MORE DOESN'T MEAN BETTER:

Larger High Schools and More Courses do not Boost Student Achievement in Iowa High Schools

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Introduction

In March 2005, Governor Tom Vilsack and a committee of 12 legislators endorsed a set of proposals intended to "make Iowa's public schools more efficient and improve student achievement." Among the proposals was one calling for an education commission that would recommend to the 2007 Legislature a minimum school district and high school size.

This is not the first time that Iowa's smaller school districts and high schools have been described as a barrier to improving public education. In January 2003, then Iowa Department of Education Director Ted Stilwill presented a set of rural education recommendations which included calls for reorganizing districts to ensure a minimum high school size of 200 students.[1] Of note, the reasons given for the intent to create larger districts were academic, not financial—i.e., the report dismisses the notion that district consolidation might improve fiscal efficiency and focuses on the influence of high school size on curricular offerings and academic achievement.[2] The state's findings with regard to small districts and fiscal efficiency are consistent with other research suggesting that consolidation is not likely to save much money in Iowa.[3]

And it's not just policymakers. A November 25, 2005 Op Ed piece in the *Des Moines Register* drew on findings from the state's annual *Condition of Education Report* to offer support for consolidating school districts as a means of addressing "the obvious inefficiency of operating so many school districts and the difficulty many small districts have, particularly at the high school level, in providing a first-rate education."[4]

More recently, the Institute for Tomorrow's Workforce, a group comprised of Iowa business people and educators, issued a report in January 2006 that recommends reviewing whether high schools with fewer than 400 students and school districts with fewer than 700 students can offer the rigorous courses that will adequately prepare students for the workplace.[5]

In light of these calls for consolidating school districts to create larger high schools offering more course units as a means of raising student achievement, we set out to investigate the relationship

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[1] See www.state.ia.us/educate/ootd/reports/rerec.doc.

[2] Interestingly, Stilwill locates the cause of the problems associated with smaller high schools in the state's funding formula. Specifically, his claim that smaller district size is a barrier to high student achievement is supported by the following series of assertions: (1) the state funding formula operates to provide larger high schools with twice the funding to support their high school teaching staff; (2) less money available means smaller districts must pay their teachers less, and makes it more difficult for these districts to compete for teachers, particularly in difficult-to-staff areas like math and science; (3) unable to recruit and/or retain teachers, high schools in smaller districts are thus unable to offer the breadth of curricular offerings necessary to ensure a high quality high school education.

[3] Edelman, M. (2000). *Potential cost savings and framework of strategies for improved delivery of government services*. Ames, IA: Department of Economics, Iowa State University. See http://www.cvcia.org/content/consolidation/improved.delivery.of.government.services.pdf

[4] See www.DesMoinesRegister.com article ID: des2005112511114656

[5] See http://www.tomorrowsworkforce.org/ITW_2005-2006_Report.pdf

between student academic performance and enrollment size/number of course units offered.[6] Our intent was to determine what influence, if any, enrollment size and the breadth of curricular offerings has on student performance. Two primary research questions guided the analyses:

1. In what ways and to what extent does student academic achievement vary among Iowa school districts of varying enrollment size?
2. In what ways and to what extent does the number of high school course units impact academic achievement in Iowa school districts?

The research questions were addressed using standard statistical procedures (independent samples t-tests, bivariate correlation analysis, and multivariate regression analysis). The analyses included all districts operating a high school during the 2003-2004 school year (a total of 344 districts), and used the most recent data available (achievement data from 2002-03 and 2003-04; demographic data from 2003-04 and from the 2000 Census). All data were obtained from the Iowa Department of Education, the National Center for Education Statistics, and the U.S. Census Bureau, and are available to the general public.

