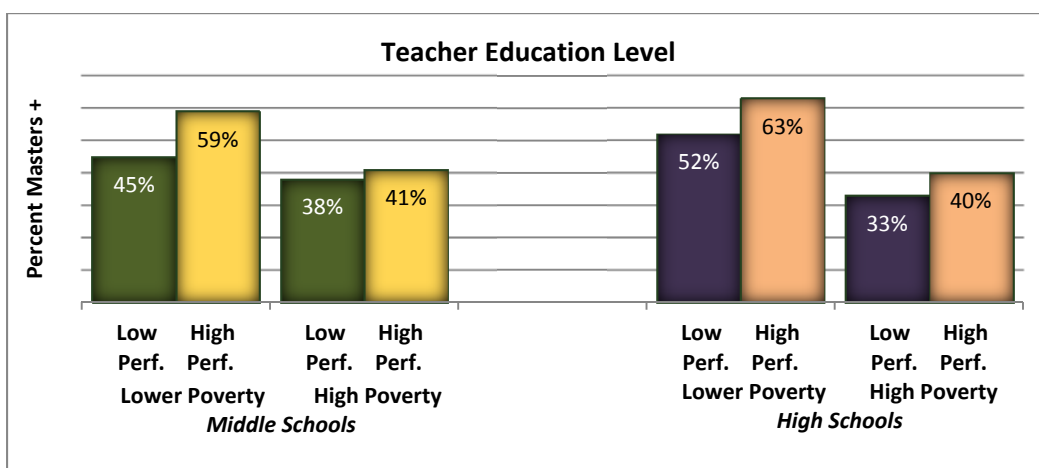
An area where there does appear to be a relationship between poverty level, school level, and student performance is in teacher education levels. Figures 21-22 report teacher education levels in terms of the percent of teachers in different type schools who have earned a master's degree or higher. Like the national research, teacher education levels

**Figure 21: K – 5 and K – 8 Schools Teacher Education Relationships**



appear to be related to performance in the upper school grades. In all cases, a higher percent of Maine teachers in lower poverty schools hold more advanced education degrees than Maine teachers in higher poverty schools. But some of the largest differences are found in K-8 school and high school higher poverty schools. Some differences are found at

**Figure 22: Middle and High Schools Teacher Education Relationships**



the middle school level, but these differences become substantially greater in K-8 and high schools. Higher poverty K-8 schools performing better than predicted have almost twice as

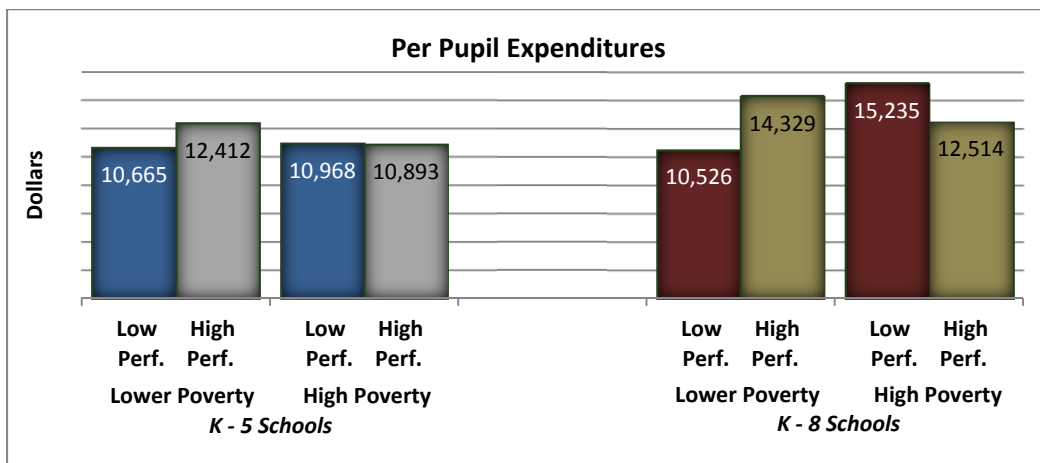


many teachers with advanced education degrees, and the percentage difference at the high school level is 7%. It appears that education level may be playing a part in performance in higher poverty schools.

To summarize the findings from these six areas then, higher poverty schools tend to be smaller in size, are in less wealthy communities, but generally have similar percentages of students with special needs. While there is little difference in student-teacher ratios in most cases, there do appear to be some difference in the relationships between teaching experience and teacher education levels for some types of school. Based on these conditions, one would expect to find some differences in expenditure levels between lower and higher poverty schools, and possibly between schools performing better or worse than predicted in terms of student achievement.

Figures 23 - 28 report three types of per pupil expenditures: (1) total per pupil expenditures: (2) per pupil expenditures for instruction alone; and (3) per pupil special education expenditures. In the case of total per pupil expenditures, the data in Figures 23 - 24 indicate that with the exception of K-8 schools, lower poverty schools spend more per pupil than higher poverty schools. But in the case of schools performing better than predicted, per pupil expenditures are higher in lower poverty schools whereas the per

