New Research Findings

New research shows that Nebraska’s smaller school systems reduce the harmful effects of poverty on student achievement.

Background

A series of studies in eight states (Alaska, Arkansas, California, Georgia, Montana, Ohio, Texas, and West Virginia) indicates that smaller schools and districts reduce the harmful effects of poverty on student achievement and help narrow the achievement gap between students from less affluent communities and students from wealthier communities (Bickel & Howley 2000, Friedkin & Necochea 1988, Howley 1996, Howley and Bickel 1999, Huang & Howley 1993, and Johnson, Howley, & Howley 2002). The implication is that the less affluent a community, the smaller the school and district serving the community should be in order to maximize student achievement. The current study applies the same research model to Nebraska, and yields findings that are consistent with those from other states.

The Nebraska findings are:

1. Poverty has a substantial negative effect over student achievement in Nebraska’s larger systems but little or no power over achievement in Nebraska’s smaller systems.

2. Across all levels of poverty and affluence, increased system size results in decreased academic achievement at critical grade levels.

Research Design

This study followed the same research models used in the earlier studies to measure how achievement levels relate to school system size and student poverty.
The analysis looked for two kinds of effects:

**The Excellence Effect** of size – Does a school system’s size influence its students’ performance differently depending on the level of poverty in the communities from which the students come? Regression analysis is used to demonstrate how the average achievement scores of school systems vary with changes in size and changes in the level of poverty. Results from this analysis allow us to answer some important questions about the effects of size and poverty on achievement.

1. First, we want to know if the level of academic achievement depends on the level of poverty among students in the school system.
2. Second, we want to know if the level of academic achievement depends on the size of the school system.
3. Third, we want to know if the level of academic achievement depends on the interaction between these two variables. That is, do school system size and student poverty compound each other, multiplying any effect they might have separately, and does the effect of the system size on achievement depend on the level of poverty among the students?

With answers to these questions, we can effectively describe the relationships between achievement, poverty, and size. We call these relationships “excellence effects” because they illustrate the size conditions that offer the maximum potential for increasing academic achievement. Put another way, the analysis measures how the absolute level of performance on tests varies with changes in size and poverty, and demonstrates how the size variable can be used to maximize student achievement.

**The Equity Effect** – Is poverty’s power over student achievement greater in smaller or larger systems? Correlation analysis is used to measure the strength of the negative relationship between poverty level and test scores in larger or smaller school systems. Where the relationship is stronger, poverty has more power in determining achievement outcomes, and the achievement gap between rich and poor is broader; where the relationship is weaker, poverty has less power over achievement, and the gap between rich and poor is narrowed. We call these relationships “equity effects” because they describe what size school systems offer more equitable distributions of achievement (that is, where wealthy and affluent alike share in high achievement), and whether the achievement gap between wealthier and poorer groups of students is relatively broader in larger or smaller school systems.

The excellence effect tells us something about the absolute level of student achievement in relationship to poverty and size. The equity effect tells us something about how much influence poverty has over achievement in smaller versus larger systems.

For this research, the unit of analysis is the system, not the individual student. This is appropriate in today’s policy environment because teachers, administrators, and leaders are increasingly held accountable for the aggregate performance of their students, and because there is a proposal currently under discussion in Nebraska to encourage or induce consolidation of systems with fewer than 390 students.

The research included all districts that were operational in the school year 2001-2002, a total of 754. To achieve the desired system level data, Class I district information was distributed to their affiliate Class II, III, IV, V, or VI district following procedures established by the Nebraska Department of Education for the purpose of calculating state aid. This resulted in a total of 263 systems for analysis. All data used in this study are provided by the Nebraska Department of Education and are available to the general public.

**Nebraska Data**
• In Nebraska, the achievement data used were the percentage of students scoring above the national mean on national norm-referenced tests in two subject areas (reading and mathematics) at grades 3-4, 7-8, and 10-12.

• The poverty level in the systems was measured by the percentage of students in the system who qualify for free and reduced-price lunches.

• The system size was measured by the average daily membership (ADM).

• Achievement, poverty, and ADM data were all downloaded directly from the Nebraska Department of Education.