Measuring Student Achievement

Arguments about the ineffectiveness of Iowa's smaller high schools and calls for consolidation of school districts often rely on average ACT scores as a measure of student performance. Specifically, consolidation proposals cite lower average ACT scores among the state's smallest high schools as evidence that they are not effective at providing high quality educational opportunities. However, there are several reasons why ACT scores do not provide a good measure of how well Iowa's high schools are educating all students. Some are limitations associated with the test itself:

1. Not every Iowa student is tested—students choose whether or not to take the test, presumably on the basis of their postsecondary plans (thus, scores reflect the performance only of those students planning to attend college and are not reflective of the student body as a whole).
2. Individuals who take the test more than once tend to score better on re-takes. This probably gives an advantage to schools with higher income test-takers, since the test-taker pays for the test.
3. Individuals who receive additional test preparation services and materials tend to improve their scores. And, the additional cost of these services and materials—as much as $495 for test preparation software from ACT—creates an advantage for schools with more test-takers from higher income families.

Other reasons why ACT scores are not reliable measures of school performance are specifically related to the Iowa context. A higher proportion of students in Iowa's smaller districts (enrollment below 400) take the ACT than do those in Iowa's larger high schools—10% higher than in all districts with more than 400 students, and 44% higher than in the state's largest

[6] Of note: we do not attend to the argument that fiscal efficiency offers a justification for setting a minimum district size, as the state has already investigated the issue and predicted that savings would be minimal—at best, shifting $6 million (.14%, or about one-seventh of one percent) of expenditures from administration to instruction.

districts.[7] Higher participation rates are a positive for small districts in the sense that more students from smaller districts are choosing to pursue postsecondary opportunities. However, the higher participation rates for smaller districts would also tend to lower the average score, since a broader range of students are taking the tests. This might be termed the small school *aspiration discount* and it makes comparison of ACT scores across size groups less than reliable.

Higher poverty rates among Iowa's smaller districts have a similar effect—call it the *poverty discount*. Higher poverty rates tend to lower the mean score for the district, and Iowa's smaller districts have significantly higher levels of poverty than larger schools. In fact, including statistical controls for socioeconomic status might very well show that—relative to poverty—there is no real difference in ACT scores between larger and smaller districts, or even that smaller districts were doing better. Unfortunately, we did not have the data required to test this hypothesis.

These ACT-based distortions are not present in state-mandated achievement tests in math and reading (the Iowa Tests of Educational Development, or ITED). State participation rates for ITED assessments over the two year period covering school years 2002-03 and 2003-04 are 98.34% (for 11th grade reading) and 98.27% (for 11th grade math). Compared with a statewide participation rate for the ACT of 64% over the same time period, the ITED assessments are clearly a better indicator of a school's overall performance. Thus, for these analyses, we chose to focus on 11th grade ITED reading and math assessments (specifically, the percentage of students scoring proficient in 2002-03 and 2003-04) as a measure of high school effectiveness.

T-Test Results

We first conducted independent samples t-tests to determine whether smaller districts and larger districts differed on math and reading proficiency, the number of high school credits offered, and socioeconomic variables. "Smaller districts" refers to those districts with high school enrollments of 200 or less (the number often suggested as a minimum district size). "Larger districts" refers to those with high school enrollments above 200. Table 1 summarizes these results.

Table 1.
Do Iowa's Smaller School Districts Produce Lower Achievement Levels (200 cutoff)?

District size category (*based on 2003-04 high school size*)	Combined math & reading proficiency* (2002-04)	Number of high school credits offered**	Percent students eligible for free or reduced meals (2003-04)	Median family income (Census 2000)**	Percent adult college graduates (Census 2000)**
200 or fewer high school students (n=138)	78.33	57.97	29.6%	$43,810	17.34%
More than 200 high school students (n=206)	78.27	80.16	26.8%	$47,748	23.03%

** Differences are statistically non-significant*
*** Differences are statistically significant at $p \leq .01$*

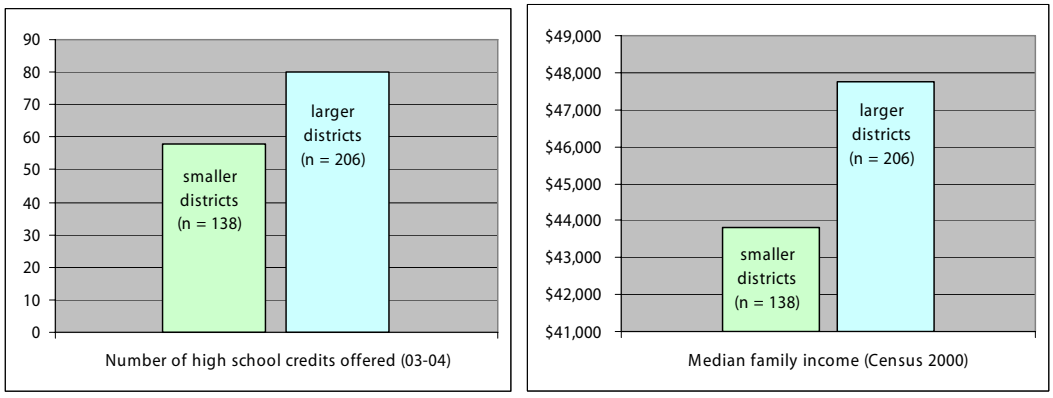
[7] ACT participation data taken from *Iowa Condition of Education 2005* report. See http://www.state.ia.us/educate/fis/pre/coer/index.html.

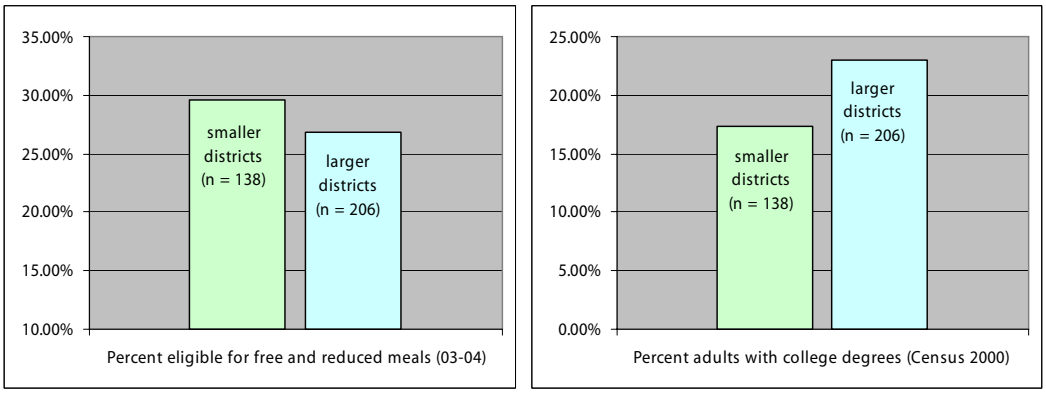
As Table 1 indicates, school districts with high school enrollments of 200 or fewer produce a slightly higher percentage of proficient students than larger districts. T-test results indicated that the differences between scores of larger and smaller districts were not statistically significant, however, and so we must conclude that there is no "real" difference in scores between smaller and larger school districts.[8]

T-test results for the other four variables above yielded highly significant results, and so we can conclude with statistical certainty that smaller school districts in Iowa offer fewer credits (28% fewer) and contend with greater socioeconomic barriers to high student achievement (9.5% higher free and reduced meal rate, median family incomes that are more than $4,000 lower, and nearly 6% fewer adults with college degrees).

In sum, Iowa's smaller districts face greater challenges, and they do so without the higher number of credits offered in larger high schools. Still, their students achieve at the same level. See Figures 1-4 for visual depictions of these comparisons.

Figures 1 – 4.
Challenges, Credits Offered, and Achievement Levels





[8] Strictly speaking, tests of statistical significance are not necessary for analyses where the entire population of cases is used, as opposed to a sample drawn from the population. It is, however, customary in such instances to treat statistically non-significant results as lacking practical significance as well.

We explored these same questions using the 400 student high school enrollment cutoff mentioned in the Institute for Tomorrow's Workforce report, and obtained similar results (see Table 2).

Table 2.
Do Iowa's Smaller School Districts Produce Lower Achievement Levels (400 cutoff)?

