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ABSTRACT
                Data compiled on the impact of school poverty in the Wake
County Public School System (WCPSS), North Carolina, support the current
policy that sets 40% as a target maximum percentage of low-income students
that would be assigned to a school. Major findings of a study of the effects
of school poverty in the WCPSS include the determination that previous
actions of the district have created a system of schools in which relatively
few campuses have a high concentration of poverty. Given the variations in
WCPSS schools' performance, many factors beyond school poverty are affecting
achievement growth in each school. Analysis of the North Carolina
End-of-Grade (EOG) test scores show that small reductions in the
concentration of poverty at a school are unlikely to have a meaningful effect
on student achievement growth, although the differences might be
statistically significant. Larger changes in the concentration of poverty in
a school would be likely to produce changes in student achievement growth
that would be both statistically and educationally significant. Two
appendixes contain a report on tests for the curvilinear effects of school
poverty on EOG scores by grade and subject and achievement test results for
low-income students. (SLD)

Research Watch

Evaluation and Research Department

The Effect of School Poverty Concentration in WCPSS

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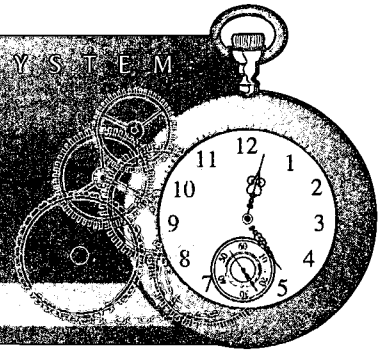
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The Effect of School Poverty Concentration in WCPSS
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Summary

Data compiled on the impact of school poverty in WCPSS support the current policy that sets 40% as a target maximum percentage of low-income students that would be assigned to a school. Major findings include:

* *Previous actions of the district have created a system of schools in which relatively few campuses have a high concentration of poverty.*
* *Given the variations in WCPSS schools' performance, many factors beyond school poverty are affecting the achievement growth in each school.*
* *Analysis of EOG test scores showed that small reductions in the concentration of poverty at a school are unlikely to have a meaningful effect on student achievement growth, although the differences might be statistically significant.*
* *Larger changes in the concentration of poverty in a school would likely produce changes in student achievement growth that would be both statistically and educationally significant.*

Individual students from low-income families have a statistically higher risk of dropping out of school, low academic achievement, and retention in grade, among other negative outcomes. In 1999, the Evaluation and Research Department published a brief summary of research on the relationship between student achievement and the concentration of poverty within a school (E&R Report 99.20). That brief research review indicated that schools with high concentrations of poverty were less likely to attract the most qualified teachers and that all groups of students— including below average, average, and above average students—had lower achievement in high poverty schools. The national research encompassed schools with concentrations of poverty that ranged from close to zero to well over 75%. In 1999-2000, the Wake County Public School System (WCPSS) had fewer than 10 schools out of 122 with poverty concentrations above 40%, a level at which the national research indicated a sharp increase in the effects of school poverty

on student achievement. Given the *relatively* low concentration of poverty in most schools in WCPSS, perhaps the central unanswered question is, "What impact does an individual school's poverty concentration have on school performance in our local community?"

Researchers typically distinguish between poverty of *individual* students and the *aggregate* poverty levels of schools or school districts. Participation in the federal school lunch program is the most common way of estimating students' socioeconomic level. The percentage of individual students in the school who qualify for the free- or reduced-price lunch program gives an indication of the school's poverty concentration. Of course, many students from low-income families are successful in school. In order to be successful, however, they may need extra support. In a school with a high concentration of poverty, higher numbers of students are likely to need extra help to succeed.

Two Ways To Measure School Performance

One way to look at a school's performance is in terms of "absolute" performance. By that, we usually mean a measure based on the percentage of students who meet some standard, or sometimes a comparison among schools based on mean test scores or percentile ranks. High concentrations of poor children have a predictable relationship to the average scores in a school because an individual student's socioeconomic status is so strongly linked to his or her individual performance.

Another way of measuring the success of a school is to measure where students start in terms of their achievement and how effective the school is at helping students grow. Thus, a school that gets a full year's worth of growth from students who started out a half-year below or behind grade level may be doing a better job than a school that got half a year's growth from students that started two years ahead. Growth becomes a better measure of a school's effectiveness when one wants to avoid confounding the effects of school-level variables with the effects of the individual students' poverty level.

Recent North Carolina Data on School Poverty

One way of assessing a school's effectiveness in terms of student growth uses the state's ABCs model. The ABCs growth composite is scaled so that "zero" is the statistically expected score for each school. At the time of our earlier review on the impact of school poverty, there was controversy over North Carolina's ABCs model of accountability, which provides financial incentives to schools for achievement growth. The concern was whether the ABCs created a disadvantage for schools with high levels of school poverty. Were teachers in high-poverty schools less likely to earn incentive pay through the ABCs program than were teachers in low poverty schools?

In the mid- to late 1990s, the correlation coefficients between school poverty for individual North Carolina schools and the schools' ABCs performance were statistically significant, but some psychometricians argued that the negative correlations were not large enough to be considered *educationally* significant. Others argued that the negative correlations were strong enough to merit attention. Recent state data are shown in the table below. The 1999-2000 data

leave little room for argument: the lower *growth* performance of high poverty schools is cause for concern, as shown in Table 1.

Table 1
Correlation of ABCs Measures with Percent of F/R Lunch Students in the School

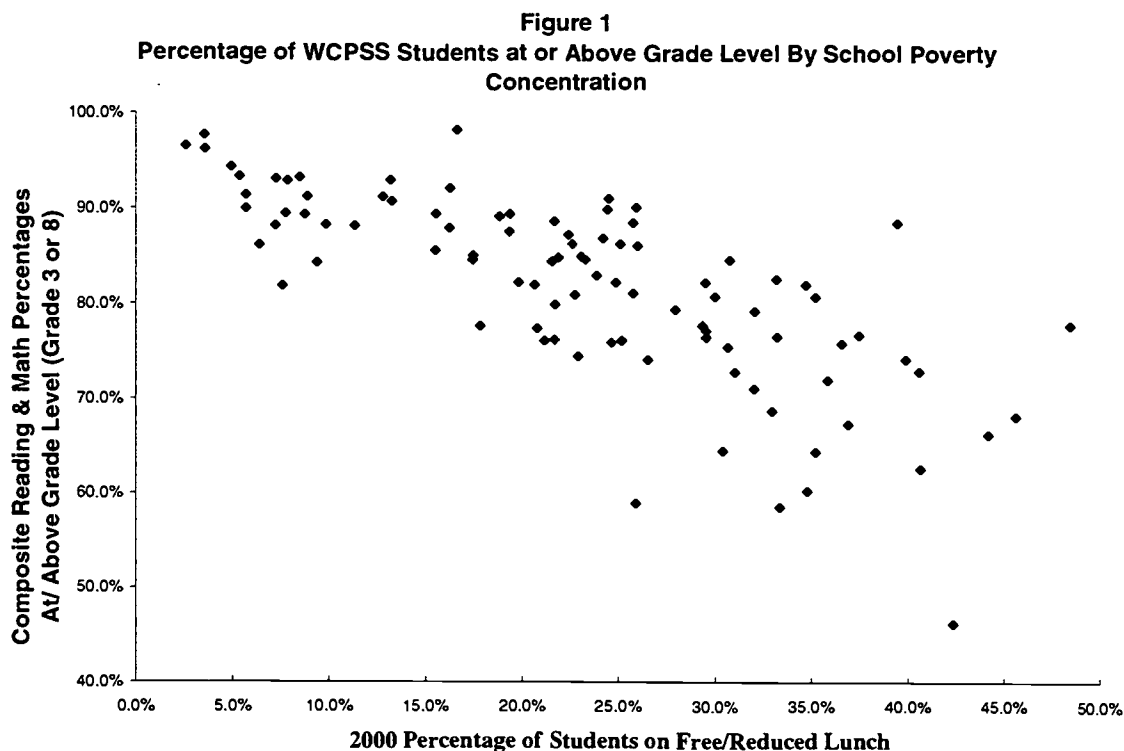| ABCs Outcomes	1996-97	1997-98	1998-99	1999-2000
Expected Growth Composite	-0.28	-0.19	-0.23	-0.38
Exemplary Growth Composite	-0.28	-0.19	-0.24	-0.38
Met/ Not Met Expected Growth	-0.27	-0.21	-0.30	-0.35
Met/ Not Met Exemplary Growth	-0.21	-0.24	-0.23	-0.33

Source: Paper presented by Kris Kaase of DPI, to the NCARE, March 22, 2001.

