

The Interaction of School Size and Socio-Economic Status on Student Performance

A Review of the Research Evidence

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Key Points

- There is a very large research literature on the effect of school size on student achievement. It generally shows that students perform better in smaller elementary and middle schools while the results for high schools are mixed.
- Much of this research literature over-looks the possibility that school size may be associated with different outcomes for students from different backgrounds. This gap has been rectified by a stream of state-wide and national studies in the US in recent years.
- These new research studies show that:
 - Small school size is unambiguously good for students from low socio-economic status (SES) backgrounds and communities with relatively high levels of disadvantage. Students from low SES backgrounds achieve better results in smaller schools;
 - The negative effect of disadvantage and poverty on student achievement is substantially weaker among smaller schools than among larger schools. The impact of poverty on student achievement in small schools is about half that in large schools;
 - for example, one study shows that those attending the smallest schools experience a 60 per cent reduction in the influence of SES on mathematics performance, a 39 per cent reduction on reading performance, a 50 per cent reduction for science, and a 45 per cent reduction for history;
 - Large schools do academic harm to students from low SES backgrounds. As one study says, increasing school size “imposes increasing ‘achievement costs’ in schools serving impoverished communities”;
 - The more affluent the community, the larger the school can be without damaging achievement levels.
- Small schools should be maintained in low SES communities. Government policies should strengthen the benefits of smaller schools, rather than seek to consolidate small schools.
- Widespread school consolidation, without regard to student background, is likely to increase inequity in schooling outcomes and degrade academic accomplishments.
- Financial savings from the closure and consolidation of small schools are likely to be over-estimated if the impact of consolidation on educational outcomes for students from low SES backgrounds and the achievement gap between low SES and high SES students are not taken into account.

School size research

Research on the impact of school size on student outcomes has a long history and has produced a voluminous literature. It has largely focused on the search for an optimal school size for high schools, with relatively few studies of the influence of school size on primary school outcomes.

The discussion of research findings on the relationship between school size and student outcomes is complicated by the lack of agreement over the definition of small and large schools. Different studies employ widely differing definitions. However, some broad approximations about school size categories can be derived from surveys of research results. Howley [2002] suggests that small schools at the primary or elementary school level are those with less than 200 students and a small secondary school has less than 400 students.

The majority of research studies support the idea that students perform better in smaller elementary and middle schools while the results for high schools are mixed [Howley 2002; Hicks & Rusalkina 2004; McMillen 2004; Stevenson 2006]. An overview of the research on school size prepared by the Education Commission of the States [ECS n.d] in the US states that, despite these uncertainties, researchers have reached broad consensus on several key issues:

- Under the right conditions, as schools get smaller they produce stronger student performance as measured by attendance rates, test scores, extracurricular activity participation and graduation rates;
- Smaller schools appear to promote greater levels of parent participation and satisfaction, and increase communication between parents and teachers;
- Teachers in small schools generally feel they are in a better position to make a genuine difference in student learning than do teachers in larger schools;
- There appears to be a particularly strong correlation between smaller school size and improved performance among poor students in urban school districts. These findings provide evidence that smaller schools can also help narrow the achievement gap between white/middle class/affluent students and ethnic minority and poor students;
- Smaller schools provide a safer learning environment for students.

Similar conclusions from a review of studies on school size were made by Caldwell [2005].

There are conflicting findings about the optimal size of schools. Similarly unresolved is the question of when, if ever, a school can be too small [ECS n.d; Lee & Smith 1997; Howley & Howley 2004]. Despite the extensive literature on the relationship between school size and student achievement, there is little research evidence about the lower limits of school size.

A school serving 50 students cannot be judged to be “too small” on the basis of any research known to the authors. [Johnson et.al. 2002]

School size, socio-economic status and student achievement

Until recently, the research on school size has long over-looked the possibility that school size may be associated with different outcomes for students from different backgrounds. This has been rectified in a stream of research studies over the last 10 years. It suggests that the influence of school size on school performance is contingent on socioeconomic status (SES). Several studies have shown that the well-known adverse consequences of poverty for school performance are tied to school size. In brief, as size increases, the mean achievement of a school with less-advantaged students declines and the greater the concentration of less-advantaged students attending a school, the steeper the decline.

This literature stems from a study based on Californian data which demonstrated an interaction between size and SES such that large schools benefited affluent students, whereas small schools benefited students from low socio-economic backgrounds [Friedkin & Necochea 1988].

A replication of the California study in West Virginia found that the direct association of size and student achievement is neither practically nor statistically significant, but, instead socioeconomic status governs the relationship [Howley 1995]. As in the California study, large size benefits affluent students, but afflicts impoverished students and vice versa. Further, as in the California study, the negative effects of size on the achievement of impoverished students are much stronger than the positive effects of size on affluent students.

Following this study, a series of similar state-level studies were conducted in Arkansas, Georgia, Montana, Ohio, and Texas [Bickel & Howley 2000; Howley & Bickel 2000; Bickel et.al. 2001; Johnson et.al. 2002; Howley & Howley 2004]. The overall conclusion was that students from low SES backgrounds have higher achievement in smaller schools and as schools become larger, the negative effects of poverty on student achievement increases.

In short, as schools get larger, average achievement among schools enrolling larger proportions of low socioeconomic-status students suffers...

Smaller schools diminish the achievement disadvantages associated with being poor. Larger schools, by contrast, exaggerate these disadvantages. [Bickel et.al. 2001]

The effect varies from very strong (California, Georgia, Ohio, Texas, and West Virginia) to weak (Montana), although the preponderance of small schools in essentially rural states may account for the latter [Bickel & Howley 2000].

The studies also show that larger schools serve the same function for more affluent communities. Generally, the more affluent the community, the larger the school can be without damaging achievement levels [Howley & Howley 2004]. However, in some cases the benefit of larger schools among affluent communities was comparatively weak and more limited [for example, see Johnson et.al. 2002].

The benefits of small schools for students from low SES backgrounds appear to be particularly important in the middle years of schooling, when students become susceptible to dropping out of school [Howley & Bickel 2000].

These state-level studies also demonstrate an equity effect in that the relationship between SES and achievement is substantially weaker among smaller schools than among larger schools. At all grade levels for a variety of alternative measures of SES, and for quite different sorts of achievement tests (both criterion-referenced and norm-referenced), the amount of variance in school achievement associated with SES is substantially less in smaller schools than in larger schools. In most cases, the magnitude of the relationship among the smaller schools is about half what it is among the larger schools [Bickel & Howley 2000]. In some cases, the correlation between poverty and low student achievement is 10 times stronger in larger schools than small schools [Howley & Bickel 2000]. Smaller schools thus “mitigate” the effect that SES has on student achievement.

A similar state-wide study of South Carolina schools conducted by a different research team found that small middle schools in poor districts and large schools in more affluent districts tend to have a positive impact of school performance.

In general, the hypothesis generated from the literature that smaller scale tends to be more effective in promoting student achievement for low socioeconomic student populations while large scale is better for higher income populations was generally confirmed for middle and high schools in South Carolina. [Miley & Associates 2003: 54]

Similar results have also been reported separately for Maine [Rural and Community Trust 2005a, Coladarci 2006]. For both reading and mathematics, achievement was shown to be increasingly related to poverty as school size increased, and decreasingly related to poverty as school size decreased.

An exception to the above findings is a study of two school districts in Kentucky which found that small school size does not appear to moderate the impact of poverty on school performance [Roeder 2002]. However, a recent study of Kentucky schools on a state wide basis supports the conclusion that small schools tend to produce better outcomes for low income students than large school [Rural and Community Trust 2005b].

A state-wide study of Washington schools using the methodology of the Howley & Bickel team partially replicated the findings of these studies [Abbott et.al. 2002]. It found a tendency for larger schools to be somewhat more beneficial for student achievement in more affluent districts (and, equivalently, for smaller schools to be more beneficial in less affluent districts). However, this tendency was not found to be statistically significant. The study did conclude that small schools appear to have the greatest equity effects, that is, the relationship between SES and achievement was weaker in small schools.

Some recent studies have found similar results in terms of the relationship between school district size and SES background of students in Nebraska, Missouri, Iowa and

South Carolina [Johnson 2004a, Johnson 2004b, Johnson 2006, Miley & Associates 2003].

The statewide studies universally used test score data aggregated at the school and district level rather than student level data. A recent US study used national student-level test data for mathematics, reading, science and history in the grade 8 cohort and found similar results to the state school- and district-based studies [Howley & Howley 2004]. In particular, it found that smaller school size confers an achievement advantage on all but the highest-SES students. In every subject, with and without control of prior achievement, the observed means for the lowest SES quartile were higher in smaller than in larger schools. In each case, the results were statistically significant. However, in contrast to the general findings of the statewide studies, the study suggests that larger school size does not significantly improve performance among affluent students.

The study also confirmed the results of the statewide studies that small school size mediates the otherwise strong association between SES and student achievement. In comparison to the relationships between achievement and SES that prevail among students attending the largest schools, those attending the smallest schools experience a 60 per cent reduction in the influence of SES on mathematics performance, a 39 per cent reduction on reading performance, a 50 per cent reduction for science, and a 45 per cent reduction for history.

Other national and statewide US studies demonstrate that achievement gaps between different sub-groups of students in high schools tend to be greater in larger schools [Lee & Smith 1997; McMillen 2004]. While the Lee & Smith study attributed greater achievement disparities in larger schools to the relatively low performance of less advantaged students in those environments, the McMillen study raises the possibility that these disparities may in some cases be due to the relatively high performance of more-advantaged students in larger schools.

Assessment of methodology

All school-level studies use school level data to demonstrate the interaction between school size, SES background and student achievement. The interaction is shown by regressing achievement on SES, school size, and the mathematical product of SES and school size, and then testing the product term for statistical significance. If the slope associated with this term is statistically significant - which researchers have been reporting with remarkable consistency - there is an interaction between SES and school size.

One of the major problems in statistical studies of factors influencing student achievement is controlling for the variety of influences. Variables excluded from testing for a statistical relationship may exert a hidden influence on the findings. For example, differences in student/teacher ratios and teacher quality between schools may account for significant differences in school results. If significant factors are ignored, any resulting relationship between school size and student achievement may be misleading.

Several, but not all, of the studies of the interaction between school size, SES background and student achievement have adjusted for a range of other factors that influence student achievement. Several statewide studies took into account the different racial and ethnic background of students, differences in class size and student/teacher ratios. The inclusion of these factors did not significantly alter the results [Bickel & Howley 2000; Howley & Bickel 2000]. Bickel et.al [2001] confirmed the general findings while controlling for ethnicity, language, size, expenditure per student, and curricular composition factors including special education programs.

The methodology used in these studies has largely withstood rigorous assessment. A particular feature of the literature is that the findings have proved robust for different technical specifications of the modeling procedures used for the statistical analysis, which is a rare degree of consistency in educational research [Bickel et.al. 2001]. Also, there is no evidence that the ameliorative role of smaller schools in the SES-achievement relationship is the result of less variability in either student SES or student achievement among smaller schools than among larger schools [Coladarci 2006].

Another possible source of statistical bias is the greater volatility of school achievement scores from one year to the next for smaller schools compared to larger schools. It is possible that the lower SES-achievement correlation among smaller schools is an artifact of the demonstrated lower reliability of school achievement scores for such schools. Coladarci [2006] tested for such an artifact in his study of school data for Maine by repeating the analysis for successively less volatile collections of schools for both reading and mathematics. The hypothesis was that if the poverty-size interaction is a statistical artifact due to the lower reliability of school-level achievement among smaller schools, then this interaction should attenuate with successively less volatile collections of schools and be negligible for schools having the least volatility.

The study found that, for reading, the interaction between poverty and school size was not systematically smaller for less volatile schools and that the pattern of results was similar for all schools and the group of least volatile schools. However, there was evidence of a statistical artefact in the results for mathematics in that poor reliability of school score results in smaller schools appears to be a plausible explanation of the reduced impact of poverty on school results for these schools. As there was no less volatility in reading scores compared to mathematics, the author was unable to explain the greater robustness of the poverty/school size interaction for reading. Nevertheless, the author concludes that results are insufficient to support the statistical-artifact hypothesis with respect to mathematics achievement because of potential problems in his study such as the under-representation of small schools in the group of least volatile schools.

In short, the celebrated interaction of poverty and school size has survived a sincere attempt to empirically cast doubt on it. Consequently, we can have greater confidence in this interaction than was warranted before. [Coladarci 2006: 16]

Policy implications

The research findings on the interaction of school size and socio-economic status with school achievement clearly demonstrate that small school size facilitates higher academic

achievement for students from low SES backgrounds. Small school size is unambiguously good for students from low SES backgrounds and communities with relatively high levels of disadvantage. Large schools do academic harm to students from low SES backgrounds.

The studies offer no support for government proposals to close small schools, especially those serving communities with significant levels of socio-economic disadvantage. The following conclusion from one study is representative:

Findings from this study obviously offer no support for arrangements that work to increase the size of already small schools, especially those that serve impoverished communities (the common proposal in rural areas)...In light of the findings from this and other studies, concern for achievement and for reducing achievement gaps means that educators and policy makers must search for ways to meet these challenges without closing schools that are already appropriately small. [Howley & Howley 2004: 27]

Indeed, increasing school size may produce educational effects that are the opposite of those that policymakers claim they intend in closing smaller schools [Howley 1995]. Widespread school consolidation, without regard to student background, is likely to increase inequity in schooling outcomes and degrade academic accomplishments [Johnson et.al. 2002].

The research findings also challenge the widespread belief that large schools are less costly to operate than small schools. A significant shortcoming of studies of the cost efficiency of small and large schools is that they are almost universally conducted in terms of cost per student rather than the cost to achieve a given outcome or threshold achievement.

It is clear that school costs should be looked at in conjunction with outputs and school size in both theoretical analyses and empirical studies. How well students do in school, and not simply the size of the student body, obviously affects the cost of educating students. Students who take more than four years to graduate, for example, will cost more than those taking only four years to graduate. A greater number of students taking more than four years to graduate raises a school's cost per graduate. [Steifel et.al. 1998: i]¹

Not only do studies of the financial efficiency of large schools largely ignore the impact of size on educational outcomes, they also ignore the impact on educational equity.

As with much contemporary educational research, equity questions are usually dismissed as irrelevant to the school size discussion, at least when fiscal efficiency is at stake. [Bickel et.al. 2001]

Financial savings from the closure and consolidation of small school are likely to be over-estimated if the impact of consolidation on educational outcomes for students from low SES backgrounds and the achievement gap between low SES and high SES students are not taken into account.

...we advise that education decision makers refrain from adopting policies that enforce widespread consolidations and school closures. The belief that smaller schools and districts are more expensive to

¹ This study of New York high schools demonstrated that though smaller schools have somewhat higher costs per student, their much higher graduation rates and lower dropout rates produced among the lowest cost per graduate in the entire New York City system.

operate is generally given as the reason for consolidation and closure, yet the existing literature suggests (a) money is not saved and (b) educational outcomes are likely to be harmed. Smaller schools and districts may be *somewhat* more expensive to operate than larger districts and schools, but that marginally greater expense seems, on the basis of this study and others like it, to be required to improve the adequacy and equity of educational *outcomes*—measured as student achievement on state-mandated tests. Very large districts and schools, however, are both ineffective (they exhibit poor educational outcomes) *and* inefficient (they are more costly). [Johnson et.al. 2002]

The policy implication of research on the interaction of school size, socio-economic status and school achievement is that government policies should strengthen the benefits of smaller schools, rather than seek to consolidate small schools.

If improving student achievement and narrowing the achievement gap between children from the most affluent and the least affluent communities is a policy goal, governments should consider adopting policies favouring smaller schools, especially in the least affluent communities [Howley & Bickel 2000: 11].

A key practical policy recommendation arising from these research studies is that small schools should be maintained in low SES communities [Howley 2002; Howley & Howley 2004]. The most impoverished communities should be served by the smallest schools. Small schools should be sustained and built in areas of low SES status and areas of mixed class composition.

However, appropriate and adequate support should be provided to these schools because while small schools improve the odds of success in disadvantaged communities they do not guarantee it. Operating smaller schools in impoverished communities is good policy, but it is not a “magic bullet.”

A further implication is that governments should avoid building or consolidating schools into mega-schools [Howley 2002].

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