District size category (*based on 2003-04 high school size*)	Combined math & reading proficiency* (2002-04)	Number of high school credits offered**	Percent students eligible for free or reduced meals (2003-04)	Median family income (Census 2000)**	Percent adult college graduates (Census 2000)**
400 or fewer high school students (n=252)	78.30	62.77	28.1%	$44,788	18.30%
More than 400 high school students (n=92)	78.28	94.50	27.5%	$49,998	27.53%

** Differences are statistically non-significant*
*** Differences are statistically significant at $p \leq .01$*

Again, the achievement level of smaller districts is slightly higher, but the difference is non-significant. Smaller districts offer fewer credits, and contend with significantly greater socioeconomic challenges (based on two of the three measures; differences for free and reduced meal rate are non-significant in this comparison).

Equity Effects

Results from the T-test analysis indicate that the proficiency levels of Iowa's smaller school districts are equal to those of larger districts, in spite of the fact that they face more substantial socioeconomic barriers to high student achievement. Such results might be interpreted to suggest that the influence of poverty over student achievement is weaker in smaller schools. We can test that hypothesis using bivariate correlation analysis to measure the strength of the negative relationship between poverty and achievement scores in smaller versus larger districts. Where the relationship is stronger, poverty has more power over academic outcomes, and the achievement gap between rich and poor students is wider. Where the relationship is weaker, poverty has less power over academic outcomes, and the achievement gap between rich and poor students is narrower. Previous studies[9] have characterized these relationships as "equity effects" because they describe the size of school districts that offer more equitable distributions of achievement (i.e., where groups of more and less affluent students produce similar levels of achievement).

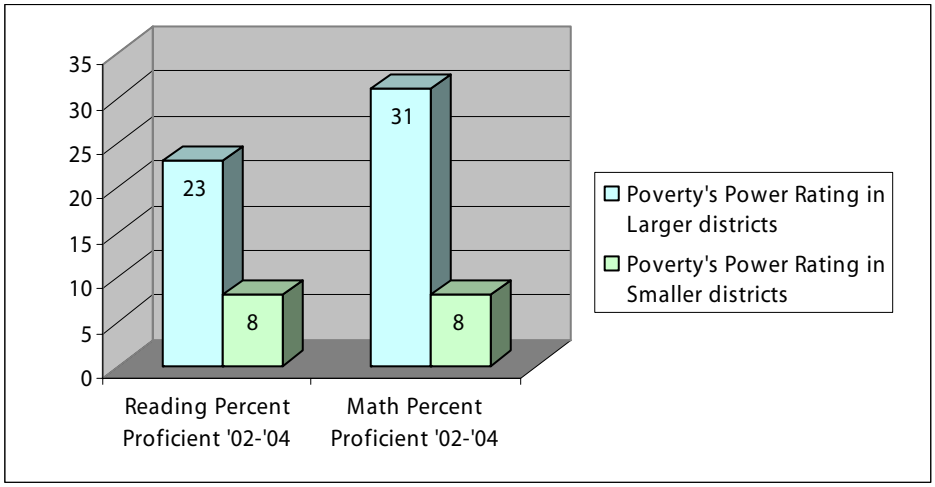
For the equity effects analysis, we compared the proportion of the variance[10] in test scores that can be statistically explained by the level of poverty (the shared variance) in two categories of

[9] See the April 2004 edition of *Rural Policy Matters* (available at www.ruraledu.org) for a summary of relevant studies conducted in 10 states.
[10] In statistical terms, we are computing Pearson's r, then squaring the value of the Pearson's r correlation coefficient to obtain the percentage of variance accounted for by the variable in question (r^2).

school districts: smaller (those districts with 2003-04 high school enrollments of 200 or less) and larger (districts with high school enrollments of more than 200).

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 districts. Table 3 presents the results from the equity effects analysis. Figure 5 depicts the comparisons visually.

Figure 5.
Poverty's Power Rating*



*Note: *Poverty's power rating refers to the proportion of the variance in test scores that can be statistically explained by the level of poverty (the shared variance) in each of the two categories of school districts*

Table 3.
Does Poverty's Power Rating* Differ in Smaller Versus Larger Iowa School Districts (200 cutoff)?