Nebraska is a state composed mostly of systems that are small by national standards. With the exception of a few large and very large systems, it is almost uniformly small. About 80% of its school systems enroll fewer than 800 students, and just over 50% enroll 390 or fewer students—the enrollment number that has been suggested as a trigger for consolidation inducements.

**Excellence Effects**

In Nebraska there is some evidence that the effect of system size on the average academic achievement of students depends on the level of poverty among the students in the system. Specifically, the less affluent the community, the better students perform in smaller schools and districts. We found this pattern in Nebraska to be evident in all six achievement measures, and to be statistically significant in half of them (reading and mathematics at grades 7-8, and mathematics at grades 10-12). It was strongest at the middle and upper grade levels when students are near or at the age when they are at risk of dropping out.

These findings are strong, but not as strong as comparable findings in most of the other states, except Montana. The relative weakness of these findings may be due to the fact that like Montana, Nebraska’s small school systems simply outperform larger systems no matter the level of poverty in the community. When regression analysis is used to track achievement test scores against system size alone, poverty notwithstanding, all six of the equations show that larger size produces lower scores, and four of the six are statistically significant at very high levels of confidence.

These findings strongly suggest that increased size will result in decreased achievement levels for all student populations, regardless of the level of poverty or affluence.

**Equity Effect: Poverty’s “Power Rating” Is Weakened By Small Size**

We next compared poverty’s “power rating”—its impact on student achievement—in various size categories of school systems. Poverty’s negative impact on achievement is well documented, and indeed, the regression results show that higher levels of poverty produce lower scores on all six achievement measures in Nebraska school systems. The issue here is whether the negative affect of poverty is greater or lesser in smaller school systems than in larger ones.

To analyze this issue, we compare the percentage of the variance in test scores that can be statistically explained by the level of the poverty in the communities served by systems in various size categories. This
“variance” was calculated for size categories based on proposed consolidation plans. Those size categories are:

1. ADM 390 or less – this is the cutoff for consolidation under the proposal being heard by the Legislature’s Education Committee.
2. ADM greater than 390 – all systems not at risk for consolidation under the current proposal
3. ADM 391 to 800 – this is the system size that will most likely result if systems consolidate voluntarily as a result of incentives and enter into only enough consolidations to meet a legal standard (we call this size level the “plausible voluntary” level).
4. ADM 391 to 2500 – this is the range of sizes to be anticipated if systems are more aggressively forced to consolidate (we call this “plausible compulsory”). Districts above 2500 are not likely to result from consolidation.

In keeping with earlier reports, we call the variance statistic poverty’s “power rating” because it suggests how much negative impact poverty has over student achievement in a particular group of school systems.

As in all the other states studied, the Nebraska results indicate that for all achievement measures, poverty’s power rating is lowest in the smallest school systems. In fact, the power rating for poverty in Nebraska’s smallest systems was among the lowest of any group of schools in the nine states we have studied. On some achievement measures, poverty’s influence over achievement virtually disappears in Nebraska’s smallest systems.

Comparing poverty’s power rating in small school systems being proposed for consolidation with each of the larger size categories, we find that:

1. On all six achievement measures, poverty’s power rating is lower in Nebraska’s small school systems than it is in its larger systems. Poverty’s power rating is from 57 percent lower (reading, grades 10-12) to 98 percent lower (mathematics, grades 10-12) in the small systems (see Table 1 and Figure 1).
2. On all six achievement measures, poverty’s power rating is lower in Nebraska’s small school systems than it is in systems of a size that would result from a plausible voluntary consolidation plan (between 391 and 800 ADM). Poverty’s power rating is from 33 percent lower (reading, grades 10-12) to 98 percent lower (mathematics, grades 10-12) in the small systems (see Table 2 and Figure 2).
3. On all six achievement measures, poverty’s power rating is lower in Nebraska’s small school systems than it is in systems of a size that would result from a plausible forced consolidation (between 391 and 2500 ADM). Poverty’s power rating is from 45 percent lower (reading, grades 10-12) to 98 percent lower (mathematics, grades 10-12) in the small systems (see Table 3 and Figure 3).