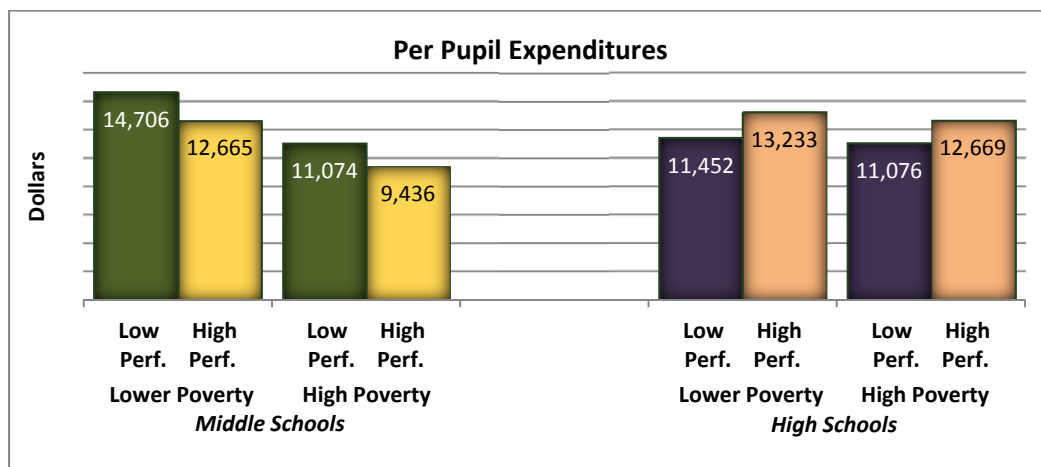
**Figure 23: K – 5 and K – 8 Schools Per Pupil Expenditures Relationships**



pupil expenditures levels are mixed (i.e., sometimes higher and sometimes lower) in higher poverty schools. For example, lower performing higher poverty middle schools spend more

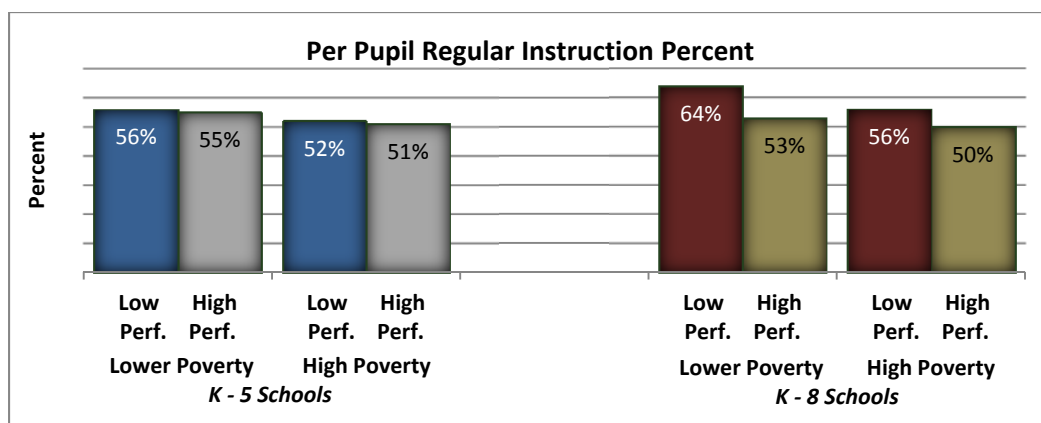
than higher performing higher poverty middle schools, but the per pupil expenditure levels in high schools are reversed.

**Figure 24: Middle and High Schools Per Pupil Expenditures Relationships**



What about how schools spend money? Are there differences in how much schools spend on regular instruction depending upon their poverty levels and performance? Figures 25-26 report the percentage of per pupil expenditures schools spend on regular instruction, where regular instruction is defined as including all classroom related expenditures, excluding special education. Somewhat surprisingly there is considerable commonality in the percentages different type schools spend on regular instruction. Most

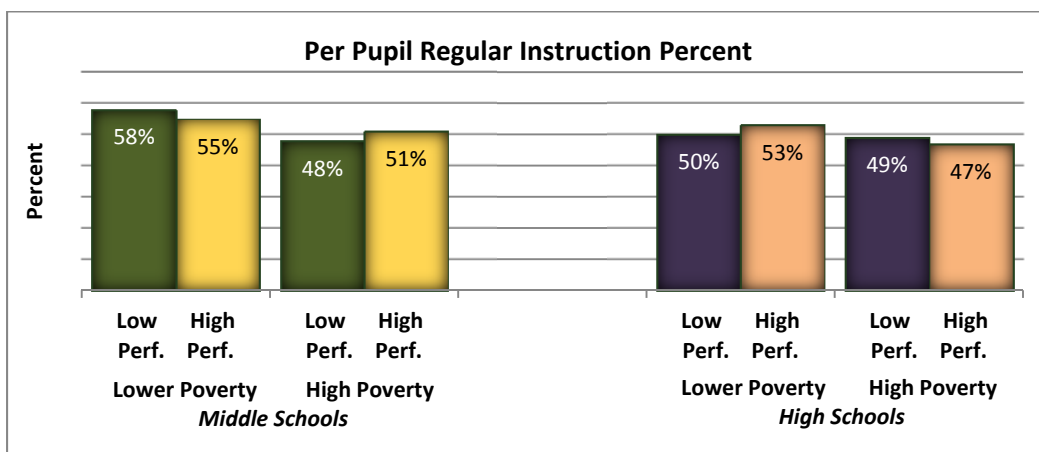
**Figure 25: K – 5 and K – 8 Schools Per Pupil Regular Instruction Relationships**



range between 52-55%. The one exception is lower poverty K-8 schools, but only a few such schools were included in this analysis so the exception may be related to the sample size. It is of some note, however, that higher poverty high schools spend a smaller percent