Variable	Poverty's power rating* in larger districts	Poverty's power rating in smaller districts	Point difference	Percent difference
Reading Percent Proficient**	23	8	15	65%
Math Percent Proficient**	31	8	23	74%

*Notes: *Poverty's power rating refers to the proportion of the variance in test scores that can be statistically explained by the level of poverty (the shared variance) in each of the two categories of school districts*
***Correlation results are statistically significant at $p \leq .001$*

Iowa's smaller school districts cut the influence of poverty over student achievement by 65% in reading and 74% in math. For both reading and math, this represents a dramatic narrowing of the achievement gap between rich and poor students in districts enrolling 200 or fewer students, as compared to larger districts in the state.

As with the t-test analyses above, we explored these same questions using the enrollment cutoff mentioned in The Institute for Tomorrow's Workforce report, and obtained similar, if stronger, results (see Table 4).

Table 4.
Does Poverty's Power Rating* Differ in Smaller Versus Larger Iowa School Districts (400 cutoff)?

Variable	Poverty's Power Rating* in Larger districts	Poverty's Power Rating in Smaller districts	Point difference	Percent difference
Reading Percent Proficient**	42	8	34	81%
Math Percent Proficient**	52	10	42	81%

*Notes: *Poverty's power rating refers to the proportion of the variance in test scores that can be statistically explained by the level of poverty (the shared variance) in each of the two categories of school districts*
***Correlation results are statistically significant at $p \leq .001$*

As Table 4 indicates, the equity effects associated with smaller schools are even stronger when using a 400 student cutoff. Using this approach, Iowa's smaller school districts cut the influence of poverty over student achievement by 81% in both reading and math.

Excellence Effects

To further explore the relationship between student achievement, socioeconomic challenges, district size, and high school credits offered, we next performed a multivariate regression analysis. This type of investigation allows us to demonstrate how the achievement scores of districts vary with enrollment size and the level of poverty. This analysis does not require any arbitrary cutoff defining what a "small" district is. It takes each school as it finds it on the spectrum of small to large and compares it with others.

Results from the analyses allow us to answer some important questions about the effects of size and poverty on student achievement in Iowa:

1. Are the levels of reading and math proficiency dependent upon the level of poverty among students in the school district?
2. Are the levels of reading and math achievement dependent upon the enrollment size of the school district?
3. Is the influence of poverty on the levels of reading and math achievement itself influenced by the size of the district? That is, do school district size and student poverty interact with each other to influence student achievement?
4. Are the levels of reading and math proficiency dependent upon the number of high school credits offered? (Note: calls for larger high schools argue that the course offerings

in smaller high schools are too narrow and undermine academic achievement for students attending those schools).

With answers to these questions, we can effectively describe the relationships between achievement, socioeconomic status, enrollment size, and curriculum offerings. Previous studies have characterized such relationships as *excellence effects* because they illustrate the conditions that offer the greatest potential for increasing academic achievement. The regression results are presented in Table 5.

Table 5.
Does School District Size, Student Poverty, or the Interaction Between Size and Poverty Affect Student Achievement in Iowa?

Variable	Enrollment size	Free and reduced meal rate	The interaction between poverty and size	Number of credits offered
Reading Percent Proficient	.052	-.353***	-.134*	-.057
Math Percent Proficient	-.053	-.412***	-.126*	-.050

****Statistically significant at $p \leq .001$*
**Statistically significant at $p \leq .05$*

The first question sought to determine whether reading and math proficiency levels are influenced by district enrollment size. The answer is no: there is no statistically significant relationship between enrollment size and proficiency levels in reading or math. These results indicate that there no basis for the belief that increasing district size (e.g., through consolidation) will benefit students academically.

The second question sought to determine whether reading and math proficiency levels are influenced by the level of poverty among students enrolled in the district. The answer is yes: poverty exerts a significant influence over reading and math proficiency in Iowa. The influence is negative, i.e., the higher the rate of poverty, the lower the scores in both math and reading. This finding is consistent with 40 years of research on achievement gaps.

The third question sought to determine whether the influence of poverty over achievement depends on the size of the district. The answer is yes: size and poverty interact—specifically, the larger the district, the more magnified the negative effects of poverty over student achievement, and the smaller the district, the more poverty's effects are muted. These results suggest that increased district size in Iowa will increase poverty's power over student achievement in Iowa's schools and widen the achievement gap between wealthier and poorer students.

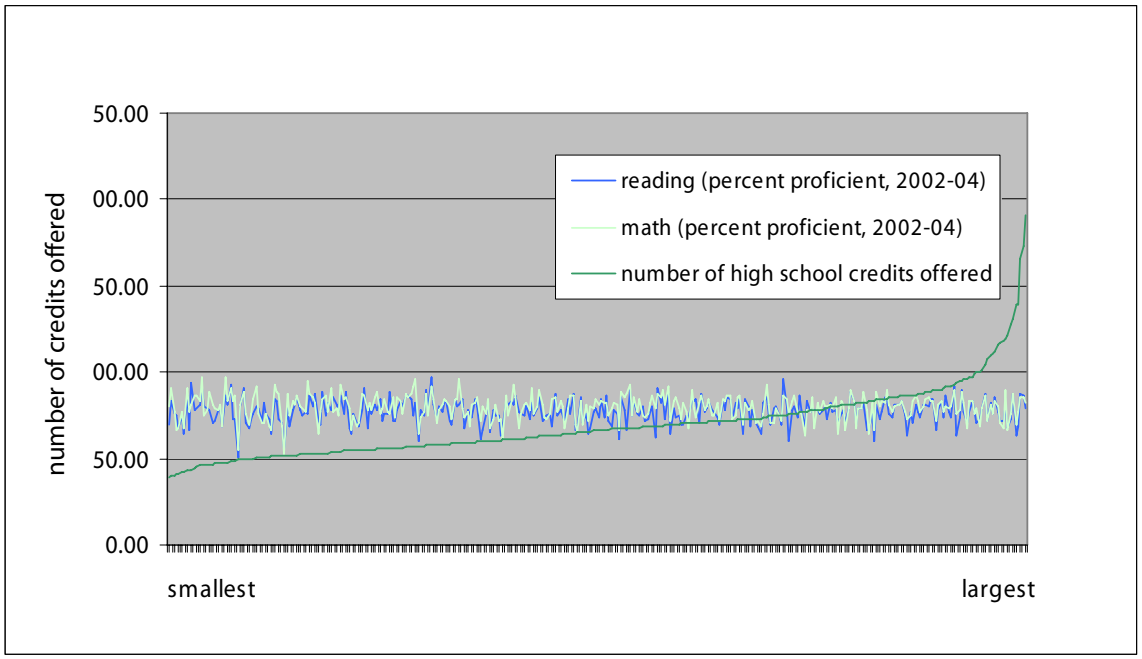
The fourth question sought to determine whether reading and math proficiency levels are influenced by the number of high school credits offered. The answer is no: reading and math proficiency levels in Iowa are not influenced by the number of high school credits offered. To the extent there is any effect, it is mildly negative—the more credits offered, the lower the test scores—but the relationship was not statistically significant. These results indicate that there is

no basis for the belief that increasing the number of high school credits offered (e.g., through consolidation and the creation of larger districts and larger high schools) will benefit students academically.

High School Credits and Student Achievement

As noted throughout, calls for consolidating smaller school districts have been based on the belief that smaller districts with high schools enrolling fewer than 200 cannot offer enough credits to provide students with a high quality education. This belief runs counter to ideas presented in the *Rigor and Relevance* educational philosophy developed by the International Center for Leadership in Education and espoused by the Iowa Department of Education.[11] Results reported in this study suggest that the number of high school credits offered is not an effective or efficient predictor of student achievement. Pictures often speak louder than words, and so we next created a graph showing the math and reading proficiency levels of Iowa's 334 school districts,[12] ranked in order of the number of high school credits offered in the district (see Figure 6).

Figure 6.
Does the Number of Credits Offered in Iowa's Schools Affect Student Achievement?



The curving line beginning just below 50.00 on the left and ending just below 200.00 on the right represents the number of high school credits offered by the district. The two jagged lines moving up and down within the range of 50.00-100.00 represent district proficiency levels in reading and math. If school districts offering more credits produced better results in reading and

[11] See Daggett, W. (2002). *The rigor and relevance handbook*. New York: International Center for Leadership in Education.
See also http://www.state.ia.us/educate/ecese/hsbf/doc/rrhsc_updated_050923.html for the Iowa Department of Education document *Improving Rigor and Relevance in the High School Curriculum*
[12] Note: The 334 school districts do not include the 10 Iowa districts with more than one high school.

math, then we would expect to see the lines representing math and reading proficiency levels follow the general pattern of the line representing number of credits offered. That is not the case. In fact, looking carefully, math and reading proficiency scores indicate a very slight downward trend as credits offered increase. This reflects the findings from the regression results (i.e., the regression coefficient for number of high school credits, while non-significant, was negative for both math and reading). The graph reaffirms that there is no evidence that increasing the number of high school credits offered will have a positive effect on student achievement.

It seems commonsensical enough that high schools offering more credits should be able to provide students with a broader curriculum and a richer educational experience. So why do they not produce higher reading and math scores than schools offering fewer credits? One possible answer is offered by two University of Nebraska researchers,[13] who found that larger schools in Nebraska, on average, offered a broader curriculum but had lower rates of participation across the whole curriculum. The lesson: in larger schools, kids may be offered more but most of them are not needed to fill the classes, and when students are not needed, they hide or get lost. A broader curriculum may mean more for a few kids and less for many other kids. Another possible answer suggested by existing research is related to the types of courses that get added as high schools get larger. Of particular note, as high schools get larger, they tend to do more "tracking" or ability grouping (e.g., offering 10th grade English separately for "college prep" and "general" students).[14] The lesson here: in larger schools, the curriculum may offer more opportunities to avoid rigor in core academic courses. A broader curriculum may mean more places for kids to hide or get lost.

On a related note, larger high schools in Iowa also tend to offer more vocational classes.[15] The addition of vocational courses at the high school level can contribute to a richer educational experience, and is not in and of itself undesirable. Still, the fact that larger high schools tend to offer more vocational courses further contradicts the argument that consolidating districts to broaden curriculum offerings will yield college success dividends.

Moreover, there are ways of fabricating the advantages of large scale without losing the advantages offered by smaller schools and districts. Strategies like distance learning can make it possible to ensure that students have access to the same curricula regardless of where they live.

Conclusions

In Iowa,

- Smaller school districts do not exhibit lower levels of academic achievement than larger districts, despite the fact that they face greater socioeconomic challenges.
- The number of high school credits offered bears no rational relationship to student achievement levels.

[13] Uerling, D. & Dlugosh, L. (1999). Selected indicators of a quality high school: Program offerings and student participation. Paper presented at the annual conference on Creating the Quality School, Memphis, TN.
[14] Oxley, D. Organizing schools into small units: Alternatives to homogeneous grouping. *Phi Delta Kappan 75*(7): 521-526.
[15] Edelman, M. and Knudsen, J. A classic economies of size analysis on average school costs: An Iowa case study. *North Central Journal of Agricultural Economics, 12*(1): 99-108.

- A strategy of consolidating districts to create larger high schools offering more credits *is not* likely to raise student achievement levels.
- A strategy of consolidating districts to create larger high schools *is* likely to magnify the negative effects of poverty on academic performance, widening achievement gaps between rich and poor students.

Consolidating Iowa's smaller districts would not contribute to improvements in student achievement. On the contrary, smaller school districts should be an important part of any Iowa strategy to improve student achievement where it is weak and to sustain it where it is strong. They should be recognized as an educational value and intentionally supported within the state's system of public education.

Iowa has changed, as many have observed. It is ethnically more diverse, and socioeconomic inequalities are greater than they once were. And yes, the education system must change to recognize this. But not everything is wrong about Iowa's school system. The smallness of its schools and districts are an achievement blessing, not a curse, and should remain an important part of the state's strategy to meet the challenging needs of its changing population.