The correlations between school poverty and ABCs performance for North Carolina schools in 1999-2000 show that high poverty schools experience greater challenges in sustaining the growth shown in the earlier years and in determining next steps to ensure student success. At least at the state level in N.C., the link between poverty and school performance, and the strength of that relationship for 1999-2000, cannot be dismissed as trivial.

How effective are WCPSS schools in terms of school performance? Let's look at both absolute performance and achievement growth.

Data From WCPSS on School Poverty

In WCPSS, just as in other school districts around the nation, there is a link between "absolute" school performance and the percentage of students in poverty. Figure 1 contains a scatter plot of WCPSS schools' performance as a function of the percentage of free- or reduced-price lunch students in each elementary and middle school. Performance is measured by the percentage of students in grades 3 and 8 who scored at or above grade level in the spring of 2000 on End-of-Grade (EOG) tests. Obviously some schools with similar poverty levels have widely varying percentages of students meeting the grade level standard, but one cannot miss the clear pattern of higher "absolute" performance with lower poverty concentrations and vice versa.

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Figure 1
Percentage of WCPSS Students at or Above Grade Level By School Poverty
Concentration

y-axis: Composite Reading & Math Percentages At/ Above Grade Level (Grade 3 or 8)

*x-axis: 2000 Percentage of Students on Free/Reduced Lunch*

National research examined a much broader range of school poverty. How effective are schools in WCPSS, in terms of student growth, within the truncated range of poverty found in our district? As previously mentioned, the state's ABCs growth composite is scaled so that "zero" is the statistically expected score for each school. We calculated the expected growth for each school and for subgroups of students who scored in different proficiency levels on the pretest.

Within the range of school poverty found in WCPSS, the achievement growth patterns differ for elementary and middle schools. Figures 2 and 3 show the ABCs growth composite for WCPSS elementary and middle schools with varying concentrations of school poverty. The graphs also show the growth composite scores for low achieving (Level I and II), high achieving (Level IV), and at-grade level (Level III) students.

As shown in Figure 2, elementary schools in WCPSS demonstrate a relationship between school poverty and school performance, although this relationship appears strongest at the "extremes" of the WCPSS range, particularly as the concentration rises *above* 35-40%. In other words, elementary schools at the highest level within WCPSS's range of poverty probably do experience an impact on student growth due to that high concentration.

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Figure 2

Elementary Growth Composite Scores by School Percent Free/ Reduced Lunch
1999-2000
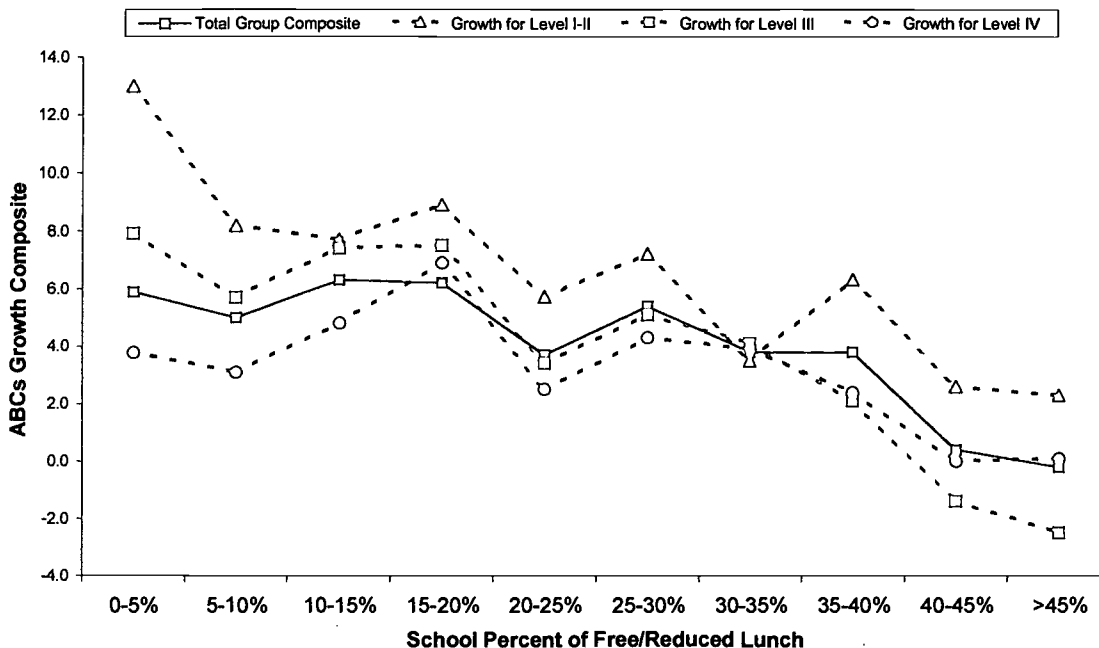
At the middle school level, achievement apparently varies due to many other influences besides the concentration of poverty. In other words, the effect of school poverty is not very noticeable at WCPSS middle schools where growth scores for 1999-2000 were unimpressive overall and the most concentrated school had only 35% of students receiving free- or reduced-price lunch.

Figure 3
Middle School Growth Composite Scores by School Percent of Free/Reduced Lunch Students
1999-2000
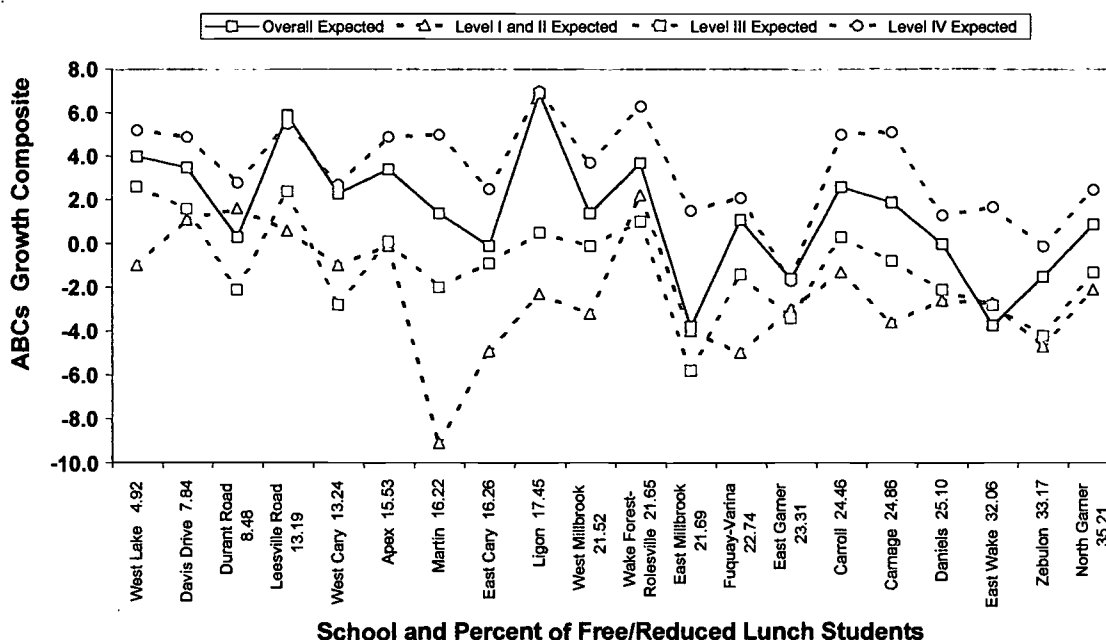
What does all this mean to an individual child's achievement growth?

How big is the impact for an individual child of moving from a low poverty school to a high poverty school? Tables 2 and 3 provide results from regression analyses testing the effect of school poverty on EOG reading and math scores. The analyses controlled for individual students' pre-test scores, special education status, and free-lunch status. School poverty was measured by the percentage of students in the school who received free or reduced lunch.

Table 2 shows how much of the variation in EOG reading and math scores is explained by the variables in the statistical models. The first column for each subject shows the percentage of variance[1] accounted for by all of the other variables *without* the school poverty variable, and the second column shows the percentage of variance accounted for *with* the school poverty variable included. The last column shows the difference between columns 1 and 2, which equals the additional variation in EOG scores explained by adding the school poverty variable. On average, the students' pre-test scores, special education status, and free-lunch status explained about 70% of the variation in reading scores and about 75% of the variance in math scores.

Table 2
School Poverty Impact: Explained Variation in Reading and Math Scores

Grade Level	Reading			Math		
	Excluding School Poverty	Including School Poverty	Difference (Poverty R^2)	Excluding School Poverty	Including School Poverty	Difference (Poverty R^2)
3	59.1%	59.6%	.5%	62.3%	62.4%	.1%
4	70.7%	70.8%	.1%	72.2%	72.3%	.1%
5	70.9%	71.1%	.2%	74.2%	74.6%	.2%
6	73.0%	73.2%	.2%	78.0%	78.1%	.1%
7	71.9%	72.1%	.2%	80.6%	80.6%	0
8	72.9%	73.0%	.1%	81.0%	81.3%	.3%
Avg:	69.7%	69.9%	.2%	74.7%	74.8%	.1%

In context of other variables, school poverty accounted for less than 1% of additional variance in the EOG scores within the range of school poverty found in WCPSS. The school poverty variable was a statistically significant predictor, however, in all the models. The slope coefficients shown in Table 3 provide a more practical interpretation because they show the effect of school poverty in EOG scale score units. The results in Table 3 show that as school poverty increased by 5%, declines in reading scale scores ranged from .10 (grade 4) to .21

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[1] Adjusted R^2

(grades 3 and 8) scale score points. For math, a 5% increase in school poverty reduced math scale scores from .01 (grade 7) to .42 (grade 8). These analyses controlled for pre-test scores, special education status, and individual students' free-lunch status.

Table 3
Effect of School Poverty on End-of-Grade Scale Scores
Controlling for Pre-test, Special Education, and Free-Lunch Status

GRADE	READING		MATH	
	1% Poverty Increase	5% Poverty Increase	1% Poverty Increase	5% Poverty Increase
3	-.042	-0.21	-.014	-0.07
4	-.020	-0.10	-.017	-0.08
5	-.023	-0.11	-.023	-0.11
6	-.030	-0.15	-.056	-0.28
7	-.033	-0.16	-.003	-0.01
8	-.042	-0.21	-.084	-0.42

Note: All coefficients are significant at the .0001 level.

While these scale score changes may not seem educationally significant, they can be. Take for example the predicted scale score change for a student in 8th grade who moved from a school with a concentration of 40% free- or reduced-price lunch to a school with a 20% concentration of free- or reduced-price lunch. The statistically predicted decline of .84 scale score points (20 percent change in school poverty, multiplied by −.042) is about a fourth of a year's worth of growth in reading at that grade level. The actual size of the impact might vary for individual students, but the point is that the impact could be important for students on the average.

Conclusion

WCPSS has fewer than 10 schools with poverty concentrations that might be considered "high" in a national context; i.e., greater than 40%. Thus, it was important to compare the national research findings with specific data on WCPSS. As shown in the Figure 1 scatter plot, poverty concentration has an impact on the percentage of students scoring at or above grade level in WCPSS schools, but this is not surprising because of the correlation between the individual student's socioeconomic status and test scores.

In terms of achievement *growth*, school poverty also has a small, statistically significant, negative effect on EOG scores in WCPSS, but the magnitude of the effect varies across grades and subjects. Small differences in school poverty levels (e.g. 25% vs. 30%) are unlikely to have a major impact on students' EOG scores. However, large differences in poverty levels (e.g. 5% vs. 40%) can be expected to have a one to two point negative impact on EOG scale scores. If we consider that just two scale score points can equal one-third to two-thirds of a year's growth in some grade levels and subjects, differences of that magnitude are probably not only statistically significant but educationally significant, as well.

E&Rsec\isenzig\Poverty in WCPSS2.doc\03/30/01

Appendix A

Tests for the Curvilinear Effects of School Poverty on EOG Scores
By Grade and Subject*

GRADE	READING				MATH			
	Main Effect	2nd Order	3rd Order	4th Order	Main Effect	2nd Order	3rd Order	4th Order
3	.0001	.0147	.0745	**.0015**	.0001	ns	ns	**.0014**
4	.0001	Ns	**.0001**	ns	**.0001**	ns	ns	ns
5	**.0001**	Ns	ns	ns	**.0001**	ns	ns	ns
6	.0001	Ns	ns	**.0005**	.0001	.0003	.0001	**.0006**
7	**.0001**	Ns	ns	ns	.0001	.0001	**.0001**	ns
8	**.0001**	Ns	ns	ns	.0001	.0001	**.0001**	ns

Note: Figure 2 shows probability values; ns = not significant. The highest-order effect is shown in bold.

School poverty affected EOG scores for all grades in both reading and math. This figure shows the results of tests to determine if the effect of school poverty was linear or non-linear ($p<.01$). In reading, school poverty had a *linear* relationship to EOG scores for the 5th, 7th, and 8th grades. However, the effect of school poverty was *non-linear* for 3rd, 4th, and 6th grades. The 4th grade regression line had two bends while the 3rd and 6th grades had three bends.

In math, school poverty had a *linear* effect on EOG scores for 4th and 5th graders, and a *non-linear* impact for 2nd, 6th, 7th, and 8th graders. The regression lines for 3rd and 6th grades had four bends while 7th and 8th grades had three bends.

Across both reading and math, non-linear effects were apparent for 3rd and 6th grades. For these grades, the math and reading regression lines had four bends.

When regression lines bend more than once, it becomes difficult to interpret the non-linear effects in a meaningful way. Caution should be used when making policy decisions based on 3rd and 4th order non-linear effects.

Appendix B
Results for Students on Free- or Reduced-Price Lunch

Students on free- and reduced-price lunch score across the entire range of achievement levels but their growth patterns do not necessarily resemble growth patterns for students who are not on free- and reduced-price lunch. Therefore, we wanted to determine if the relationship between school poverty and achievement was evident for this subgroup of students, as well as the groups of achievement levels (I – IV) already portrayed in the previous section of this report. Figure 4 shows the ABCs growth for F/RL students as a function of school poverty.

**ABCs Growth Composite for Free and Reduced Lunch Students
By Levels of School Poverty**
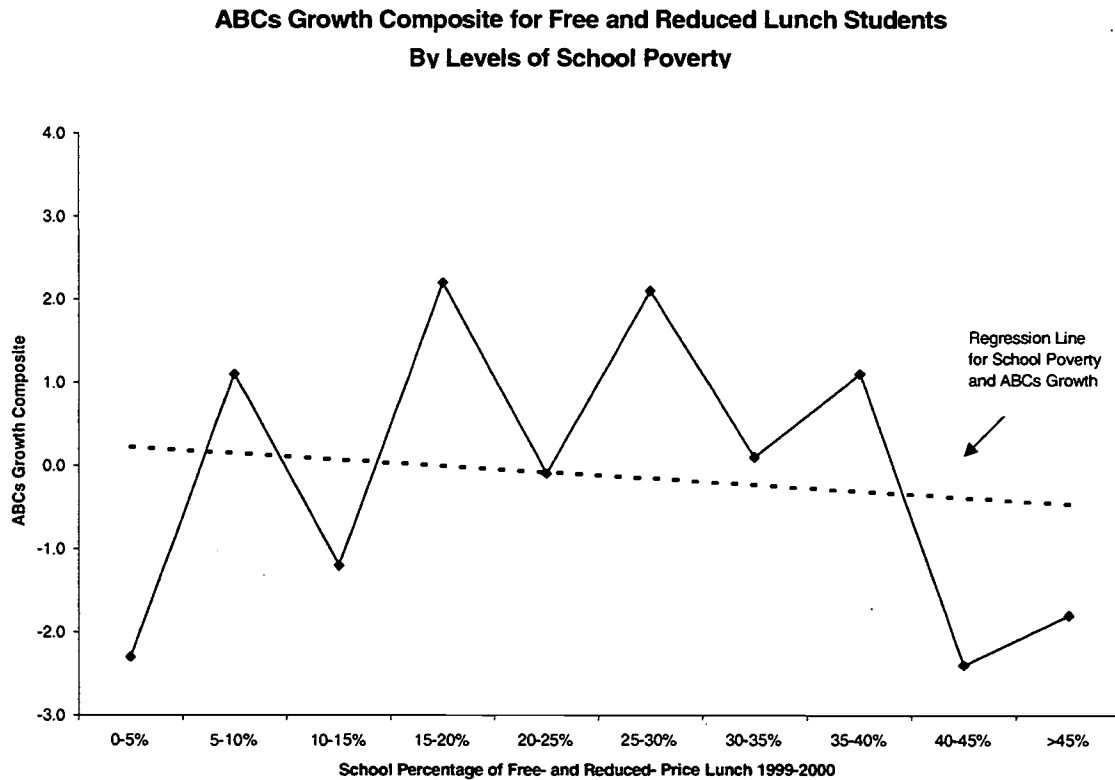
The regression line above indicates a negative correlation between school poverty and student growth, but the irregular distribution of data points for the various groups of schools also indicate other sources of variation in achievement for students receiving free- and reduced-price lunch.

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