Conclusions

In Nebraska:

1. Smaller systems are associated with higher levels of student achievement, regardless of the level of poverty or affluence. This relationship is particularly strong at the critical elementary and middle grade levels.
2. Smaller school systems do an excellent job of cutting poverty’s power over student achievement on national assessments of both reading and mathematics, and at every grade level tested. In particular, poverty’s power over achievement on the mathematics assessment at grades 10-12 is negligible.

3. A strategy of system consolidation would likely produce lower test scores in all communities where consolidation occurs, but would hurt children from lower income communities the most.

In interpreting these results, caution should be used to avoid conclusions this study does not support about the quality of the education being provided in Nebraska’s schools.

This study examines the relative performance of Nebraska students in schools of varying sizes serving student populations of various levels of poverty and affluence. The conclusion is unavoidable that Nebraska’s smaller systems do better than larger ones at mitigating the effects of poverty and that the poorer the community, the smaller schools ought to be to maximize student achievement. Nebraska can be added to the growing list of states in which we can safely conclude that “small works” in education, especially for the poor.

This is not to say that either large or small systems in Nebraska do well enough to meet the state’s constitutional standards for public schools, or that they are able to provide their students with an education that is adequate to our times. Those issues lie beyond the scope of this study. From this study we can say that Nebraska’s small school systems are a good public investment. We cannot say they are well invested with public support.

However, they should be. Nebraska has derived substantial benefits from its historic decision to maintain small school systems. Evidence for the equity effect of small systems is very strong. This study reveals that the state’s commitment to small systems has worked well to close the achievement gap between more and less affluent communities. Perhaps Nebraska’s traditionally high level of performance on nationally-normed assessments is in part attributable to the small scale of the state’s educational system.

Small school systems should therefore be an important part of any Nebraska strategy to improve student achievement where it is weak and to sustain it where it is strong. Smallness should be recognized as an educational value and intentionally supported in the state’s school finance system. And it should be encouraged throughout the state, not just where it is “necessary” due to population sparseness. The benefits of smaller scale in schooling should not be denied a child simply because that child lives in a densely populated area capable of corralling large numbers of children into big buildings. Once thought of as a necessary evil at best or an expensive luxury at worst, smallness ought to be regarded and valued as an essential part of an excellent educational system in any community.
### Table 1

**Do School System Size, Student Poverty, or the Interaction Between Size and Poverty Affect Student Achievement in Nebraska?**

Regression Analysis Output for the Relationship Between Student Achievement and Poverty, School System Size, and the Interaction Between Poverty and System Size.

<table>
<thead>
<tr>
<th>The Achievement Measure</th>
<th>Free and Reduced Price Lunch Rate</th>
<th>Average Daily Membership Size</th>
<th>The Interaction Between Poverty and System Size</th>
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</thead>
<tbody>
<tr>
<td>Grade 3 &amp; 4 reading</td>
<td>-.369***</td>
<td>-.214***</td>
<td>-.112</td>
</tr>
<tr>
<td>Grade 3 &amp; 4 math</td>
<td>-.076***</td>
<td>-.223***</td>
<td>-.120</td>
</tr>
<tr>
<td>Grade 7 &amp; 8 reading</td>
<td>-.421***</td>
<td>-.183**</td>
<td>-.175**</td>
</tr>
<tr>
<td>Grade 7 &amp; 8 math</td>
<td>-.372***</td>
<td>-.338***</td>
<td>-.140*</td>
</tr>
<tr>
<td>Grades 10-12 reading</td>
<td>-.303***</td>
<td>-.005</td>
<td>-.079</td>
</tr>
<tr>
<td>Grades 10-12 math</td>
<td>-.230***</td>
<td>-.092</td>
<td>-.185**</td>
</tr>
</tbody>
</table>

*significant at .05  
**significant at .01  
***significant at .001

Notes:

1. The test scores are taken from the nationally norm referenced test results reported on the Nebraska School Report Card at the Nebraska Department of Education Website. All school systems are reported unless there are fewer than 10 students per grade.