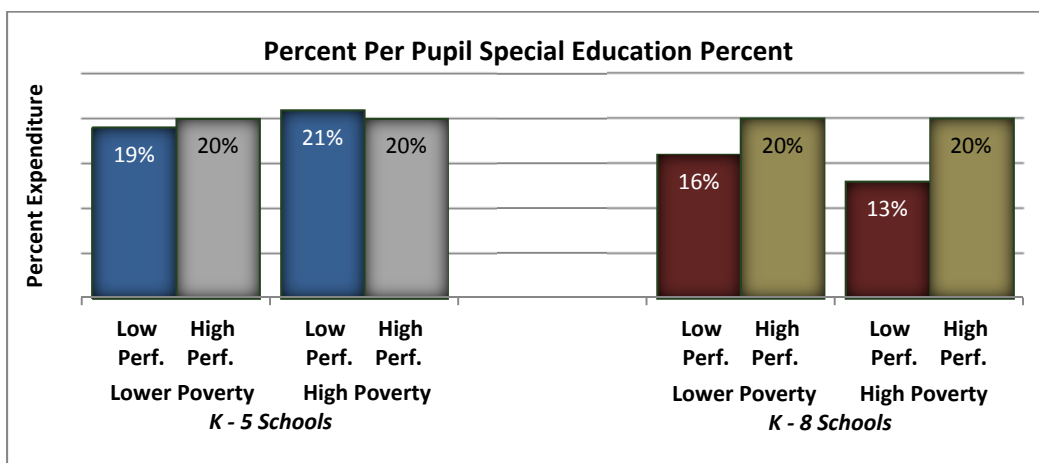
on regular instruction than any other school type. An additional analysis revealed that this was not related to vocational education expenditures; all types of high schools had similar levels of vocational education expenditures.

**Figure 26: Middle and High Schools Per Pupil Regular Instruction Relationships**

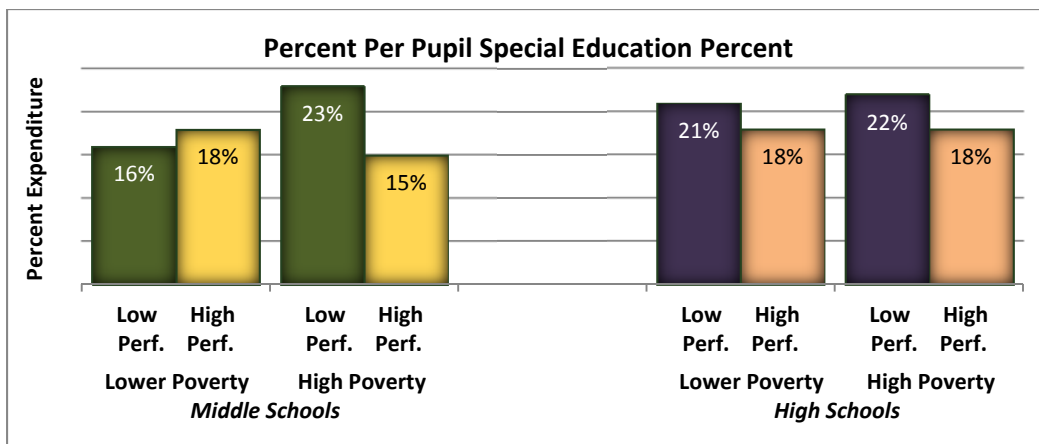


A third analysis of expenditures looked at the percent schools were spending on providing special education, and these results appear in Figures 27-28. The percentages are very similar for K-5 schools, but quite different in other types of schools, with no consistent patterns. Higher performing higher poverty K-8 schools spend a higher percentage of their expenditures on special education, but it is just the opposite in high schools. Some of these

**Figure 27: K – 5 and K – 8 Schools Per Pupil Special Education Expenditures Relationships**



**Figure 28: Middle and High School Per Pupil Special Education Expenditures Relationships**

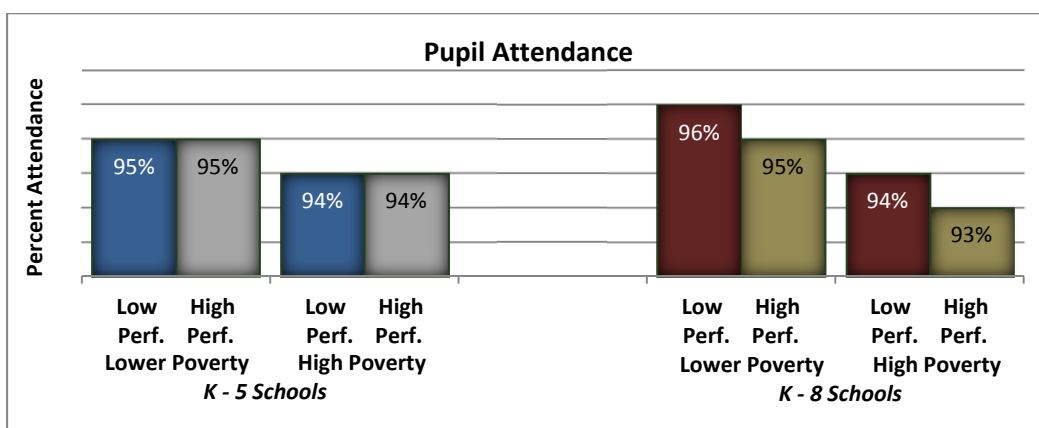


differences may be related to different levels of special needs and the cost of providing services found in different types schools, but the analysis earlier of the percent of special needs students found in different schools does not track in a similar fashion in expenditures. In-other-words, the percent spent on special education does not always match the percent of special needs students found in schools.

### **Additional Student Variables**

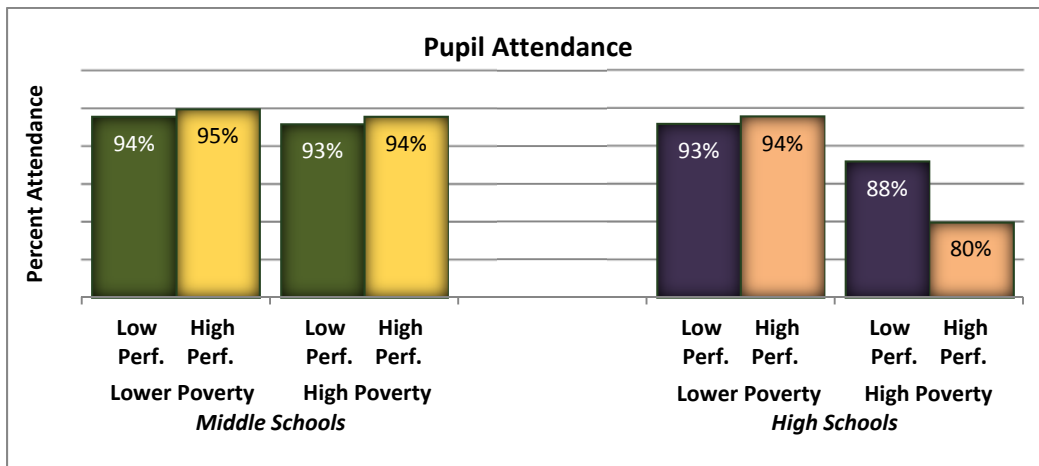
Turning to additional student characteristics, two specific ones were explored: (1) school attendance; and (2) free or reduced lunch status. In terms of student attendance one might expect to find that average daily student attendance was lower in higher poverty schools, and particularly higher poverty schools performing worse than predicted. But this is not the case except at the high school level. As shown in Figures 29 – 30, attendance rates are very similar and range for 93-96% in most schools. The one case where attendance rates

**Figure 29: K – 5 and K – 8 Schools Pupil Attendance Relationships**



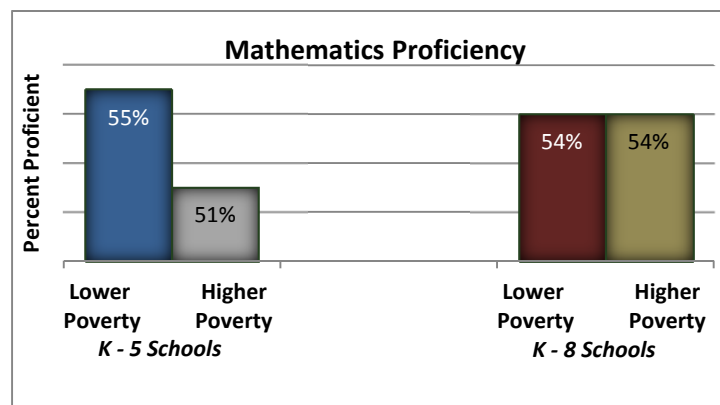
are considerably different is in higher poverty high schools. Attendance rates in these schools are 6-13% less than in lower poverty high schools. So outside of this one case, attendance rates do not seem to be related to poverty levels and performance.

**Figure 30: Middle and High Schools Percent Attendance Relationships**



Lastly, performance of students who qualify for free or reduced lunch programs was compared with those students who do not qualify for these programs. In essence, performance of students in poverty was compared with students outside of poverty. Figures 31-32 compare the mathematics proficiency performance of students in poverty at the four different school levels. Reading proficiency performance profiles appear in Appendix C. Three key findings stand out from this analysis. First, regardless of the school

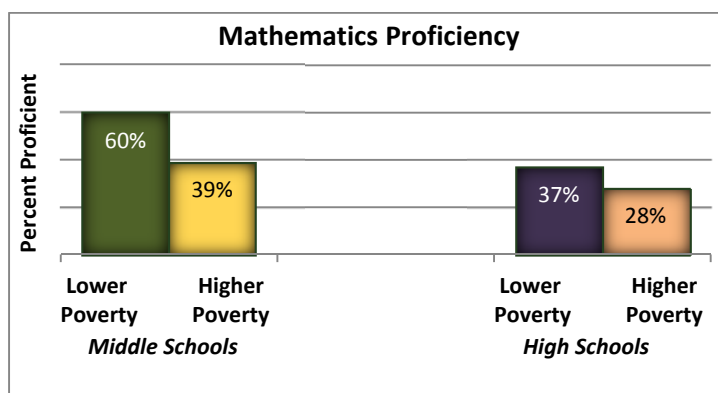
**Figure 31: K – 5 and K -8 Schools Percent Mathematics Proficiency for Students in Poverty**



level, less than 60% of the students who qualify for free or reduced lunch programs met proficiency in mathematics. The same is true for reading. Second, the performance of these

students does not vary much between lower and higher poverty schools. And third, the percent of these students meeting mathematics proficiency decreases in higher grades. For example, 55% of these students in lower poverty K-5 schools met proficiency and 51% met proficiency in higher poverty schools. However, this changes in higher grades. The

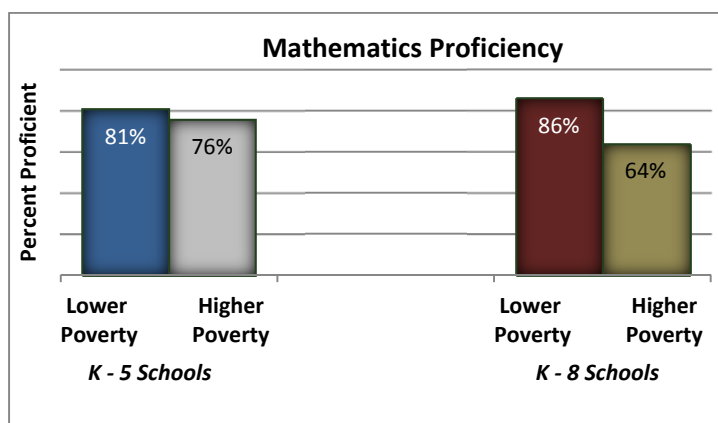
**Figure 32: Middle and High Schools Percent Mathematics Proficiency for Students in Poverty**



difference in the percent of students meeting proficiency is 60% in lower poverty middle schools and only 39% in higher poverty schools. Although not as wide a difference, the same is true at the high school level (based on 11<sup>th</sup> grade performance). This evidence suggests once again that the relationship between poverty and student performance become stronger in the upper grades.

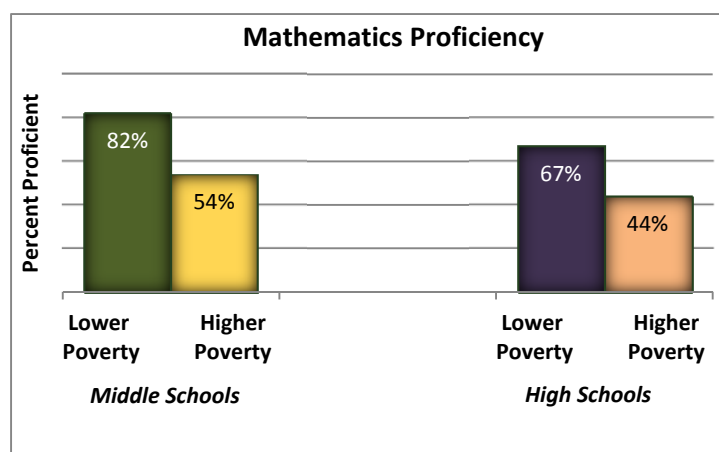
What about the performance of students not in poverty? This evidence appears in Figures 33 – 34. The percent of these students meeting proficiency is similar in K – 5 schools but changes quite dramatically in other school levels. Only 64% of non-poverty

**Figure 33: K – 5 and K – 8 Schools Percent Mathematics Proficiency for Students Not in Poverty**



students in K – 8 higher poverty schools met mathematics proficiency, and this decreases to 54% in middle schools and even further to 44% in high schools. At the same time, 86% of non-poverty students in lower poverty K – 8 schools met proficiency, and 82% in middle

**Figure 34: Middle and High Schools Percent Mathematics Proficiency for Students Not in Poverty**



schools. While this percentage decreased at the high school level it still is considerably higher than non-poverty students in higher poverty high schools. This suggests non-poverty students in higher poverty schools do not perform as well as their non-poverty peers in lower poverty schools.

Thus, to summarize these disaggregated analyses, it appears that while there are some differences in the characteristics of lower and higher poverty schools the difference in many cases appear to be small. Higher poverty schools tend to be smaller and are located in less wealthy communities. In most cases special education rates are similar across schools, and expenditure while somewhat higher in some schools, all schools spend similar percentages of their expenditures on regular instruction and special education. Student-teacher ratios and school attendance rates tend to be similar or mixed across school types.

On-the-other-hand, the analyses appeared to reveal some difference in the lower and higher poverty schools in some areas. These were in comparing K-8 schools and middle schools. These were also in terms of teaching experience and education level of teachers.

### Multiple Regression Analyses

To explore these characteristics further and to determine how these characteristics may interact in explaining difference in student performance, three stepwise multiple regressions were computed for the three school levels. Multiple regression is a statistical technique for determining the amount of variance accounted for with a specific group of variables. It is used to identify the best set of variables that will best predict a certain outcome, in this case student performance. The stepwise feature allows the researcher to determine what is the best single predictor of a specific outcome, then what are the best two predictors, and so on. Calculations end when adding another predictor does not significantly improve the prediction.

Based on the evidence described above, seven variables were included in the regression analysis, and regressions were calculated for three grade levels. The seven variables were: (1) percent school poverty; (2) K-8 type of school; (3) school size; (4) percent school special education; (5) teaching experience; (6) teacher education levels; and (7) per pupil regular instruction expenditures.

The stepwise regression for Grade 4 appears in Table 2. In this case only three of the seven variables significantly predicted performance. These were percent school poverty, being from a K-8 type of school and teaching experience. As expected, school level poverty levels was the best single predictor of student performance, followed by type of school and teaching experience. Together the three only account for approximately 28% of the variance. To put this another way, 72% of the difference in performance in Grade 4 is attributable to other factors besides these three.

**Table 2. Grade 4 Regression**

Regression #	Variable Name	R-square	Significance Level
1	Percent Eligible for Free Reduced Lunch 2013	.256	<.001***
2	K-8 School	.272	<.001***
3	<i>Teacher Ave. Years of Experience</i>	<i>.284</i>	<i>&lt;.001***</i>



The amount of variance accounted for increases at the 8<sup>th</sup> Grade level. As may be seen in Table 3, a little over one half of the difference in student performance in Grade 8 is

**Table 3. Grade 8 Regression**

Regression #	Variable Name	R-square	Significance Level
1	Percent Eligible for Free Reduced Lunch 2013	.408	<.001***
2	K-8 School	.496	<.001***
<b>3</b>	<b><i>Teacher Education (Percent MA or higher)</i></b>	<b>.524</b>	<b>&lt;.001***</b>

related to poverty levels, being in a K-8 school, and the education level of teachers. Teacher education level replaces teaching experience as a significant predictor of student performance. But as in the case of Grade 4 performance, the percent of students in poverty in the 8<sup>th</sup> Grade is the single best predictor of performance.

Teacher education level also helps explain the difference on performance at the 11<sup>th</sup> Grade. As shown in Table 4, percent of poverty is the single best predictor, followed by per pupil regular instruction spending, and teacher education levels. Together they explain 70% of the difference in student performance across school poverty levels. Taken together

**Table 4. Grade 11 Regression**

Regression #	Variable Name	R-square	Significance Level
1	Percent Eligible for Free Reduced Lunch 2013	.636	<.001***
2	Per Pupil Spending Regular Instruction 2012	.686	<.001***
<b>3</b>	<b><i>Teacher Education (Percent MA or higher)</i></b>	<b>.702</b>	<b>&lt;.001***</b>

these three regression analyses indicate that in terms of the variables examined in this study, poverty is clearly related to student performance. But in addition, some other factors are related to student outcomes.

## Discussion

The goal of this study was to explore the relationships between school level poverty found in Maine schools and student academic performance. The evidence clearly shows that there is a relationship. As the percent of poverty increases in a school, student performance declines. But the poverty level alone does not explain the wide variations in performance found across the state. True, the level of poverty in a school is the single best predictor of student performance, but other factors also play a role in influencing student achievement. Some of these factors include the type of school students are enrolled in, years of teaching experience, and the education levels of teachers.

Thus, the findings from this study are congruent with those found in other studies of school poverty and its effects on student performance. Schools with higher levels of poverty struggle to achieve high levels of student achievement. But some of these higher poverty schools defy the odds. Even with higher levels of poverty in their schools, they are successful in producing higher levels of student performance.

The findings from this study also have uncovered what appear to be two other distinguishing characteristics of higher poverty schools. First, overall performance differs in K-8 and middle schools. The negative relationship between poverty levels and performance is weaker for K-8 schools. More of the higher poverty K-8 schools are performing better than higher poverty middle schools.

This finding is not without precedent. Several researchers in the past have explored the relationships between school grade configuration and student performance. In most cases these researchers have reached the same conclusion; school grade configuration matters, particularly for upper elementary middle school grades. For example, research by Offenbergh (2001), and Coldarci and Hancock (2002) have found that students in K-8 have higher mathematics and reading achievement. Similar results have been found in longitudinal studies in Wisconsin (Simmons & Blyth, 1987) and Maryland (Baltimore City Schools, 2001).

However, while the findings from this study are supported by other studies, it is not all together clear why the results are better for K-8 schools. Some attribute it to differences

in student populations in the two types of school or better attendance in K-8 schools (Balfanz, 2002, Yakimowski & Connolly, 2001). Others attribute the higher performance to differences in teacher quality (Paglin & Fager, 1997) and fewer school transitions (Herman, 2004; Simmons & Blyth, 1987). Unfortunately, it is not possible within the scope of this study to discern the causes for the differences in Maine schools. Further research is needed in this area.

A second additional finding from this study was that the levels of poverty in schools not only affected children in poverty but also those not in poverty. Students in higher poverty schools who *do not* qualify for free or reduced lunches do not perform as well as their cohorts in lower poverty schools. This finding is not without precedent either, but the research in this area is by no means voluminous. The majority of research in this area focuses on examining the effects on poverty children in lower poverty schools. However, a small number of researchers have examined what happens to non-poverty children in higher poverty schools. Kennedy (1986) found that non-poverty students in higher poverty schools do not perform as well, and Puma, Jones, Rock and Fernandez (1993) found that high concentrations of poverty in schools affect the performance of all students. What is unclear are the causes of this lower performance of non-poverty children in higher poverty schools. Some have speculated that it is because of peer or parental influences, lower expectations, weaker curriculum, and teacher quality (Kahlenberg, 2002; Caldas, 1997; Hoglebe & Tate, 2010; Palardy, 2008). The use of free and reduced lunch eligibility as a binary definition of poverty is also limiting, as it treats all ineligible students (with household incomes greater than about \$45,000 for a family of 4) as equivalent. Given the limited evidence in this important area, considerable more research is needed to not only document more clearly the impacts of higher poverty schools on non-poverty children, but also to establish a much deeper understanding of the causes of these impacts.

Without question, the evidence examined in this study indicates that levels of school poverty and student achievement are related. The magnitude of the relationship varies, and other factors are related to poverty and achievement, but the single best predictor of performance is school poverty level. The good news is that there are schools at all levels that defy the odds. Student achievement is better than predicted in spite of school poverty

levels. These schools may provide good models for other schools to emulate. In addition, the evidence from this study indicates that there is more to learn about the performance of some types of school configurations (i.e., K-8 schools) and the performance of non-poverty children in higher poverty schools.

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## **Appendices**

## Appendix A

Figure 6. K - 8 School Letter Grades

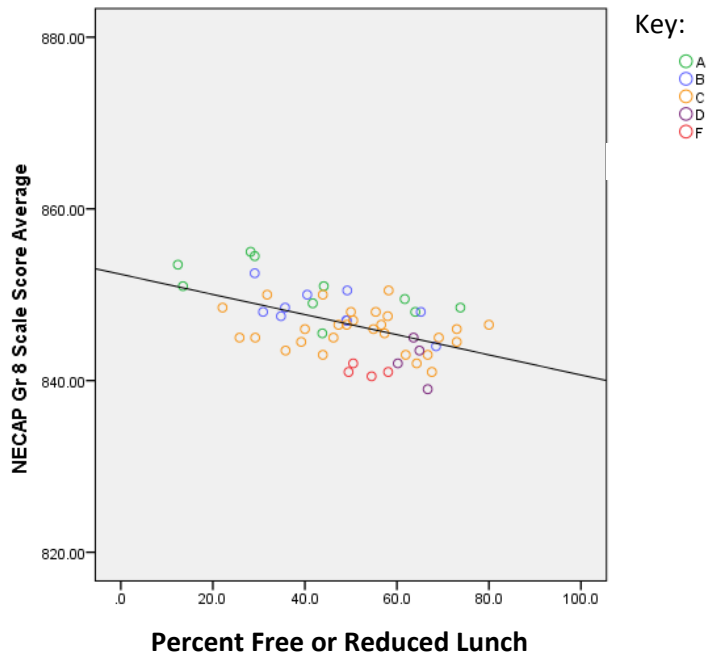
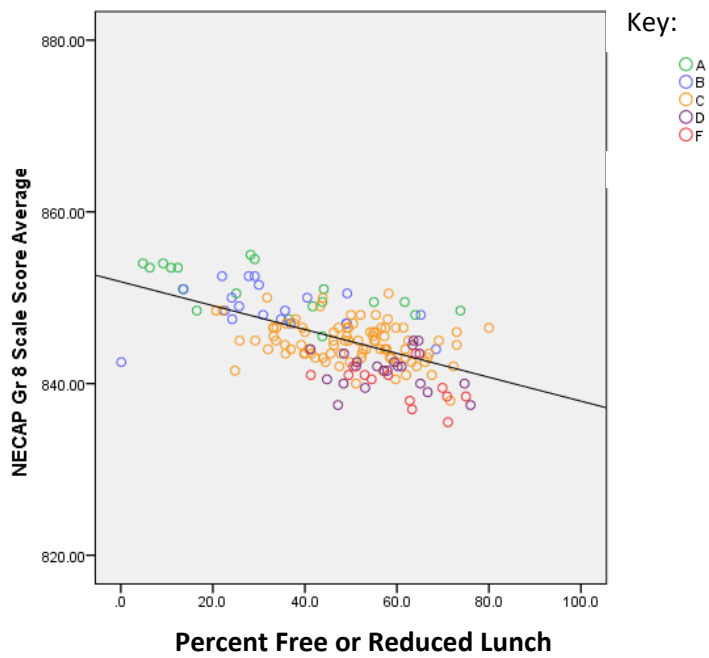
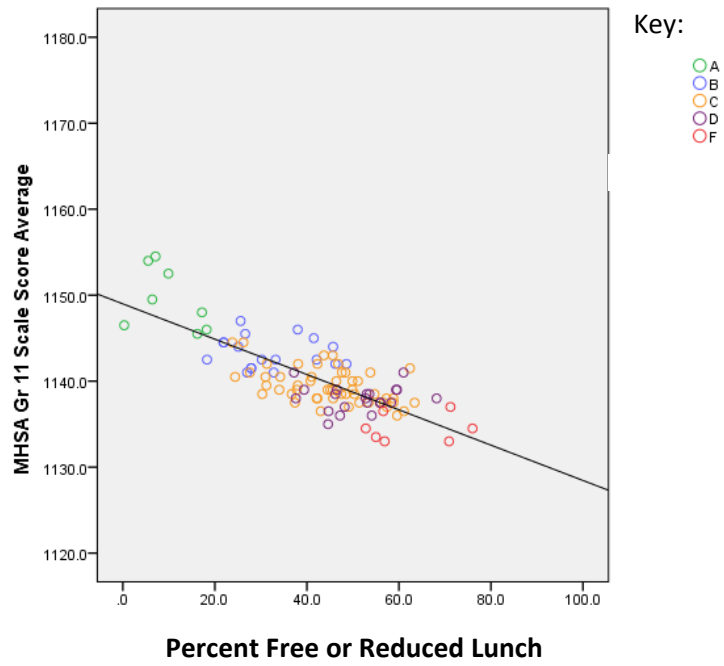


Figure 7. Middle School Letter Grades





**Figure 8. High School Letter Grades**



## Appendix B

Figure 6. K-8 Schools Performance by Poverty

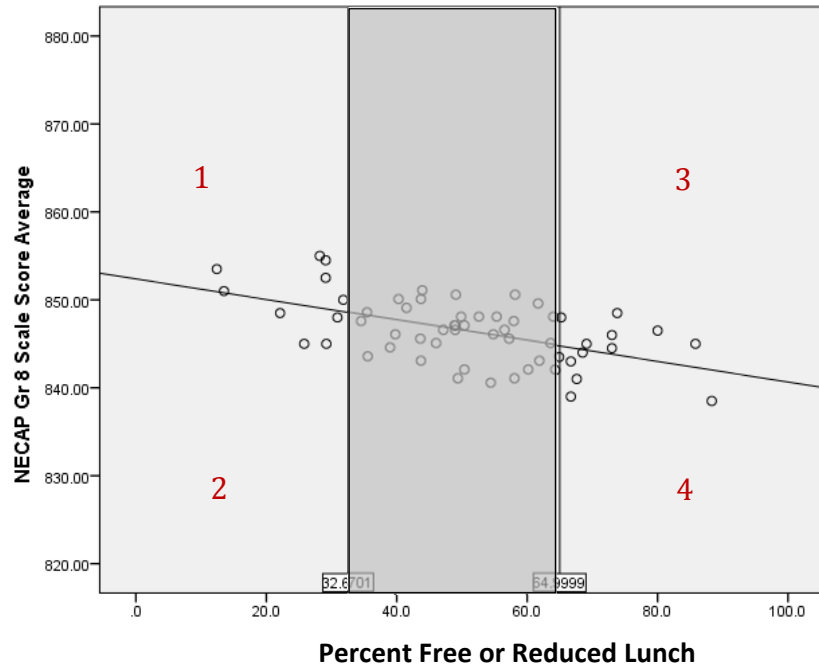
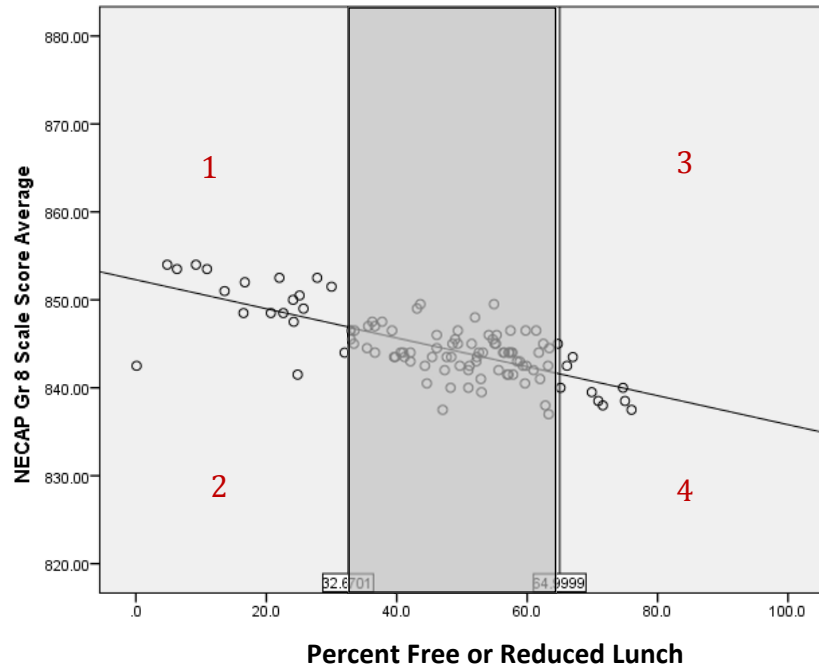
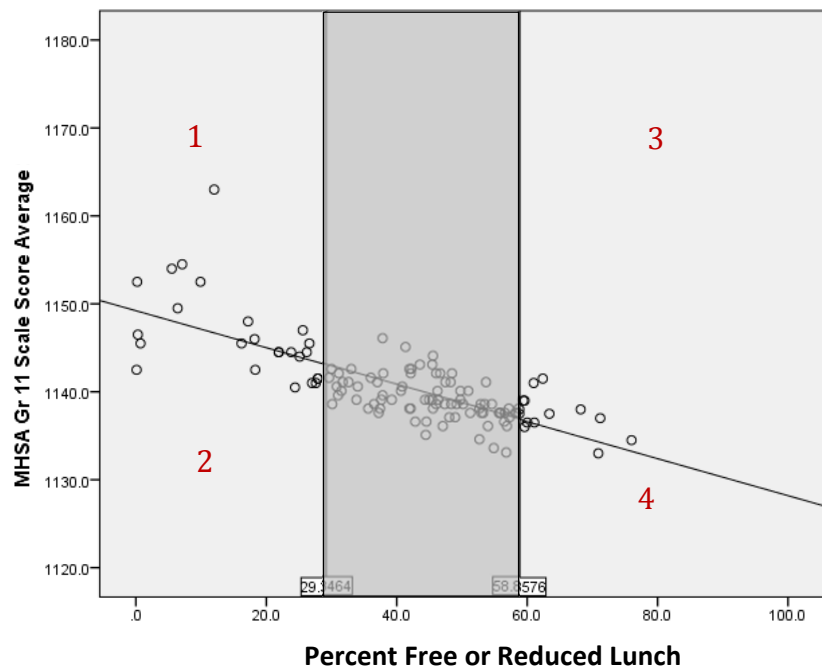


Figure 7. Middle School Performance by Poverty  
(Grade 8 Reading and Math School Average Scale Score)



**Figure 8. High School Performance by Poverty  
(Grade 11 Reading and Math School Average Scale Score)**



Appendix C