2. A negative in either of the first two columns means that as the free lunch rate or system size increases, test scorers on the indicated test decline. A negative in the third column means that as either size or free lunch rate increases, it compounds the negative effects of the other.

3. Since data included all school systems in the state and not merely a sample, tests of statistical significance are not strictly relevant. The actual relationship between these variables is revealed in the statistic. However, tests of significance are useful for the practical purpose of emphasizing the magnitude of these relationships.
Table 2
Nebraska’s Smaller School Systems Slash Poverty’s Power Over Achievement

<table>
<thead>
<tr>
<th>Grades</th>
<th>Math</th>
<th>Reading</th>
<th>Math</th>
<th>Reading</th>
<th>Math</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>Grades 3-4</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>83</td>
<td>68</td>
</tr>
<tr>
<td>Grades 7-8</td>
<td>24</td>
<td>7</td>
<td>7</td>
<td>17</td>
<td>71</td>
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<tr>
<td>Grades 10-12</td>
<td>19</td>
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<td>19</td>
<td>81</td>
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<td></td>
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<tr>
<td>Math</td>
<td>14</td>
<td>6</td>
<td>8</td>
<td>57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. "Larger" means above 390 ADM; "Smaller" means 390 or lower ADM
2. The "Power Rating" is the portion of the variance for achievement scores that can be explained by the level of poverty in the school as measured by free and reduced price lunch. It is calculated by squaring the correlation coefficient.

Figure 2
Nebraska’s Small School Systems Slash Poverty’s Power Over Achievement

Poverty’s Power Rating is the proportion of variance in average test scores that is explained by the level of poverty among students in the school system.
Table 3
Nebraska’s Small Systems Do More To Slash Poverty’s Power Than Systems That Would Result From Voluntary Consolidation

<table>
<thead>
<tr>
<th></th>
<th>Poverty’s Power Rating Is...</th>
<th>Smaller Systems Cut Poverty’s Power By...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Larger Systems</td>
<td>Smaller Systems</td>
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<tr>
<td>Grades 3-4</td>
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<td></td>
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<tr>
<td>Math</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Reading</td>
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<td>7</td>
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<td>Grades 7-8</td>
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<td>7</td>
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<tr>
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<tr>
<td>Grades 10-12</td>
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<tr>
<td>Math</td>
<td>14</td>
<td>.3</td>
</tr>
<tr>
<td>Reading</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

Notes:
1. “Larger” means 390 to 800 ADM; “Smaller” means 390 or lower ADM
2. The “Power Rating” is the portion of the variance for achievement scores that can be explained by the level of poverty in the school as measured by free and reduced price lunch. It is calculated by squaring the correlation coefficient.

Figure 3
Nebraska’s Small Systems Do More To Slash Poverty’s Power Than Systems That Would Result From Voluntary Consolidation

Poverty’s Power Rating is the proportion of variance in average test scores that is explained by the level of poverty among students in the school system.
Table 4
Nebraska’s Small Systems Do More To Slash Poverty’s Power Than Systems That Would Result From Aggressive Consolidation

<table>
<thead>
<tr>
<th></th>
<th>Larger Systems</th>
<th>Smaller Systems</th>
<th>Points</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades 3-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>Reading</td>
<td>19</td>
<td>7</td>
<td>12</td>
<td>63</td>
</tr>
<tr>
<td>Grades 7-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Math</td>
<td>20</td>
<td>7</td>
<td>13</td>
<td>65</td>
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<tr>
<td>Reading</td>
<td>34</td>
<td>7</td>
<td>27</td>
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<tr>
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<td>13</td>
<td>0.3</td>
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<tr>
<td>Reading</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>45</td>
</tr>
</tbody>
</table>

Notes:
1. "Larger" means 390 to 2500 ADM; "Smaller" means 390 or lower ADM
2. The "Power Rating" is the portion of the variance for achievement scores that can be explained by the level of poverty in the school as measured by free and reduced price lunch. It is calculated by squaring the correlation coefficient.

Figure 4
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Poverty’s Power Rating is the proportion of variance in average test scores that is explained by the level of poverty among students in the school system.
References:


