Final School Size Study Report: Impact of Smaller Schools

Prepared for
Maryland State Department of Education

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The Maryland General Assembly enacted Chapter 288, Acts of 2002 – the Bridge to Excellence in Public Schools Act, which established new primary state education aid formulas based on adequacy cost studies using the professional judgment and successful schools methods and other education finance analyses that were conducted in 2000 and 2001 under the purview of the Commission on Education Finance, Equity and Excellence. Over the next six years, state funding was phased in to implement the Bridge to Excellence Act, which reached full implementation in the 2008 fiscal year. Chapter 288 called for a follow-up study of the adequacy of education funding in the state, to be undertaken approximately 10 years after the 2002 enactment. This study is required to include, at a minimum, adequacy cost studies identifying the following: a base funding level for students without special needs; per-pupil weights for students with special needs which could then be applied to the base funding level; and an analysis of the effects of concentrations of poverty on adequacy targets. The adequacy cost study is to be based on the Maryland College and Career-Ready Standards (MCCRS) adopted by the State Board of Education. The study should include two years of results from new, MCCRS-aligned Maryland state assessments. These assessments are scheduled to be administered beginning in the 2014-2015 school year.

There are several additional components mandated to be included in the study. These components include evaluations of the following: the elements of school size and its impact on educational delivery; the Supplemental Grants program; the use of Free and Reduced Price Meal eligibility as the proxy for identifying economic disadvantage; the federal Community Eligibility Program in Maryland; prekindergarten services and funding; the current wealth calculation; and the impact of increasing and decreasing enrollments on local school systems. The study must also include an update of the Maryland Geographic Cost of Education Index.

APA Consulting (APA), in partnership with Picus Odden and Associates and the Maryland Equity Project at the University of Maryland, will submit a final report to the State no later than October 31, 2016.

This report on the impacts of school size is required under Section 3.2.2 of the Request for Proposals (R00R4402342), and is the third and final school size report. This report presents the analyses and findings from the first two school size reports along with analyses and findings from the current study. The current study examines the impacts of school size on student achievement and school operating costs; examines the relationship between school size and school climate; examines the relationship between school size and extracurricular participation; presents a review of factors influencing school size; proposes alternative methods for creating smaller learning environments; and discusses the potential impact of smaller school guidelines on Maryland's school construction funding programs. Finally, this report presents the research team's recommendations regarding school size.

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Executive Summary

This report on the impacts of school size is required under Section 3.2.2 of the Request for Proposals (R00R4402342), and is the third and final school size report. The report reviews the analyses and findings from the first two school size reports and introduces new analyses, findings, and recommendations on school size. This new content includes the following:

- an extension of the findings from the literature review on the impacts of smaller schools on student achievement, efficiency, and school climate;
- an identification of models for establishing smaller schools, as taken from the literature;
- an assessment of the impact of smaller schools on student achievement, school operating costs, and school construction funding in Maryland; and
- a presentation of recommendations on maximum school size.

To develop an optimal school size, multiple factors must be considered. The school sizes recommended herein are not made with the assumption that smaller schools are necessarily better schools. Rather, the recommended school sizes are based on the following findings and factors:

- the mixed results reported in the literature with respect to optimal school size;
- the mixed results of experimentation with small school designs across the country;
- the analysis of actual data on operations, achievement, and discipline in Maryland schools; and
- the school size parameters currently in use in several Maryland Local Education Agencies.

The study team has developed two recommendations for state policy makers to consider, each related to school size:

1. Create a policy establishing maximum school sizes by school level (elementary, middle, and high). These maximum school sizes would be set at the enrollment levels at which school operating costs were no longer benefiting from economies of scale and where student performance begins to decrease due to larger school size.
2. Institute a competitive grant program to support the construction of small schools and/or the renovation of existing large school buildings. Such a program would help accommodate school-within-school models – that is, the program would be targeted toward replacing or reconfiguring the lowest-performing large schools in the State.

The research team has suggested enrollment limits based on the points at which schools in Maryland start becoming both less cost efficient and less productive. These enrollment limits are set at 700 students for elementary schools, 900 students for middle schools, and 1,700 students for high schools. The study team does not recommend that schools in Maryland should be this large, but no newly constructed schools should be allowed to exceed these limits.

The second recommendation suggests that the State should develop a small schools incentive grant program. Such a program would provide financial incentives and support for replacing the State's largest, low-performing schools or for renovating existing large school buildings. Based on the research team's set of assumptions, up to 74 schools would be eligible for this type of grant. The estimated costs vary, but will ultimately be controlled by the fiscal decisions of state policy makers.

Introduction

Since the passage of the No Child Left Behind Act in 2001, policy makers at all levels have worked to reform education programs and services so that *all* students have equitable access to an adequate education that can be sustainably funded through available revenue streams. After a decade of implementation and evaluation, a number of reforms have shown promise in improving education outcomes for all students. One such reform is the creation of smaller learning communities (Oxley et al., 2006). The Maryland State Department of Education (MSDE) asked the study team to examine the effects of school size on student academic achievement and operational efficiency. In the first report on this topic, the *Summary of School Size Report,* the team completed the following tasks:

- described current Local Education Agency (LEA) policies regarding school size in Maryland;
- studied other states' policies and best practices regarding school size; and
- conducted research on school size and its impact on student academic achievement and expenditures.

The first two reports on school size (the *Preliminary Impact of School Size Report* and the *Summary of School Size Report*) reviewed the research on the effects of school size. This research suggested that smaller schools may positively influence key education climate factors, such as student engagement, teacher and parent satisfaction, and student social behavior. Research also suggests that the positive influences on students are strongest for students from lower-income families.

In this final report to examine the effects of school size on student achievement and operational efficiency, the study team undertook the following tasks:

- updated data and information from the *Preliminary Impact of School Size Report,* presented to MSDE on January 23, 2015;
- identified other states' best practices related to school size and public input;
- expanded on previous analysis of literature on the effects of smaller schools;
- identified models for establishing smaller schools;
- assessed the impact of different factors (e.g. local public facilities ordinances and school attendance boundaries) on school size;
- provided a description of programs for financing school construction in the State; and
- provided recommendations on maximum school size, and identified the respective impacts to the State's education funding and school construction program.

Methodology

For this final report, the research team completed a carefully designed analysis to answer the questions set forth in the state's original Request for Proposals (RFP). The analysis involved four main actions:

1. The study team reviewed data collected from LEAs, using online document reviews, local LEA phone interviews, and case studies.
2. The team described emerging trends and perspectives from recognized facility planner professionals based on phone interviews.
3. The team used online databases and other online resources to conduct a thorough review of literature on, and state reports on, school size.
4. The team analyzed data collected from MSDE, LEAs, and other sources, and created a model to assess the cost effectiveness of alternative school sizes.

Completing these four steps allowed the study team to build optimal school size models and to provide overarching school size recommendations. Appendix A denotes how each of the study components helped to address the requirements of the RFP.

In the *Summary of School Size Report* submitted on September 2, 2014, the study team presented findings on Maryland's existing school size policies; other states' school size policies; best practices for facility management and school administration; and the educational implications of school size. The study team also presented a preliminary summary of the literature and research on the effects of school size.

In the *Preliminary Impact of School Size Report* submitted on January 23, 2015, the study team expanded on the previous literature review (in the *Summary of School Size Report*) and described several models of smaller schools.

In this document, the study team reports on the impacts of school size on Maryland schools in terms of educational outcomes, extracurricular activities, operating costs, and construction costs. In this document, the team also presents recommendations for the size of schools in the State.

Data Collection

For the *Summary of School Size Report*, the study team conducted a comprehensive review of the documents and data available on the MSDE website, and, subsequently, on each LEA's website. The study team contacted LEA facilities planning directors to review LEA school size policies, to clarify any information not publicly available on the LEA websites, and to discuss (through a formal interview process) the factors that affect school sizes within LEAs. To prepare for these discussions, the research team searched each LEA website for a school size policy, either within the policies of the Board of Education or in the published Educational Facilities Master Plan (EFMP). Based on the information gathered, the team developed a semi-structured questionnaire to guide each interview. The questionnaire included inquiries about the following topics: school size policies, the impact of school size on educational outcomes, facilities costs, the involvement of the public in school size policy decisions, and other factors potentially influencing the sizes of schools within an LEA. All 24 LEAs provided data related to school size policies. The findings from these interviews inform the sections that follow.

For the current report, the study team gathered a significant amount of quantitative and qualitative data from MSDE, including the following information:

- 2014 enrollment and attendance data, by school;
- 2012 state assessment data, by school, for elementary and middle schools, as well as 2013 assessment data for high schools;[1]
- Free and reduce-priced meals (FARMs), Limited English Proficiency (LEP), and special education enrollment data, by school, for the 2014 fiscal year;
- School staffing and salary expenditure data, by school, based on the 2013 fiscal year *Selected Financial Data* reports;
- 2014 student suspension data by school;
- 2014 square footage, state-rated capacity, and state capital allocation data, by school, based on information from the Public School Construction Program; and
- LEA expenditure reports based on the 2013 fiscal year *Selected Financial Data* reports.

Literature Review

There is a sizeable body of literature related to (1) the impacts of school size on educational achievement and (2) the options for creating smaller learning environments at each educational grade level. Some of the options presented in the literature are as follows:

- schools within schools, including houses or academies within high schools;
- pods or clusters within middle schools;
- learning families or neighborhoods within elementary schools; and
- redistribution of grade configurations across multiple school buildings.

The study team expanded on the literature review presented in the *Preliminary Impact of School Size Report*, which discussed academic performance and operating efficiencies within smaller schools. The team paid particular attention to whether smaller schools and smaller learning communities are associated with more favorable learning environments.

Case Studies

Using existing state and LEA data, the study team identified three LEAs to participate in case studies. The team designed an interview protocol to collect information that was not available from other sources

[1] To generate the composite percent of students scoring proficient or above on state assessments, the study team used Maryland School Assessment (MSA) data from 2007-2012 and High School Assessment (HSA) data from 2008-2013. More recent MSA data were not used because Maryland adopted its Common Core-based College and Career-Ready Standards effective in the 2012-2013 school year. Because new assessments were not yet available, the state continued to use the MSA and HSA, though these assessments are not fully aligned with the new standards. This resulted in a decline in MSA and HSA scores across the state. For this reason, upon the recommendation of the MSDE, 2013 and 2014 MSA data were not included in the initial selection of schools. There was less of an impact on HSA scores (high school), so the most recent available data at the time, 2013 data, were used.

while simultaneously minimizing the time required of interviewees. The team selected LEAs that met specific criteria:

- LEAs had to operate multiple schools at each level (elementary, middle, and high school);
- the schools in the LEAs had to have a broad range of enrollment numbers at each level; and
- taken together, the LEAs had to be representative of urban, suburban, and rural LEAs.

The discussions that resulted from these LEA case studies provided additional insights into how LEAs make decisions that balance school size, instructional programming, and LEA- and school-level expenditures.

The study team completed the following tasks for this report:

- updated all previous analyses using new data or improved methods;
- examined the impact of school boundaries and attendance areas;
- assessed the costs and impacts of zoning laws that call for the building of adequate facilities to accommodate new development;
- estimated the potential impact of smaller schools on the Public School Construction Program;
- analyzed the impact of school size in Maryland on educational activities; and
- described the processes that ensure that public input will be taken into account in the establishment of school size standards or guidelines.

Maryland School Size Policy Findings

In the *Summary of School Size Report,* the study team identified nine LEAs that have adopted a Board of Education (BOE) policy or a published guideline addressing maximum school size. Since the submission of the *Summary of School Size Report* in September 2014, the study team has identified two additional LEAs that have a published school size policy or guideline, bringing the total to 11 LEAs. Of these 11 LEAs, five have their school size policy documented in their posted board policies. Six have included a guideline in their posted Education Facilities Master Plans (EFMPs), which are BOE approved. The study team gathered this information through reviews of the LEA websites and through follow-up conversations with the LEA facilities directors.

For the 11 LEAs with confirmed school size policies or guidelines, Table 1, below, provides the range and median values of maximum school sizes.

Table 1: Maryland LEA Maximum School Size Policies

School Level	Range of Maximum School Size Policies	Median of Maximum School Size Policies
Elementary	550-822	650
Middle	700-1,200	900
High	1,200-2,600	1,600

Of the 11 LEAs that have adopted a school size policy, seven listed both a minimum and a maximum school size for each of the levels. Table 2, below, provides the range and median values of minimum school sizes for each school level for these seven LEAs.

Table 2: Maryland LEA Minimum School Size Policies

School Level	Range of Minimum School Size Policies	Median of Minimum School Size Policies
Elementary	200-500	400
Middle	400-900	600
High	700-1,575	950

There is a significant amount of variation in the recommended school sizes among these 11 LEAs. In a few cases, the minimum size established in one LEA's policy is larger than maximum size established in another LEA's policy. For example, the minimum middle school size for Harford County is 900 students, while the maximum middle school size for six other LEAs is equal to or less than 900. In Queen Anne's County, the minimum high school size of 1,575 is larger than the recommended maximum school size in five other LEAs.

Appendix B presents the school size policies for each of the 11 LEAs that have published school size policies. Appendix D provides a graph showing the recommended school size, by school level, for each of these 11 LEAs.

The map in Figure 1, below, highlights those LEAs with school size policies. The embedded chart at the bottom of the figure shows total student enrollment for each LEA. About half of the LEAs adopting school size policies are smaller LEAs, located on the Eastern Shore. The remaining LEAs with confirmed school size policies tend to be larger and are found in the central part of the State. Of the 13 LEAs that do not have school size policies or guidelines, many have related policies that may serve to constrain school sizes or limit the number of students served in a building. These include policies specifying a target utilization ratio for their existing buildings (this is the ratio of students enrolled in a building to the building's rated enrollment capacity), maximum class sizes, or target school sizes for new school construction only.

Figure 1: Map of Maryland LEAs with School Size Policies

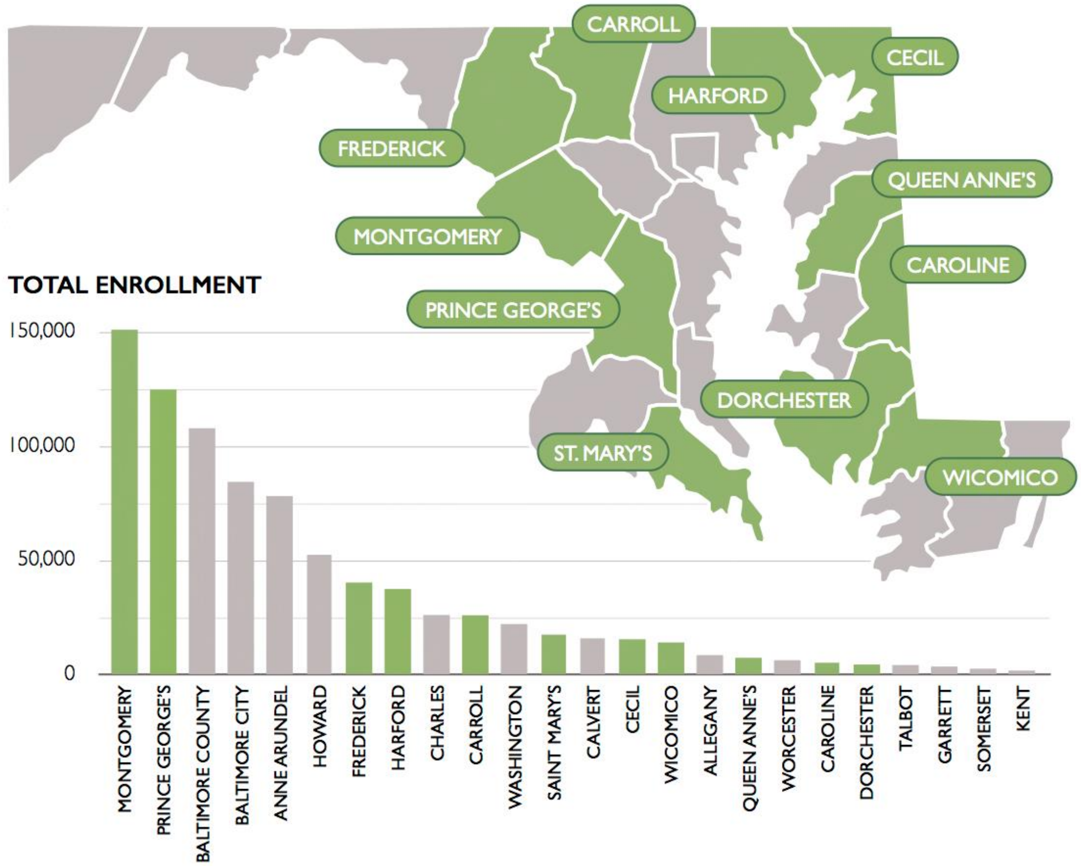
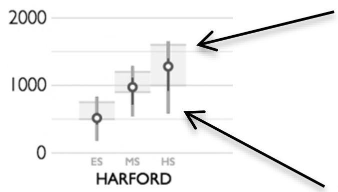


Figure 2, below, shows the range of actual enrollments by school level. Where applicable, the figure also shows maximum school size policies. The three vertical lines on Figure 2 show the range of actual enrollment by school level (elementary, middle and high) for each of the 24 LEAs. At each level, the median school size is presented as a dot on the vertical line.

The maximum enrollment for those LEAs with a maximum school size policy is shown as a horizontal grey line for each school level. In those LEAs with a policy specifying both a maximum and minimum school size, the maximum and minimum enrollments are shown as grey horizontal lines, and the range between the two lines is a shaded bar. Figure 2 indicates how, within those LEAs with school size policies, actual school enrollments compare to school size limits.

The following example shows how to interpret Figure 2.



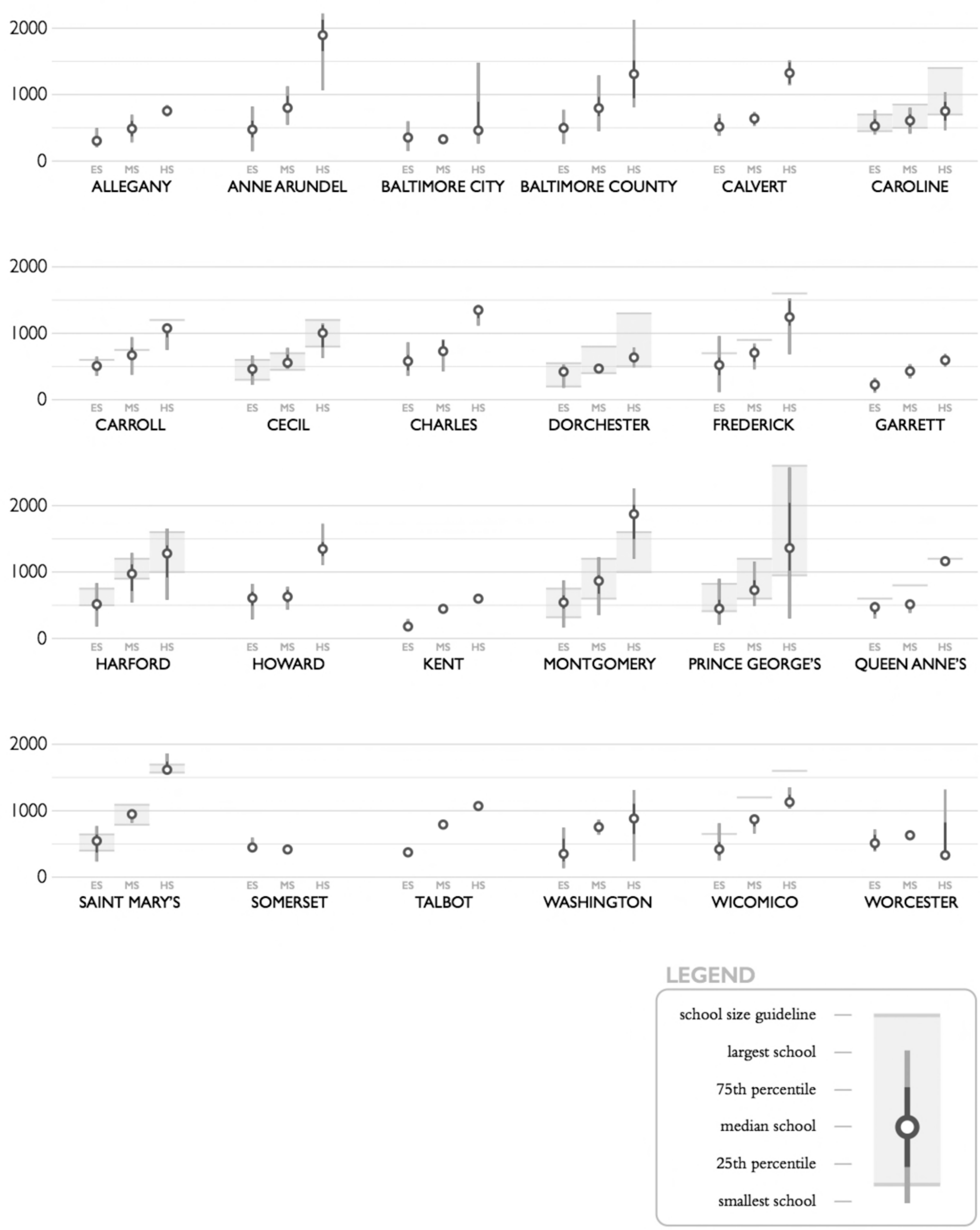
The horizontal grey lines at the top and bottom of each bar show the maximum and minimum school size policies. In this example, Harford County's size policy for high schools ranges from a minimum 1,000 students to a maximum of 1,600 students.

The vertical lines show the range of actual student enrollments, by school level. In this example, the actual enrollment range in Harford County's high schools is 583 students to 1,655 students. Both of these enrollment figures fall outside of the district's specified policies for school size.

Figure 2 shows that school sizes generally increase moving through school levels from elementary to high school.[2] However, the amount of increase varies among LEAs. The median Baltimore City enrollment is 354 students at the elementary level (prekindergarten through grade five) and 393 students at the high school level (grade nine through grade 12) – a difference of 39 students. Anne Arundel County has a median elementary school enrollment of 474 students and a median high school enrollment of 1,894 students – a difference of 1,420 students. Prince George's County has the largest range in high school enrollments. Figure 2 also shows that, in a majority of LEAs with maximum school size policies, actual enrollments exceed the recommended maximum enrollments for at least one school level.

[2] This analysis does not include charter schools or alternative schools. It does, however, include magnet and focus schools, which are typically smaller than traditional comprehensive high schools.

Figure 2: Variation in School Enrollment and School Size Policies



Best Practices Regarding School Size

Other Size-Related Statutes

The study team examined all 50 states for best practices in school size policies, relying primarily on state education agency and legislative websites, as well as publications from national organizations (e.g. the Education Commission of the States and Building Education Success Together) that compile relevant state policy and practice information. From these sources, the study team gathered information about the relationship between school size and facility planning policies.

Below is a list of the components most often found in state facility planning policies:

- school size requirements, as well as classroom size guidelines;
- guidelines for square footage per student;
- minimum school size requirements;
- requirements for completing an EFMP; and
- benchmarking operational data.

Over half of the states have some sort of guidelines or recommendations regarding classroom size, square footage per student, or site size requirements. Eight states, including Maryland, have requirements related to completing a district-level EFMP.

Table 3, below, presents the number of states with policies or guidelines related to the facility planning components listed above. Appendix C provides a list of states that have enacted guidelines for each of the facility planning components.

Table 3: Number of States by Facility Planning Policy Component

Facility Planning Component	Number of States With a Statute, Published Guideline, or Recommendation
Classroom Size	29
Site Size	28
Square Footage/Student	22
Educational Facilities Master Plan	8
School Size	2

It should be noted that, in addition to facility planning policies, several other states have school finance statutes that can create guidelines for school sizes. These school finance statutes do not always outline minimum or maximum size parameters that dictate school construction or enrollment capacities. However, school finance statutes do affect planning for schools, the amount of public funding schools receive depends on the sizes of those schools. Depending on how these statutes are implemented and how districts take per pupil funding into account as they plan new construction, school funding policies can affect school sizes.[3]

Best Practices Regarding School Size and Facility Planning

Of the policies identified above, the development of EFMPs is consistently recognized as a best practice, particularly for public entities that have a fiduciary responsibility to taxpayers to protect and manage capital assets. Organizations such as the Government Finance Officers Association promote EFMPs as a best practice tool (1) for kindergarten through grade 12 school systems to connect facility needs with educational goals and (2) for direct governments, both local and state, to align capital investments with long-term needs.

Because the education environment is constantly changing, an annual EFMP is a useful tool to document changes in the current and forecasted LEA environments, respective building needs, and associated operational and capital expenditures. In particular, an EFMP update can capture changes in the following areas:

- the use of temporary portable buildings, boundaries, facility utilizations (enrollment-to-capacity ratios) targets, and optimal school size requirements;
- population and enrollment forecasts;
- facility needs related to the aging of buildings; and
- needs related to changing educational programs, such as implementation of special programs in Career and Technical Education (CTE) and science, technology, engineering, and math (STEM), implementation of magnet programs for the performing arts, or implementation of other programs with a specialized focus.

Impacts of School Size

This section builds on the research findings presented in the previous school size study reports regarding the effects of school size on student- and system-level outcomes. This section also examines the research literature and Maryland-specific data on each of the following issues:

- district and school operating efficiencies;
- overall academic achievement;
- academic achievement in schools with high learning support needs, i.e. schools with high percentages of FARMs, LEP, or special education students; and
- school climate, including extracurricular participation, teacher satisfaction, student satisfaction and student discipline policy and implementation.

In general, the analysis of the Maryland data on these topics yielded mixed results. When small schools are carefully planned, implemented, and supported, they then can have positive impacts on student

[3] A survey of state funding policies relevant to school sizes can be found here: https://schoolfinancesdav.files.wordpress.com/2015/04/density.pdf.

achievement, particularly for students living in poverty. However, size is not the exclusive driver of either operating efficiency or positive student outcomes.

Impact of School Size on Operational Efficiency

The Literature

Conventional wisdom theorizes that larger schools must be more cost efficient to operate than smaller schools, since larger schools have greater economies of scale. The research on the relationship between school size and efficiency is not conclusive, but evidence suggests that school operating efficiency is actually U-shaped. Very small schools do experience greater inefficiencies, but as schools grow larger, their efficiency advantage is diminished by the increasing costs of administration and of the need for greater coordination across a larger, more complex school organization (Stiefel, Berne, Iatorola, and Frutcher, 2000; Walberg & Walberg, 1994).

Meanwhile, some research suggests that smaller school operations may be more *efficient* when student performance is taken into consideration. Stiefel et al. (2000) found that, compared to smaller schools, larger schools are less efficient at producing student academic outcomes. This results in larger schools having lower returns on investment than smaller schools.

School Size and Operational Efficiency in Maryland Schools

The following analysis of the impact of school size on operational efficiency in Maryland uses school size and school personnel salary cost data provided by MSDE. The analysis uses school personnel salary cost data, as opposed to more comprehensive cost data, because Maryland LEAs do not track non-salary expenditures at the school level. MSDE does, however, provide data of staff counts and staff salaries by school. These data were used in this analysis as a proxy for school-level expenditures. As identified in the Selected Financial Data (SFD) report, all staff salaries (for both school-based staff and central office staff) make up, on average, 58 percent of an LEA's total current expenditures.[4] At the school level, staff salaries typically make up an even larger percentage of total school-level current expenditures. Thus, while using school-based total salaries rather than LEA total expenditure data may understate total school spending, the impact of using the alternative indicator is minimal, both in real and relative terms.

Charts 1, 2, and 3, on the following pages, present the average total school-based salary per student for staff – including mid-level administrators (i.e. principals and assistant principals) – in schools with ranges of enrollments in elementary, middle, and high schools. Because school-level expenditures are not readily accessible, the costs depicted in the charts below reflect school-based salary expenditures only. The costs shown do not include other school expenditures, such as expenditures for instructional materials or central administration costs across whole LEAs. The analysis presented in these charts identifies traditional schools only; charter schools and schools with admissions requirements have been excluded from the analysis because of their special circumstances. Combined elementary and middle

[4] This is based on expenditure data taken from the Maryland Public Schools Selected Financial Data 2012-2013 Reports http://marylandpublicschools.org/MSDE/newsroom/special_reports/financial.htm

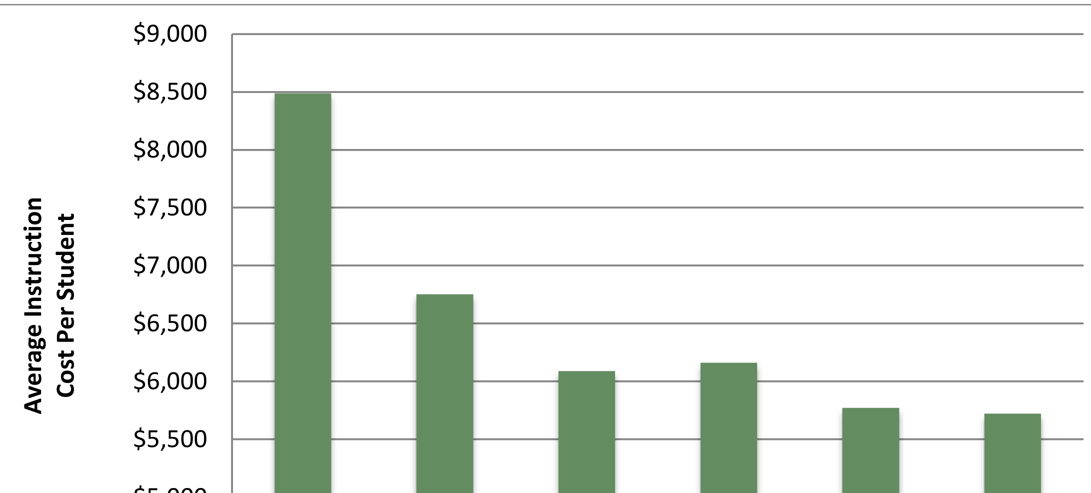
schools, combined middle and high schools, alternative campuses, and special education centers are also excluded from this analysis.

Some categories of spending, such as salaries for regular instruction teachers and school administrators, are distributed fairly evenly across all schools in an LEA. However, there are categories of funding that are more school-specific, such as funding for special education, health services, operations of school plant, and maintenance of school plant. These funding categories are more specific because of (1) differences in levels of student need and (2) differences in the sizes, ages, and conditions of school facilities.

Charts 1, 2, and 3 also show decreasing salary costs per student as school size increases. This is consistent with the research on school size and operational efficiency, as smaller schools tend to have higher per student costs for fixed costs such as school administration. Smaller schools also typically offer smaller class sizes than larger schools, resulting in higher per student costs.

The change in costs as school size increases appears larger in the Maryland school data than the amount of change that would be expected based on research data. The study team was not able to conduct an independent analysis of the characteristics of the smaller schools in the State. However, the data that *was* collected indicates that Maryland's small schools, especially those small schools at the middle and high school levels (See Chart 1), result in higher per student salary costs. The higher costs of these small schools may be due to the fact that many of the smallest schools tend to be special focus programs, like the small academies found in the Baltimore City district.

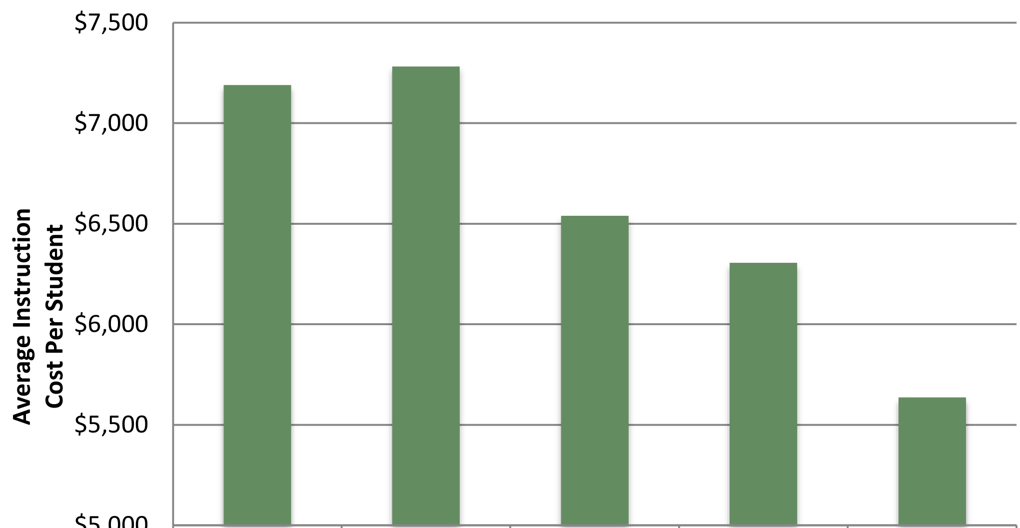
Chart 1: School Salary Costs Per Traditional High School Student by School Size



	0-400	401-800	801-1200	1201-1600	1601-2000	>2001
Average Instruction Cost per Student	$8,487.35	$6,752.07	$6,089.50	$6,160.12	$5,772.40	$5,721.67
Number of Schools	7	23	43	53	22	16
Number of LEAs	2	12	17	16	7	5

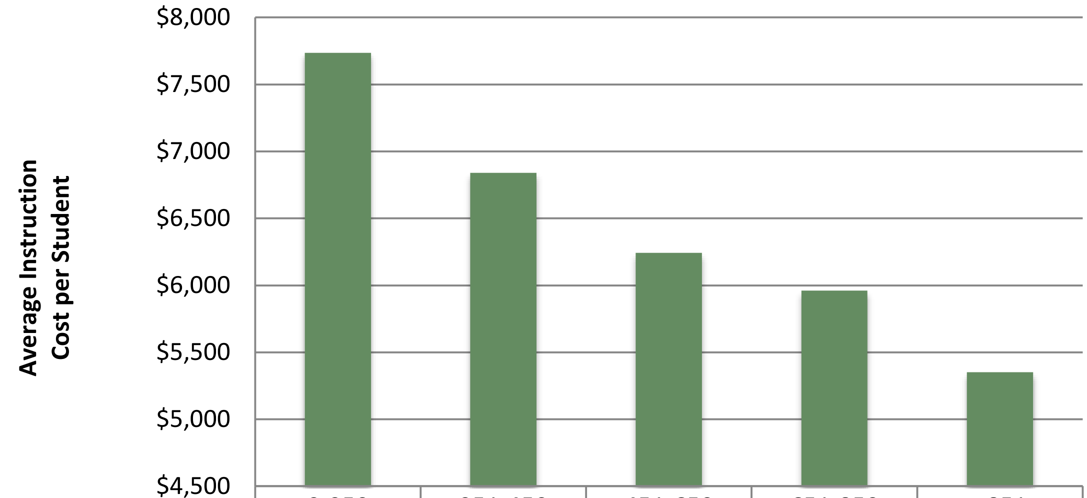
Compared to Chart 1, Charts 2 and 3 shown below, show similar patterns for middle and elementary schools, although the differences are not as extreme. The somewhat lower staff salary expenditures for the smallest middle schools (300 students or fewer) may not be a reliable result, due to the small number of schools in that category. Still, the data show that per student costs continue to decline as school size increases, at least up to enrollments of 1,000 to 1,200 students. Per student staff salary expenditures in elementary schools also decrease as school size increases, at least up to schools with 850 to 900 students. These data show that relatively larger schools are, in fact, more economically efficient to operate than similar smaller schools – a conclusion consistent with the literature on school size. However, these data do not show whether larger schools are more cost-effective – that is, whether the larger schools are not only more economically efficient but also more effective at producing higher levels of student achievement.

Chart 2: School Salary Costs Per Traditional Middle School Student by School Size



	0-300	301-600	601-900	901-1200	>1201
Average Instruction Cost per Student	$7,190.46	$7,282.60	$6,539.25	$6,306.02	$5,635.26
Number of Schools	2	55	102	36	8
Number of LEAs	2	20	18	9	4

Chart 3: School Salary Costs per Traditional Elementary School Student by School Size



	0-250	251-450	451-650	651-850	>851
Average Instruction Cost per Student	$7,736.34	$6,839.29	$6,241.71	$5,960.96	$5,352.26
Number of Schools	53	272	308	124	19
Number of LEAs	16	23	22	16	8

The Impact of School Size on Student Achievement

The Literature

Researchers have examined the correlation between school size and student achievement for many years. However, a confluence of events – investment in small schools by the Bill and Melinda Gates Foundation, a special project of the National Governor's Association, and investment from the U.S. Department of Education – brought renewed attention to the issue in the early 2000s, especially for high schools. These investments in smaller school models were accompanied by strategy and outcome evaluations, contributing to the current understanding of the impacts of small schools.

A meta-analysis of studies of small schools (Rochford, 2005) found that school size functions primarily as an enabler of improved student outcomes. The meta-analysis found that the schools that were able to improve student outcomes were also the schools that had decreased their enrollment numbers as part of a suite of related reform efforts. Early implementers and proponents of small schools speculated that, with fewer students, school staff would be able to form deeper and more supportive relationships with learners. Indeed, this hypothesis was proven to be true – but only in the schools that also changed their approaches to community engagement, instruction, and school structure.

First and foremost, these small schools benefited from leadership that both (1) set a tone that encouraged personalization and (2) distributed responsibility for reform efforts among multiple staff as well as the community at large. Successful small schools focused on improving the quality of instruction, often implementing new curricula or approaches to teaching. Teachers and leaders participated in professional development to learn new methods of content delivery and relationship-building skills.

Teachers and leaders also participated in follow-up meetings to discuss implementation of these new skills. Furthermore, smaller schools were more successful when district leaders, boards of education, and community members were supportive of the work. In short, a school's staff, leaders, and surrounding community needed to work collaboratively to make the small school learning environment successful (Howley, 2002).

It is also critical to note that research shows smaller schools and smaller learning environments have an even more pronounced effect on children from low-income families (Friedkin & Necochea, 1988; Greenwald, Hedges, & Laine, 1996). Indeed, in addition to improved grades and standardized test scores, low-income elementary-aged students attending small schools have better attendance, fewer behavior problems, and increased participation in extracurricular programs compared to low-income students in larger schools.

It is also true, however, that research around outcomes in smaller schools is not uniformly favorable. Several recent studies have found a performance advantage for larger schools (Steiner, 2011; Tanner & West, 2011). In the case of high schools, proponents of larger schools have argued that larger enrollments are needed to support more diverse course offerings (Conant, 1959; Hoagland, 1995). Other research, however, suggests that this advantage of larger schools may be overstated. Unks (1989) found that smaller schools provide a broader array of learning experiences than the published course offerings may suggest, while Monk (1987) found that the relationship between school size and curricular diversity begins to decrease with school enrollments above roughly 400 students.

Academic Achievement of Students in Need of Additional Learning Support

With the conflicting conclusions about the effects of school size on academic achievement, there is a growing sub-area of research focused on the benefits of smaller schools. Specifically, this research examines the degree to which smaller schools help students who need additional learning support. When examining this area of research, it can be challenging to isolate the effects of school size on academic achievement, since small school reforms often take place as a package – in combination with multiple other changes in policies, practices, or resources over time (Schwartz, Stiefel, & Wiswall, 2011).

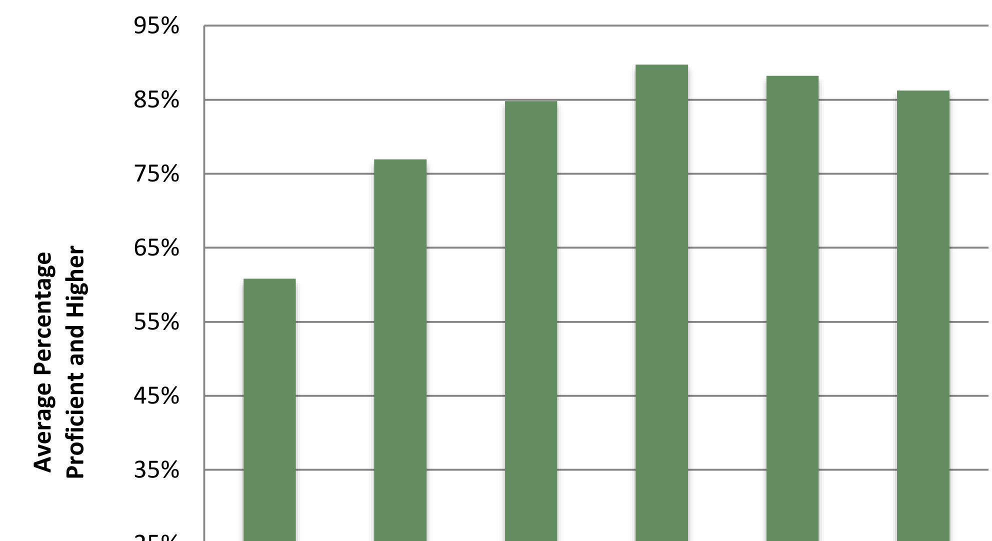
There is a growing body of research identifying interventions and services that bolster the achievement of students receiving special education services, LEP students, and students living in poverty. Relationship-enhancing interventions are especially important for student populations that are, according to research, more prone to teacher-student relationship problems. Such students include boys, students living in poverty, students with disabilities, students from minority backgrounds, and students with problematic behaviors (Rathvon, 2008). As noted above, other interventions shown to be beneficial for students from low-income families are often part of the fabric of successful small school environments. Such interventions include strong parental engagement, personalized instruction, and collaborative, flexible approaches to meeting student needs. Thus, the academic achievement of students who need additional learning supports increases when certain academic tools and interventions are made part of the reform package. Such tools and interventions could include personalized learning, specialized curriculum, a distributed model of school leadership, and parent and community engagement. These tools and interventions are also often found in small school settings.

Small school achievement outcomes appear to be more pronounced for students who have traditionally shown lower levels of achievement (Darling-Hammond, Ross, & Milliken, 2006). This is evidenced in Unterman's (2014) report on New York City's Small Schools of Choice (SSC). The SSC student population, accepted on a lottery basis, is 94 percent minority. Eighty-four percent of SSC students are eligible for FARMs, and 75 percent of them enter high school performing below grade level in reading or math. Nevertheless, these SSCs are sending more students to college than other city schools: Forty-nine percent of SSC students attend college, compared to an average of 40 percent at other city high schools.

Impacts of School Size on Student Achievement in Maryland

The charts below show the average percentage of students in Maryland schools scoring proficient or advanced on state assessments, by ranges of school sizes, for each school level. The horizontal axis of each chart shows the ranges of school sizes and the vertical axis shows the average composite performance score of students in each school size range. The composite score represents the percentage of all students in all subjects in a school achieving proficient or advanced on the state assessments.[5] In the case of elementary schools and middle schools, the data for schools with FARMs percentages less than or greater than 60 percent are shown separately.

Chart 4: Average Percentage of Students Attending Traditional High Schools Who Score Proficient and Higher on State Assessments, by School Size



	0-400	401-800	801-1200	1201-1600	1601-2000	>2001
Average % Proficient & Higher	60.82%	76.96%	84.79%	89.75%	88.25%	86.24%
Number of Schools	7	23	43	53	22	16
Number of LEAs	2	12	17	16	7	5

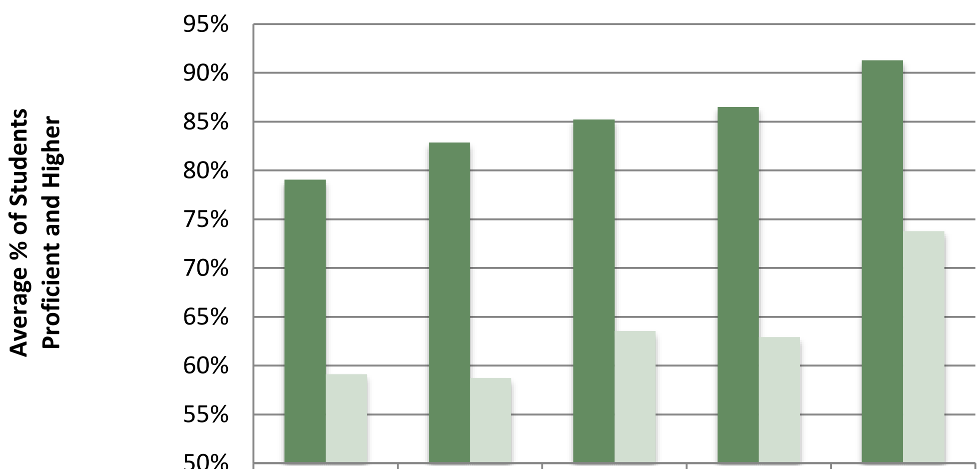
[5] The state assessment used for elementary and middle schools is the 2012 Maryland School Assessment. For high schools the assessment is the 2013 Maryland High School Assessment. The subjects assessed consist of reading, mathematics, and science (in grades five and eight only) in elementary and middle schools, and English, algebra and biology in high schools.

While the charts presented show the distribution of schools by size and student performance level, they do little to explain why the distribution of school performance across school size looks as it does. The multivariate analysis, reported in Appendix E, suggests that schools serving higher-need student populations will tend to experience lower levels of student achievement on state assessments.

As Chart 4, above, shows, high school achievement scores increase with school size up to a certain point, then begin to level off in schools enrolling more than 1,600 students. Based on data from 2013, student achievement is highest in schools that enroll 1,201 to 1,600 students. These schools represent 31 percent of the traditional high schools across the state. Because FARMS-eligible students in high schools tend to be undercounted, the FARMS counts in many high schools were quite low. Thus, the sample size of schools with greater than 60 percent FARMS students was too small to include in the analysis reported above.

For the multivariate high school analysis reported in Appendix E, the school characteristics explained 75 percent of the variation in the composite test scores. Special education percentage, FARMs percentages, square footage per student, total enrollment, and staff salary expenditures per student were all significant and were all associated with lower test scores.

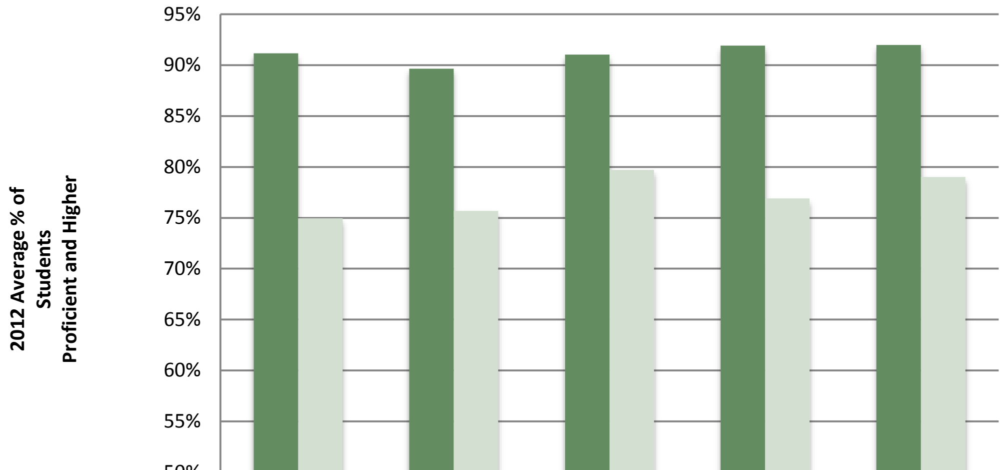
Chart 5: Average Percentage of Students Attending Traditional Middle Schools Who Score Proficient and Higher on State Assessments, by School Size



	0-300	301-600	601-900	901-1200	>1201
Average % Proficient and Higher FARM < 60%	79.07%	82.87%	85.24%	86.51%	91.31%
Average % Proficient and Higher FARM >60%	59.11%	58.72%	63.54%	62.92%	73.77%
Number of Schools FARM <60%	1	42	76	30	7
Number of Schools FARM >60%	1	13	26	6	1

Chart 5, above, shows that in the school size categories with significant numbers of schools, those ranging from 301 to 1,200 students, average middle school performance on the composite state assessment scores increased gradually with larger school sizes. This is true both for schools with less than 60 percent FARMs students and for those with greater than 60 percent FARMs. However, average performance peaked in schools with more than 60 percent FARMs students in the 601 to 900 student school size category and declined in schools with enrollments between 901 and 1,200 students. The number of schools in the zero to 300 student and greater than 1,200 student school size categories are too small to draw any valid conclusions.

Chart 6: Percentage of Students Attending Traditional Elementary Schools Who Score Proficient and Higher on State Assessments, by School Size



	0-250	251-450	451-650	651-850	>851
Average % Proficient and Higher FARM < 60%	91.16%	89.65%	91.05%	91.93%	92.00%
Average % Proficient and Higher FARM >60%	74.95%	75.68%	79.70%	76.90%	79.03%
Number of Schools FARM =<60%	27	148	188	77	12
Number of Schools FARM >60%	22	118	110	43	7
Number of LEAs	16	23	22	16	8

The Maryland elementary school data in Chart 6, above, show that school size has little impact on achievement, regardless of the level of poverty in a school. This result is in contrast to the apparent performance advantage found in larger middle and somewhat larger high schools. However, average school achievement peaked in schools with greater than 60 percent FARMs students that had enrollments between 451 and 650 students.

It is important to note that the data presented above represent merely a snapshot in time and not trend data. It is also important to note that the descriptive data presented in the charts shown above show the distribution of schools by the relationship between school size and per student staff salary expenditures, and school size and average school performance on state assessments. However, the charts cannot show the interactions between size, spending, and performance.

It is telling that, at first glance, school size does not appear to be a main driver of student achievement in the traditional schools in Maryland. Also, as noted above in the analysis of school size and cost, the smallest schools, particularly at the middle and high school levels, consist largely of schools designed to provide focused or special programs, which tends to be associated with both higher per student costs and lower levels of performance.

Impacts of School Size on School Climate

Extracurricular Activities Participation

The research related to extracurricular participation (EP) in high school focuses on the correlation between EP and socioeconomic status, academic achievement, self-esteem, and school size. The school size research compares participation at smaller high schools (defined as having enrollments under 800) to participation at larger high schools (defined as having enrollments greater than 1,600). Enrollment size is often associated with other community characteristics that contribute to EP. For example, smaller schools are often located in rural areas, where the high school is the hub of community attention and activity. Research suggests that students in rural areas feel a greater sense of opportunity, even responsibility, to participate in activities like sports or plays. This results in students participating in multiple activities over the course of the school year. Students who attend large, urban high schools often have EP readily available outside of school through other venues, such as parks and recreation programs or competitive youth sports that allow student athletes to specialize in specific sports or other activities, resulting in participation in a narrower range of activities within the high school setting.

Overall, research on the impact of school size on EP has competing findings. Larger schools tend to offer more varied opportunities that include expanded student government and volunteerism choices, enhancing the likelihood that students will be able to find an activity of personal interest (Lay, 2007). Yet, Coladarci and Cobb (1996) found that EP was higher among students attending smaller high schools than those attending larger high schools. There is agreement in the research that larger high schools offer a greater variety of activities, which provides greater opportunities for more students to participate. While smaller schools have a narrower range of opportunities, it also is more likely that the students feel encouraged or compelled to participate in multiple, varied activities throughout the school year.

Unfortunately, data on school-level participation in extracurricular activities in Maryland are not readily available. Because both the Maryland Public Schools Secondary School Athletic Association and the Maryland Association of Student Councils track and report student participation by LEA, data are only available on trends in LEA-level participation. For example, according to the annual High School Athletics Participation Survey conducted by the National Federation of State High School Associations, participation in high school athletics in Maryland has steadily increased as a percentage of the student population over the past decade. In the 2013-14 school year, total participation in extracurricular activities was 116,104 students, or 15.4 percent of total high school enrollment. This represents an increased participation since the 2004-05 school year, which totaled 100,305 students, or 12.8 percent of total high school enrollment.

Without school-level participation data, however, an analysis of the relationship between school size and participation is not possible.

Teacher and Student Satisfaction and School Climate

Surveys of school staff show that smaller schools tend to cultivate better attitudes towards work among school administrators and teachers, leading to greater staff collaboration and more successful school improvement efforts (Cotton, 1996; Klonsky, 2006). The likely causes of this effect include the more favorable school climates and deeper personal relationships found in smaller schools (Cotton, 1996). Still, it is difficult to attribute improved teacher satisfaction solely to school size. Often, smaller schools employ other strategies that may also improve educator satisfaction. For example, small schools may use a distributed leadership model and may enjoy greater support from the district office. Both of these factors have been found to have positive impacts on teacher satisfaction and motivation (Rochford, 2005). As noted in the review of literature, teacher satisfaction and connection to students rises when school enrollment decreases.

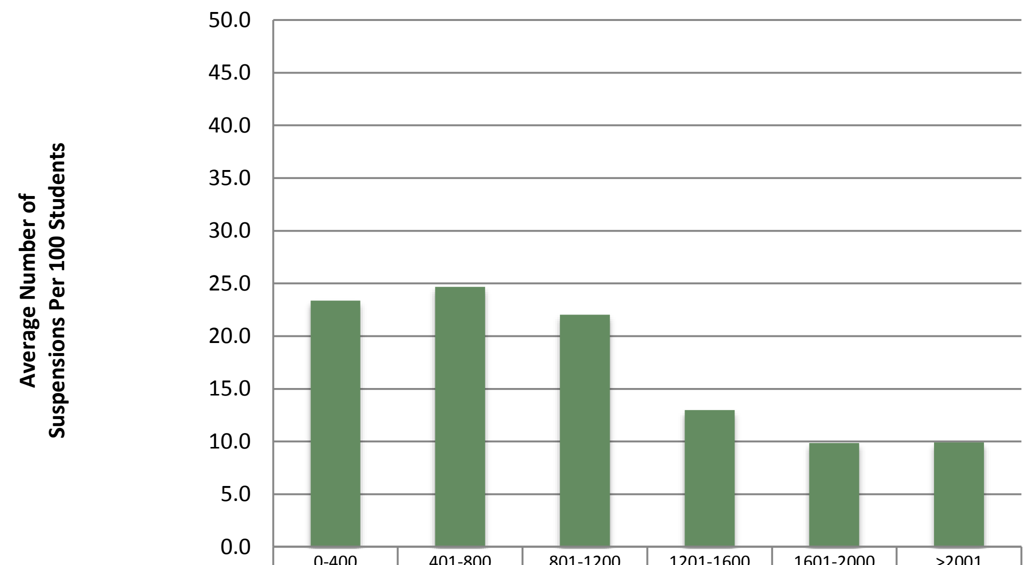
The feelings and attitudes that are elicited by a school's environment are referred to as school climate (Loukas, 2007). Advocates for smaller learning communities and schools posit that school climates would be more favorable in smaller schools. Research is showing that perceptions of school climate also influence student behavioral and emotional problems. Additionally, researchers have identified several characteristics of smaller schools that may explain their positive effects on student performance. Key among these characteristics is the presence of a supportive school climate. Some smaller schools are found to be more successful at developing personal and informal relationships among school staff, students, and parents than larger schools serving similar student populations. Such relationships lead to improved student engagement and student social behavior, broader participation in extracurricular activities, heightened teacher satisfaction and collaboration, and increased parent involvement (Lee and Loeb, 2000). These positive effects are even more pronounced for low-income and minority students, who tend to have higher attendance rates and lower dropout rates in smaller schools (Carruthers, 1993). A study in North Carolina specifically identified the positive impact of smaller schools on school climate, leading to recommendations for much smaller school sizes to prioritize school climate, and larger school sizes to prioritize operating efficiency (North Carolina Department of Public Instruction, 1998). A 2001 meta-analysis of research on school size notes increased attendance and fewer behavior problems among students attending elementary schools with enrollments under 500 (Rochford, 2005).

Smaller schools tend to have fewer incidences of negative student social behavior than large schools, resulting in greater student engagement and satisfaction, higher attendance rates, and lower dropout rates. Again, the research suggests that ethnic minority and low-income students, in particular, benefit from the supportive school climate that is often present at smaller schools (Cotton, 1996).

Schools suspensions are a key indicator of school climate. Therefore, to explore the relationship between school size and school climate in Maryland, the study team analyzed school level suspension data provided by MSDE. The study team plotted the combined in-school and out-of-school suspensions by school. In the case of elementary schools and middle schools, the data for schools with FARMs percentages less than and greater than 60 percent are shown separately in the charts below. The horizontal axis of each chart shows the ranges of school sizes with the vertical axis showing the number of suspensions per 100 students for traditional high, middle, and elementary schools.[6]

The relationship between school size and suspension rates appears to vary by school level and by the percentage of students eligible for FARMs in middle and elementary schools. Chart 7, below, shows the number of suspensions per 100 students in Maryland high schools. These data show that suspension rates actually begin to decline as school sizes rise above 1,000 students.

Chart 7: Average Number of Suspensions Per 100 Students Attending Traditional High Schools

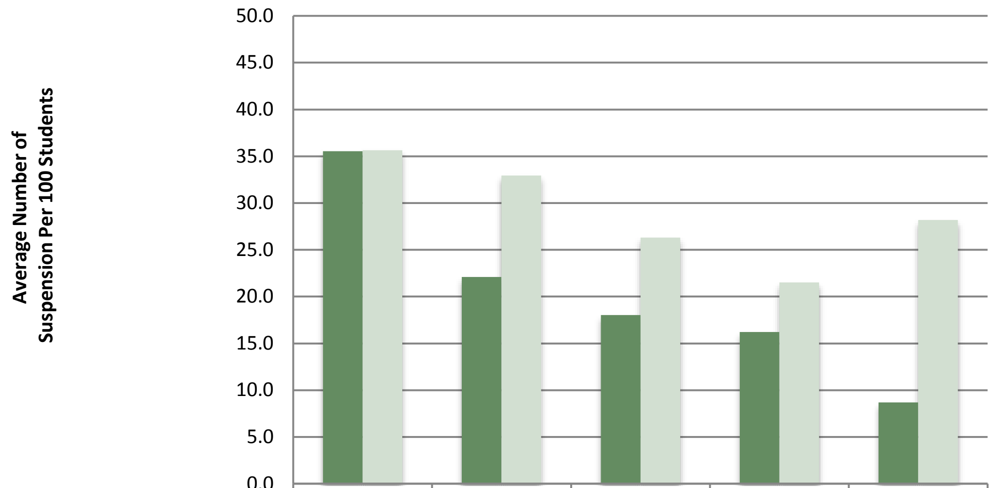


	0-400	401-800	801-1200	1201-1600	1601-2000	>2001
Average Number of Suspensions per 100 Students	23.4	24.7	22.0	13.0	9.8	9.9
Number of Schools	7	23	43	53	22	16
Number of LEAs	2	12	17	16	7	5

Chart 8, below, shows that the trend toward lower suspension rates in larger schools is less definitive in middle schools, especially in schools with higher concentrations of FARMs students. The two sets of bars represent schools with concentrations of FARMs students below 60 percent (the darker-colored bars) and schools with concentrations above 60 percent (the lighter-colored bars). In middle schools with under 60 percent FARMs students, suspensions per 100 students decrease as school enrollments increase. Large schools (over 1,201 students) with less than 60 percent FARMs students, have only about a quarter of the number of suspensions found in the smallest schools. In those schools with greater than 60 percent FARMs students, the suspension rate declines more gradually than at the lower poverty schools and actually begins to increase as schools become very large (schools with more than 1,200 students).

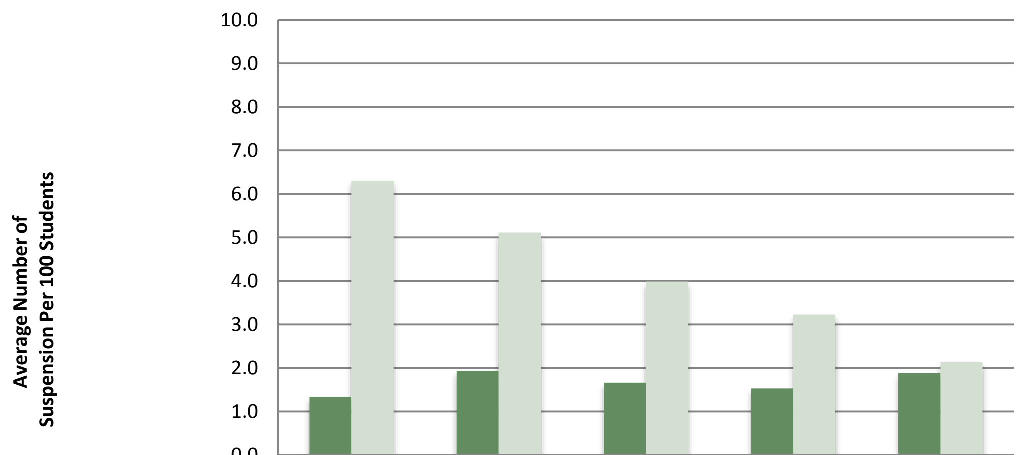
[6] The study team was not able to conduct experimental studies, such as randomized controlled trial studies, for any part of this analysis, therefore all results are correlational and do not suggest causation.

Chart 8: Average Number of Suspension Per 100 Students Attending Traditional Middle Schools



	0-300	301-600	601-900	901-1200	>1201
Average Number of Suspensions per 100 Students FARM <60%	35.5	22.1	18.0	16.2	8.7
Average Number of Suspensions per 100 Students FARM >60%	35.6	33.0	26.3	21.5	28.2
Number of Schools FARM <60%	1	42	76	30	7
Number of Schools FARM >60%	1	13	26	6	1

Chart 9: Average Number of Suspensions Per 100 Students Attending Traditional Elementary Schools



	0-250	251-450	451-650	651-850	>851
Average Number of Suspensions per 100 Students FARM <60%	1.34	1.94	1.67	1.53	1.88
Average Number of Suspensions per 100 Students FARM >60%	6.30	5.11	3.99	3.23	2.14
Number of Schools FARM =<60%	27	148	188	77	12
Number of Schools FARM >60%	22	118	110	43	7
Number of LEAs	16	23	22	16	8

Chart 9, above, shows the suspension rates for elementary schools. The suspension rates for schools with lower concentrations of FARMs students are fairly consistent across the school size categories, but show a slight increase in the largest schools – those with enrollments greater than 850 students. Surprisingly, suspension rates decline in schools with higher concentrations of FARMs students as enrollment increases.

Ensuring Public Input on School Size Guidelines

Ensuring public input on school size guidelines is generally a sound practice and helps to nurture community engagement in the policymaking process. Facility and public planners have begun to recognize the need for transparency in how facility decisions are made, as well as the value of effective community input. Implementing best practices for effective community input will not only meet the intent of soliciting public input, but also allow LEAs to realize the benefits of a participatory process.

Of the 11 LEAs that have school size guidelines, the degree of public input sought in determining the guideline was varied. For the five LEAs where the school size guideline is part of board policy, there is no mention of requiring community input. For the six LEAs where the school size guideline is defined in the EFMP, the related policies do not explicitly require community input on the EFMP or on the policy itself. There are several LEAs that solicited community input during the development stage of the EFMP rather than seeking public input after the plan was developed and presented to the local board of education for approval. The difference between these two approaches yields very different levels of community participation. The first approach will generally yield higher participation with greater buy-in on the overall plan, the latter approach rarely garners much, if any, public support.

The requirement for community involvement in governmental agencies' policymaking processes is also growing. In February 2009, the Government Finance Officers Association (GFOA) published a collection of best practices entitled *Public Participation in Planning, Budgeting and Performance Management*. The practices described in this publication may be applied to community input and engagement for the development of EFMPs, which would include school size guidelines. Per GFOA, "To ensure an effective and well implemented public participation process, governments should address the following considerations in designing their efforts:

- purposes for involving the public;
- assurances that they are getting the public's perspective rather than only that of a small number of highly vocal special interest groups;
- elicit public comment and participation in a respectful manner and tailor the points presented to the particular stages of the planning-budgeting-performance management cycle;
- information that the process will be incorporated into decision making;
- communication to the public regarding how the information collected will be and was used; and
- buy-in from top government officials."

There is a convincing body of evidence that supports the correlation between increased community engagement and higher student achievement (Funkhouser, Gonzalez, & Moles, 1997; Henderson & Berla, 1994). To garner the community engagement, districts should start by providing for meaningful public input related to their overall facilities master plan and school size policies.

Models of Smaller Schools

Following a survey of Maryland LEAs and a national review of state education codes, the study team learned that there are very few state and local policies guiding the creation of smaller school environments. French, Atkinson, and Rugen (2007) traced the small school movement to as early as the mid-1970s, when Deborah Meier and a group of like-minded teachers founded Central Park East Elementary School in Harlem, New York. They believed that putting an emphasis on the size of the school would bring the rigor and benefits found in many private schools to students in low-income communities. Thus, New York City became the first urban district to approach the development of small schools as a planned strategy for school reform. In the early 2000s, a number of funders invested in smaller learning communities and smaller schools as strategies to boost student achievement. These funders, including the U.S. Department of Education, the Bill and Melinda Gates Foundation, and the Carnegie Corporation were guided by the hypothesis that smaller schools lead to better academic outcomes. Efforts were undertaken to determine if smaller, more personalized education settings would lead to improved academic achievement. In some cases, small schools did improve achievement, particularly for children in poverty. Overall, however, research shows school size as merely one of a collection of factors in improving student achievement. Parallel reforms and actions taken to help implement and support smaller school size models can also contribute greatly to overall improvements in student achievement.

Several comprehensive reform models have emerged for creating smaller schools or smaller learning environments. A number of factors – students, facilities, operating autonomy, and instructional philosophy – guide LEAs as they select models for smaller and more personalized learning environments. Some models, such as career academies and magnet schools, are learner-focused and seek to create community by bringing together students and staff who share particular interests and goals. Other models, like clusters and pods, are supported by facility design. These schools have been intentionally designed to accommodate a team-driven model of instruction. The terms *school within a school* and *school within a building* imply subtle differences, indicating varying levels of autonomy among multiple school administrators. There are also smaller learning communities guided by alternative educational philosophies. These communities include Montessori schools and foreign language immersion schools, among others.

A variety of terms have been used to describe small school models. In 2001, Cotton defined a number of common and relevant small school models. The broad categories of these models are described below.

School within a School/School within a Building

This model brings several small schools under one roof. More specifically, in a *school within a school* model, there is a building administrator or principal responsible for the entire physical plant and all schools, students, and teachers on a campus. In the *school within a building* model*,* principals are more autonomous and report directly to an LEA. Baltimore City, with support from the Bill and Melinda Gates Foundation, has created several schools that have adopted a *school within a school* model. The LEA calls these co-located schools. There are no standard definitions for these terms, rather individual districts define how they use each term.

Additional terms used to describe *school within a school* configurations include *minischool, multiplex, multischool,* and *scatterplex.* In Maryland*,* some LEAs have large schools clustered in a multischool or multiplex complex, such as the Old Mill Educational Complex in Anne Arundel County. The former Frederick Douglass High School in Baltimore City was transformed into a multiplex/multischool complex of small high schools.

Smaller Learning Communities

A smaller learning community is a term used to define an individual learning unit within a larger school. Teachers and their students are scheduled together and typically hold classes in shared, common areas of the school (Cotton, 2001).

Career Academies

Career academies provide a specialized, focused curriculum to support career exploration and preparation during high school, sometimes leading to job certification or receipt of credentials. The result is a *school within a school* environment that unites a group of peers with common long-term goals and interests. Other terms used to describe these smaller learning communities include *career clusters* and *career pathways* (Conley, D. & Rooney, K., January, 2007, & Guha, R. et al., 2014).

Autonomous Small Schools

Autonomous small schools, also referred to as *freestanding schools,* have independent governance and budget control. These schools have the ability to select both teachers and students. An autonomous small school sets its own schedule and defines its own learning program. It may share a building with another school, or may simply be a *historically small school****,*** located in a small building that limits enrollment. Maryland LEAs have experimented with autonomous small schools, namely in Baltimore City, where a contract was awarded to Edison Schools to manage a number of small schools in need of reform. The Edison Schools received per pupil funding from Baltimore City Schools, but had complete autonomy over staffing, curricula, and budget decisions that are normally approved at the LEA level. Charter schools are mostly autonomous small schools.

Alternative Schools

Alternative schools often provide nontraditional curriculum and educational methods, such as credit recovery or night school. Students have more flexibility in their programs of study and/or class schedules than they would in a traditional school. In the Maryland context, alternative schools often serve the needs of students who are not successful behaviorally in a traditional school setting, and who may require a different environment from traditional classroom and school settings. These schools may be physically located within another school's building or in a separate building.

Magnet Schools or Theme-based Schools

Magnet and theme-based schools design curriculum and school activities around a particular area of study or theme. For these schools, community is built around a shared interest and experience regarding a particular subject. All classes are taught using the school's subject focus. For example, a visual arts magnet school might teach social studies concepts in the context of art history and geographic variations in artistic styles. Popular themes and subjects for theme-based schools include STEM, performing or visual arts, international studies, and world languages. Several Maryland LEAs have magnet schools, including foreign language immersion schools.

Maryland Public School Construction Programs

Maryland LEAs do not have taxing authority. They are therefore dependent on the county governments and, in the case of Baltimore City Schools, on the City of Baltimore, for revenue to fund capital expenses. LEAs must submit their budgets, which include capital construction, to the county government, or the City of Baltimore government. LEA funding flows from the county or city general fund to the LEAs. Capital construction funding for schools is also available through the state of Maryland, primarily through the Public School Construction Program (PSCP) administered by the Interagency Committee on School Construction (IAC). The proportion of state and local funds varies greatly depending on the local wealth of an LEA and the identified specific facility and construction needs.

To obtain state construction funding support, LEAs submit requests to the IAC for review and approval. The IAC consists of five members including the Superintendent of Schools, the secretary of the Department of General Services, secretary of the Maryland Department of Planning, and two members of the public appointed by the speaker of the house and the president of the senate. The program's purpose is to provide local property tax relief; to relieve governmental subdivisions of the high costs of school construction; to address the considerable backlog of new construction, renovation, and replacement schools; and to equalize educational facilities and opportunities throughout the state. Since 1971, the IAC has approved over $6.8 billion in construction funding support, with the most recent approved amount (fiscal year 2015) totaling $325.3 million for the Capital Improvement Program (Public School Construction Program, 2013).

Other funding programs for school construction include other PSCP-administered programs. During the 2013 legislative session, special legislation was also passed to support school construction and renovation in the Baltimore City Schools. The following list provides brief explanations of each of these programs:

- The **Aging Schools Program (ASP)** was established in 1997 to address the needs of aging school buildings. The fiscal year 2015 allocation for the ASP totals $7.9 million.
- The "**Relocatable" Repair Fund (RRF)** provides limited funding to repair and renovate state-owned "relocatable" classrooms.
- The federal government authorizes the **Qualified Zone Academy Bond (QZAB)** program for capital improvements, repairs, or deferred maintenance at eligible public schools and requires a 10 percent private equity contribution. Construction of new schools is not allowed under this

program. QZAB requires the issuer, the State of Maryland, only to repay the principal (Public School Construction Program, 2013). Beginning in fiscal year 2012, the PSCP began distributing QZAB funds on a competitive basis based on project priority, scope, and eligibility. All 24 LEAs have at least one school that is eligible based on its FARMs population (35 percent or greater) and the age of the facility. For fiscal year 2015, the State Board of Public Works allocated more than $4.6 million to 13 LEAs for 38 projects.

- The **Baltimore City Public Schools Construction and Revitalization Act of 2013** was passed by the Maryland Legislature in April 2013, to provide up to $1.1 billion in bond funding to support new and modernized school buildings in the City of Baltimore. The Maryland Stadium Authority, the City of Baltimore and the Baltimore City Public Schools will contribute $60 million annually over the next 30 years to service the bond debt. This program was enacted to help address the city's identified capital facility needs of over $2.4 billion.

In addition to the programs described above, two financing mechanisms that are gaining popularity across the country are also utilized in Maryland. These are Public Private Partnerships (P3) and the Energy Saving Performance Contracting (ESPC) program. These financing options allow LEAs to utilize general funds, rather than capital funds, to pay for facility improvements and construction. The following provides a brief description of both of these options.

- **P3** allows LEAs to transfer ownership and management of a public facility – including capital improvements and construction – to a private entity. The LEA then makes an annual lease payment to the private firm for use of the facility. The lease payment is a general fund obligation rather than a long-term debt obligation to the LEA.
- **ESPC** is a self-funding financing program that provides infrastructure improvements, energy and water savings, monitoring and verification of effectiveness, training, maintenance, and environmental benefits. LEAs can finance the costs of an ESPC through the state's Master Lease Program or through funding from the State Agency Loan Program. The financing costs are paid for through guaranteed energy savings, which are a result of the improvements that do not require capital dollars.

Impacts of Adequate Public Facilities Policies on School Size

Maryland statutes (Art. 66B, § 3.01(a) and Art. 66B, § 10.01(a)) allow for municipal governments to adopt an Adequate Public Facilities Ordinance (APFO). An APFO ensures that infrastructure necessary to support proposed new residential developments, including public schools, is built concurrently with, or prior to, a proposed development. As of 2012, 14 counties and 26 municipalities in Maryland had adopted APFOs. Table 4 below identifies these counties and their respective adequacy standards. Nationally, APFOs are considered a best practice to ensure smart growth.

APFOs in Maryland include a variety of devices to link development growth to adequate infrastructure. These devices range from holding a moratorium period on the construction of new developments, to providing land for schools, to providing for impact fees for the construction of the necessary infrastructure. APFOs in Maryland do not include school size requirements – school size decisions are left up to the LEAs. The APFO requirements are based on current and forecasted utilization of the existing schools. Hence, APFOs are linked to potential capital funds necessary to construct new schools or add to existing schools, if and when there is a forecasted need for additional space to address growth.

According to a study completed by the National Center for Smart Growth in 2006, APFOs in Maryland are often inadequately linked to capital improvements. The required level of service that needs to be met prior to development is inconsistent among the counties that have adopted APFOs. Counties may use either the state-rated capacity (SRC) or a local-rated (city or county) capacity (LRC) as a basis for adequacy. Most counties utilize the SRC to determine if space is available to accommodate the anticipated growth that will come with development. The SRC is the number of students that an individual school has the physical capacity to enroll, according to the IAC. The IAC determines this number using a formula for the number of students per classroom, typically on a per grade or grade range basis. Some jurisdictions have chosen to adopt their own capacity formulas for purposes of evaluating capital requests as well as development requests. These are referred to as LRCs. To determine if the proposed development meets the level of service defined as adequate, counties compare the forecasted enrollment – which includes current enrollment combined with additional, projected enrollment from the proposed development – with the designated, rated capacity of the schools that serve the development area. If the forecasted enrollment is equal to or less than the percentage identified in the ordinance, then the proposed development meets the level of service defined as adequate. As shown in Table 2, below, these utilization percentages vary significantly, ranging from 100 percent to 120 percent of a school's identified capacity. Some counties could authorize a development that would potentially cause schools to be 20 percent over capacity, as is the case in Montgomery County. Washington County, in contrast, does not allow for development that would take the school capacity of an elementary school beyond 90 percent of capacity.

The moratorium periods are inconsistent as well, ranging from seven years in Calvert County to three years in Harford and St. Mary's counties. Another shortcoming of some APFOs is that the moratorium period can elapse before capital funds have been approved for the required school construction. LEAs may then be required to add portable classrooms to accommodate the actual growth.

Table 4 on the following page identifies the counties that have adopted APFOs and notes the counties' respective levels of service requirements before commencing development.

In an effort to ensure that school facilities are constructed prior to new development, municipalities can also require impact fees. Impact fees serve as a funding source to offset some of the costs of required infrastructure and the costs of executing Developer's Rights and Responsibilities Agreements (DRRA). A DRRA is an agreement between a property owner and the county that describes the property owner's rights to develop a property under the zoning requirements and other regulations in place at the time of the agreement. In return, the property owner must accept responsibility for the manner and condition in which the property is to be developed. By executing a DRRA with a county, a property owner locks in the zoning codes and regulations current at the time of the agreement. A property owner can thereby avoid having to adhere to any changes that may occur in ordinance or zoning requirements after the DRRA's effective date.

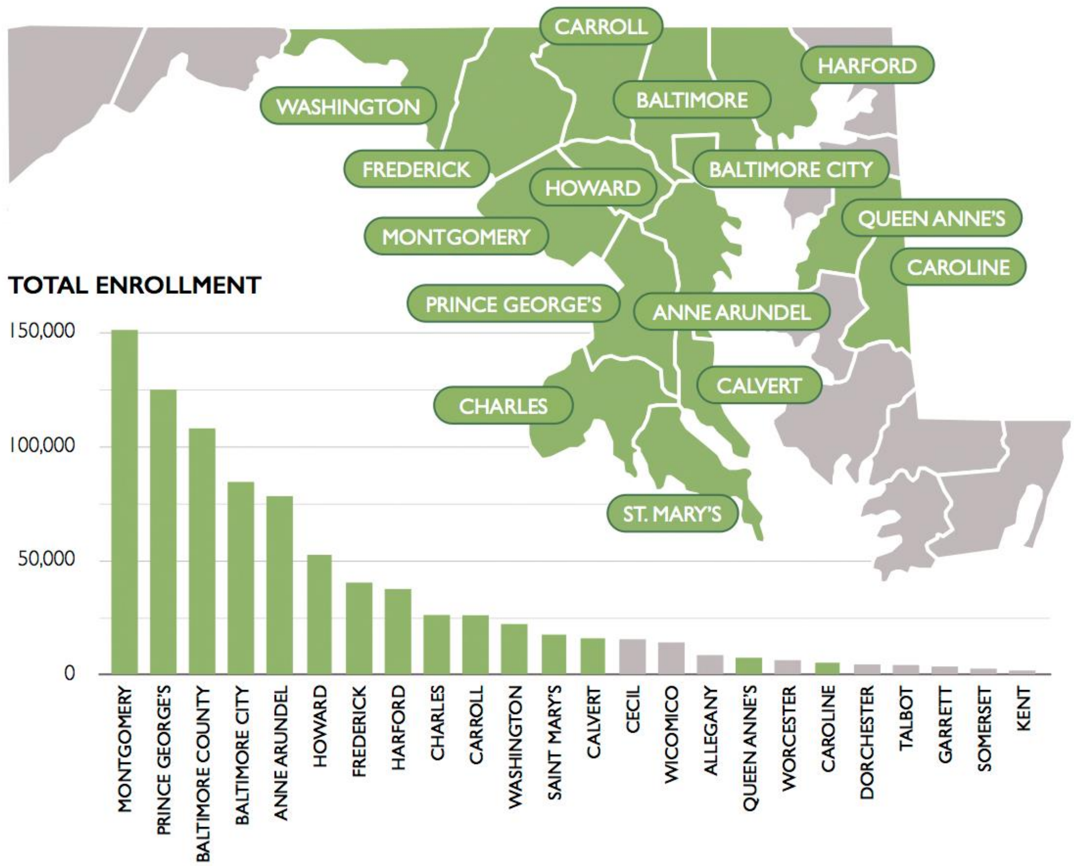
Table 4: Counties with Adequate Public Facilities Ordinances

County	Adequate Public Facilities Provisions Level of Service Standard 2012
Anne Arundel	100% of SRC; does not include temporary or portable structures; 6-year wait period
Baltimore	115% of SRC or adequacy in Capital Improvement Plan (CIP) in LEA or adjacent LEA
Calvert	100% of LRC; 7-year wait period
Caroline	100% of LRC
Carroll	109% of SRC is adequate; conditional approval if adequacy in 6-year CIP; 110-119% of SRC is approaching inadequate and subject to permit restrictions
Charles	100% of SRC; considers portable classrooms and CIP
Frederick	100% of SRC; includes school construction fee option
Harford	110% of SRC within 3 years
Howard	Open/closed chart defined by school region, approved by County Council
Montgomery	120% of SRC; school facilities fee option for 105%-120%; does not include portable structures, considers first 5 years of CIP
Prince George's	105% of SRC
Queen Anne's	100% of SRC; option to propose mitigation plan, but cannot include temporary or portable structures
St. Mary's	Elementary schools 107% of SRC, Middle schools 109% of SRC, High Schools of 116% SRC; based on capacity within 3 years
Washington	Elementary schools 90% of SRC, Middle and High schools 100% of SRC; options to request redistricting or create improvements

Source: *Adequate Public Facilities Ordinance (APFO) Inventory for Maryland Jurisdictions*, prepared by Philip LaCombe, Maryland Department of Planning, May 10, 2012.

Figure 3 on the following page shows those LEAs where the counties have adopted APFOs. The embedded chart at the bottom of the figure shows total LEA enrollment for those that have APFOs and those that do not.

Figure 3: Map of Maryland LEAs with County APFOs



As shown in Figure 3, APFO's exist in the 13 largest LEAs; all of which are in areas that have had to manage growth and development. The intent of an APFO is to ensure that there is space available for students prior to the development occurring – hence eliminating overcrowding of existing schools. However, even with building moratoriums as a solution to prevent overcrowding, without adequate capital funding, the moratorium period passes and development occurs.

In summary, APFOs do not directly affect school size. In an attempt to clarify the link between APFOs and school size, one LEA facilities planner stated, "It is not the APFOs that lead to larger schools. It is the development itself and the lack of revenue that leads to larger schools." As a result, many LEAs have had to move to more redistricting of attendance areas to manage overcrowding.

Impact of School Boundary and Attendance Area on School Size

As part of the annual facilities master plan process, LEA facility planners and/or other administrative staff forecast individual school enrollments and respective utilization of school buildings. The utilization is the ratio of the forecast enrollment to the rated building capacity. If a building is forecast to be over capacity, certain processes may or may not lead to increased school size. Listed below are the options available to LEAs to address buildings that are forecasted to be over capacity and the respective impact to the school size:

Option	Impact on School Size
Use of relocatable classrooms	Increases school size
Addition to existing school	Increases school size
Construction of new school	Maintains or decreases school size
Change attendance area	Maintains schools size

Section 4-109 (c) of the Education Article, Maryland Annotated Code states "with the advice of the county superintendent, the county board shall determine the geographical attendance area for each school established under this section." Further, per Code of Maryland Regulations 13A.02.09, each local board of education shall establish procedures to be used in making decisions on school closings. As a result of the statutes and the regulation, all 24 LEAs have policies related to establishing the attendance areas, redistricting attendance areas, and school closings. These local board policies vary in detail and complexity, including the establishment of advisory committees when boundaries will be changed.

School attendance area redistricting is used to varying degrees throughout the state ranging from common use in growing and changing LEAs to rare use in rural LEAs. Because attendance area changes can become very emotional and potentially political issues for a community where redistricting is common, the local board policies in place are very detailed on such topics such as the prioritization criteria, the inclusion of community advisory committees, and the required phasing in of new boundaries which may include transportation commitments.

Since the ability to establish and change attendance area boundaries is defined in statute and regulations and all LEAs have board policies, school boundaries are not reported to have a significant impact on school size.

Factors that Contribute to Large School Sizes

There is little research related to the factors that contribute to large schools. The extant literature focuses primarily on the characteristics and impacts of school size. When facilities directors were asked what they believe are the factors contributing to large school sizes, many responded with a question – "What is considered a large school?" or with a simple response – "costs." The following is more detailed discussion on the lack of school size definition, perceived higher costs for small schools, and other less direct factors that contribute to large school sizes.

Lack of School Size Definitions

As of 2011, the average high school size in the U.S. was around 1,100-1,200 students.[7] There were 100 high schools in the U.S. that were over 3,400 students, with the largest school serving more than 8,000 students. In comparison to many high schools throughout the U.S., the largest high school in Maryland has an enrollment of almost 2,800 and is not considered large by national norms. There are no published

[7] Per HighSchoolGuide.org http://highschoolguide.org/624/top-100-largest-high-schools-in-america/

standards or guidelines that are generally accepted throughout the U.S. for defining a small, mid-size, or large school for any school level. There is, however, literature on the characteristics, the advantages, and the disadvantages of small and large schools. The findings are mixed and often the terms are not defined even within the literature. In the absence of school size definitions, state policy, or published guidelines, each district decides what it believes is the optimal size for a given school. It would be beneficial for school districts to have a published definition of different school sizes.

Costs of School Construction and Operation

The two components of per student costs related to school construction and operation are annual (instruction and operating costs) and one-time (initial costs of construction), which may or may not include the additional cost of land procurement.

Annual Costs

For decades, the traditional wisdom of economies of scale (i.e. larger is less expensive) has been applied to school size. With new information available, this assumption has not always proven to be correct. As recommended by the Center for Reinventing Public Education (CRPE) (Roza, Swartz, & Miller, 2005), districts need to look at all components of spending to better understand their total expenditure per student. CRPE (2005) identifies the following four lessons when analyzing the cost per student:

1. Get the full cost picture. School budgets for cost per student are only one component of the full picture of costs, look at the central budgets for educational services as well. Often this is less for smaller schools, which then offsets the higher cost per student for relatively smaller schools.
2. Consider the costs of alternative options. Consider options and proposals that can demonstrate equivalent or less spending per student if allowed autonomy and deviations from central mandates on staffing or curriculum choices.
3. Isolate spending data on non-educational services. Segregate the costs for support services such as transportation, food services, and facilities.
4. Recognize that relative costs are driven by budgeting practices. Look at district formulas that allocate resources on a fixed staff position per school and modify based on that specific school's needs.

Initial Costs

The research on initial construction costs per square foot and per student for new schools does not specifically isolate the differential between small and large schools. Again, most facilities planners believe that larger schools are more cost effective with regards to cost per square foot to build. The cost for classroom spaces is relatively proportionate to the number of students. Table 5, below, provides the median, the first or lowest quartile (lowest 25 percent for that data set), and fourth or highest quartile data (highest 25 percent for that data set) for costs per square foot (SF), costs per student, SF per student, number of students, and building size for elementary schools, middle schools, and high schools from a national survey of school facility planners (Abramson, 2015).

Table 5: Profile of School Construction Costs Completed in 2014

	$/Square Foot	$/Student	Square Footage/Student	Number of Students	Building Size
Elementary Schools					
Lowest Quartile	$178.57	$28,902	149.2	552	75,000
Median	$211.55	$43,693	188.0	624	84,700
Highest Quartile	$267.50	$59,789	204.5	735	103,000
Middle School					
Lowest Quartile	$196.72	$35,524	147.4	470	80,290
Median	$242.96	$43,635	173.4	612	118,500
Highest Quartile	$270.91	$57,395	195.4	899	150,000
High Schools					
Lowest Quartile	$194.75	$32,126	148.2	650	120,000
Median	$235.29	$49,000	180.0	1,000	173,727
Highest Quartile	$348.92	$66,759	222.8	1,400	267,000

The initial cost per student at smaller schools is often higher per student due to the cost of land acquisition, athletic field development, and support spaces being spread over a smaller number of students. These support spaces include library, media center, computer lab, science lab, music, art, gymnasium, kitchen/cafeteria, administration, etc. The sizes and costs of these spaces are relatively similar for schools within a large enrollment range; i.e. gymnasiums are on average 3,700 square feet in elementary schools whether the student population is 400 or 800 students.

The belief that larger schools, based on square footage, are more economical to build then contributes to larger schools being planned. However, this belief is not necessarily validated by actual costs of new schools. For example, as a strategy to mitigate the proportionately higher cost per student of athletic spaces for small schools, some districts have pursued joint use agreements with local parks and recreation districts. Such strategies help to offset the higher cost per student for small schools.

As indicated in Table 5, above, there is a wide range of costs per student for each of the facility types. The median cost per elementary student is $43,693, with the lowest 25 percent spending $28,902 per student and the highest 25 percent spending $59,789 per student. These numbers are based on facilities from across the country, thus regional differentials also need to be considered when looking at the medians. There is also a very large spread of square footage per student, ranging from a median of 188 square footage per student with a minimum of 149.2 square footage per student and a maximum of 204.5 square footage per student.

At face value, the data seem to suggest that smaller enrollment schools can cost less per student – the lowest cost per student of $28,902 also has the smallest enrollment. However, the lowest quartile schools for cost per student are not the same schools as those that have the lowest quartile for enrollment. These summary figures are simply a reflection of the 25th percentile, median, and 75th percentile for each data element.

In understanding how the numbers relate to each other, the cost per student is more directly related to the square footage per student rather the total number of students as a whole. Therefore, strategies for how an LEA can maintain the same square footage per student regardless of how small or large the building is the key to making smaller schools cost efficient on an initial cost basis. One such strategy, mentioned above is to enter into a joint use agreements, another is to have shared athletic fields between two or three smaller schools.

In addition to the perception that larger schools are cheaper to build and operate, in urban and suburban areas, the lack of available or affordable land is often a factor that leads to larger school size. The number of students on each site is a direct result of the number of sites an LEA can afford. If only one parcel of land is available in an attendance area the LEA may have to increase the size of an existing school to accommodate new development or increased enrollment rather than build a new smaller school and split the enrollment equally between two sites.

Forecasting Enrollment

In addition to the lack of definition for different school sizes and the perceived increased costs for small schools, the practice of forecasting enrollment is an indirect factor that contributes to the practice of building larger schools. Predicting future enrollment due to a new housing development is formula driven and the realization of exactly how many students come from the new development occurs over time. Predicting the exact number is as much an art as science.

Forecasting students from home attendance areas that are well established can be even less predictable. The student yield trends for existing housing developments changes over the life of the developments. The yield for the first 10 to 15 years of a development grows over time and is higher than the yield in the next 15 years, which is steady but somewhat lower than the initial yield. It is during this lower yield period when a school may see a drop in enrollment that the school becomes underutilized. During this period, schools often research options for attracting students to their school, such as magnet or special focus programs.

During the next 10 to 15 year period, housing developments begin to turn over and the home attendance area yield increases equal to that of the initial 10 to 15 year period. This student yield is directly related to the number and age of occupants in the housing developments. Housing turnover transitions are hard to predict and can be impacted by many outside factors such as gas prices, unemployment rates and the economy in general. When older developments transition from occupants that have no school-age children to younger families, the anticipated number of students is difficult to predict and often results in the addition of portable temporary classrooms to a school to accommodate the new increase in enrollment. Once portables are on a site, that new total enrollment often becomes the de facto enrollment for planning school needs or for a replacement school in the future.

Alternative Methods for Creating Smaller Schools

A common strategy for creating smaller school environments is the organization of grade-level teams. This *school within a school* strategy brings together a team of students, teachers, and support staff (e.g. counselors) to personalize the learning experience. Academic subjects and activities are team-specific, allowing a team of teachers to get to know students and students' families very well over the course of an academic year. The learning community can house several teams within a central administration. In some cases, teams have their own physical learning spaces within a school, but share common areas such as the library, cafeteria, and gym.

The division of a school into smaller learning communities by grade or by interest is sometimes called a *house plan.* Other terms used to refer to similar arrangements are defined by school design – *cluster* or *pod. Clusters* and *pods* both feature a set of classrooms organized around a large common area. The common areas are often used for daily or weekly large group meetings to discuss student governance, climate, and discipline issues.

The *school within a school*, house plan, or clusters models are ways of implementing smaller student environments within a large existing facility. French, Atkinson, and Rugen (2007) along with the Center for Collaborative Education (CCE) have explored and documented small school models and the conditions for successful small schools. Their research mirrors what others have found after over a decade of investment from philanthropic foundations to increase student achievement by implementing small schools: the size of the school is only one factor in increasing student success. To be truly effective, a decrease in school size must be accompanied by increased autonomy and accountability and a unifying vision to achieve the desired educational outcomes.

The method for implementing small schools suggested by French, Atkinson, and Rugen is not based on wholesale change in districts, rather it suggests that pilot programs rolled out thoughtfully and methodically through a district are more effective. To encourage the development of smaller schools, several urban districts have developed and implemented pilot programs that are led by the schools and parents and supported by central administration. Coinciding with this recommendation, there is newer data that identifies models where small schools are as cost effective as the larger traditional schools. A 2000 study in high school size in New York City found that "small academies and large high schools are similar in terms of budget per graduate. Because the literature on school size indicates that small high schools are more effective for minority and poor students, the similarity in financial costs suggests that policy makers might do well to support the creation of more small high schools" (Stiefel, et al., 2000). In 2005, CRPE analyzed the costs of high schools in Seattle and Denver. CRPE identified the most cost effective high school in Seattle enrolled fewer than 500 students, and total school expenditures were 13 percent less than the district average. In Denver, not all large schools fall at or below the average operating cost; four of Denver's ten schools enrolling over 1,000 students were over the district's average cost for high schools. The CRPE policy brief identifies lessons on comparing high school costs. These lessons include the following:

- get the full costs picture;
- consider the costs of alternative options;
- isolate spending data on non-education services; and

- recognize that relative costs are driven by budgeting practices.

To achieve efficiently operating schools, districts must change their way of thinking and grant budget autonomy to the small schools. The following briefly describes the four key conditions for small school effectiveness as identified by French, Atkinson, and Rugen (2007).

Smallness

Schools must be small and personalized so that students and parents know teachers and the administration on an individual basis. Individual communities and schools must define why they believe small schools will create effective environments for students – without this definition and understanding smallness is not enough to produce the beneficial results. A common understanding of how small schools may benefit student and district outcomes must be based on both quantitative and qualitative data related to the students and the district. In addition to the work that communities must do to define "why small schools," communities must also put significant effort into defining their vision for implementation and ongoing operation.

Unifying Vision

Schools must have a unifying vision of teaching and learning. That vision binds the school community and drives teaching and learning, as well as assessment to the goal of creating powerful learning experiences for each student. Each district, pilot program, and small school must develop their own vision of teaching and learning and must be firm on it. CCE has developed the following nine small school principles:

1. equity and access;
2. habits of mind;
3. personalization;
4. less is more;
5. student-as-worker, teacher-as-worker;
6. assessment by exhibition;
7. high expectations, trust, respect, and caring for all;
8. professional collaborative communities; and
9. flexibility, autonomy, and shared governance.

These principles need to be defined for each specific small school effort and articulated to ensure understanding of the differences that may occur between the vision of small school and that of a larger traditional school. For example, one of the principles that CCE defines is "less is more – the school's curriculum is driven by the concept of less is more where each student should master a limited number of essential skills and areas of knowledge" is counter to the vision of some larger traditional schools where there is often a broad range of coursework for students.

Autonomy

Schools must have the autonomy necessary to create unified learning communities, (i.e. control over budgets, staffing, curriculum/assessment, governance, and school calendar) while also benefitting from the economies of scale that remaining within a large district affords in services such as transportation, facilities, payroll, materials and legal services.

Accountability

Schools must be held accountable for the quality of the education they provide to students and for student outcomes, through benchmarks and school quality reviews. School-level accountability is critical. Schools must all be held to the same level of expectations regarding student outcomes and a system must be developed to report the small school pilot outcomes and ongoing recommendations. Schools must develop a detailed plan for approval to document their practices in student engagement and the resulting academic performance. This ongoing implementation evaluation and mid-course correction ensures that schools are engaged in quality educational practices that lead to high student engagement and achievement.

Recommendations on School Size and Creating Smaller Schools and Learning Communities

The findings from the literature are mixed with respect to establishing an optimal school size. There is research evidence supporting the efficacy of both small and larger schools in terms of operating efficiency and producing positive student outcomes. It is up to state and local policy makers to set the priorities and goals in terms of school size policies. Larger school sizes tend to offer greater economic efficiency, while smaller schools offer greater cost-effectiveness in terms of producing higher student outcomes at a given level of resource inputs (Stiefel et al., 2000; Walberg & Walberg, 1994). Larger schools also appear to reach a point of diminishing efficiency returns. The literature suggest that very large schools are inefficient in terms of operating costs and in producing higher student outcomes (Stiefel et al., 2000; Walberg & Walberg, 1994).

Further, the literature shows that smaller school settings may serve to facilitate improved student outcomes by providing an environment that is conducive to learning, particularly for students with special needs, who are found to perform better in smaller school or learning environments (Darling-Hammond, Ross, & Milliken, 2006; Rochford, 2005; Unterman, 2014). In a study of the effects of New York City's small school initiative, Stiefel, Schwartz, & Wiswell (2015) found that the impact of New York City's small schools initiative transferred to schools of all sizes throughout the city. According to Stiefel, Schwartz, and Wiswell (2015, 170), "implementing small school reform incrementally increases student achievement systemically."

Finally, the research team's own analyses of Maryland-specific data suggest that there is a small but statistically significant relationship between smaller schools and higher student achievement on state assessments (See Appendix E).

Based on its review of the literature and the strength of its findings, the research team offers two recommendations for Maryland policy makers to consider:

1. Create a policy establishing maximum school sizes by school level (elementary, middle, and high). These maximum school sizes would be set at the enrollment levels at which school operating costs were no longer benefiting from economies of scale and where student performance begins to decrease due to larger school size.

2. Institute a competitive grant program to support the construction of small schools and/or the renovation of existing large school buildings. Such a program would help accommodate school-within-school models – that is, the program would be targeted toward replacing or reconfiguring the lowest-performing large schools in the State.

Recommendation 1

The first recommendation is to establish maximum school sizes to prevent the construction of very large and potentially inefficient school buildings. Average school sizes in Maryland are larger than national average school sizes and the average school sizes of other Mid-Atlantic states.[8] Table 6, below, shows that Maryland's average elementary school size is near the Mid-Atlantic and national averages, but its average secondary school sizes are considerably larger.

Table 6: Maryland, Mid-Atlantic, and National Average School Sizes

School Level	Maryland	Mid-Atlantic States	National
Elementary School	**494**	**428**	**453**
Middle School	**728**	**586**	**576**
High School	**1,259**	**961**	**847**

Source: National Center for Education Statistics, 2010-11 school year enrollment data.

Based on the study team's analysis of the impact of school size on economic efficiency and academic performance in Maryland's schools, the enrollment at which schools' economic efficiency and student performance levels begin to drop off was identified for each school level. These enrollment thresholds are approximately equal to the number of students in a school at which both per student spending and student performance on state assessments begin to level off. For elementary schools, both economic efficiency and effectiveness began to decrease at enrollments above 700 students; for middle schools, the drop off occurred at 900 students; and for high schools, at about 1,700 students. These data would suggest maximum school size policies should be set at the sizes before efficiency and effectiveness decrease: 700 students for elementary schools, 900 students for middle schools, and 1,700 students for high schools. These maximums would only apply to new school construction and not impact existing schools.

Recommendation 2

The second recommendation is for the State to create a competitive incentive grant program for supporting the construction of small schools, or the renovation of existing large school buildings to accommodate school-within-school models. This program would target replacing or reconfiguring the lowest performing large schools in the state. Based on an analysis of schools' size and performance on state assessments, the study team suggests that two selection criteria be used. The first criteria establishes an academic performance benchmark for all school levels of fewer than 70 percent of

[8] For this analysis the Bureau of Labor Statistics' Mid-Atlantic region is used, consisting of the states of Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia.

students achieving proficiency or higher on state assessments. The second criteria establishes a minimum school size for each school level to ensure that only larger schools are eligible for the incentive grant. For elementary schools, eligible schools must exceed 550 students; for middle schools, enrollment must exceed 750 students; and for high schools, enrollment must exceed 1,000 students.[9] Using these criteria, a total of 24 elementary schools, 12 middle schools, and nine high schools would be eligible for a small school incentive grant.

The literature clearly shows small schools and learning communities must be implemented in conjunction with systemic school improvement strategies, designed to take advantage of the positive environmental factors small schools and learning communities have to offer, in order to be a coherent and effective reform effort. Therefore, each grant application must include a comprehensive school improvement plan that builds effective community engagement and instructional strategies around the small school/small learning community concept. The improvement plan must be based on research and best practices derived from studies of effective small schools and learning communities.

Additionally, the State should hold grantees accountable over time for implementing their improvement plans with fidelity and for achieving student performance goals.

Recommendation 1 Estimated Costs

Because the suggested maximum school sizes are set at a relatively high level, the cost impact of this recommendation is estimated to be minimal. Based on the national size and cost data presented in Table 5, above, for construction projects completed in 2014, the average enrollment size of new school buildings nationally was 624 students for new elementary schools, 612 students for middle schools, and 1,000 students for high schools. If these figures are representative of the new construction projects in Maryland, then the average size of new construction of schools at all three levels was smaller than the suggested new maximum school sizes. As a result, there would be no statewide cost impact. However, without similar data on the size of new school construction projects in Maryland it is impossible to develop an estimate of what the cost of this recommendation may be.

Recommendation 2 Estimated Costs

The costs of implementing Recommendation 2 will vary significantly depending on (1) the proportion of construction/renovation costs the State elects to cover from state revenue sources, (2) the number of grant applications submitted and approved, (3) the number of approved grants for the cost of constructing new schools versus the number grants for renovation of existing buildings, and (4) the average enrollment size of new construction grant projects approved.

An estimate of the maximum cost of the small school Initiative grant program assumes the following:

[9] The enrollment eligibility thresholds for elementary and middle schools were derived from the average school size in Maryland for elementary and middle schools and the low end of the range of maximum recommended school sizes for those districts with a school size policy. For high schools, all high schools with fewer than 70 percent of students achieving proficiency or higher on state assessments had enrollments of greater than 1,000 students except for 13 schools with much smaller enrollments in Baltimore City and Prince George’s County.

- All eligible schools apply for and are awarded a grant;
- all grants fund new construction of smaller schools to replace the large existing schools;
- the average school sizes for the proposed new, smaller schools equal the average school sizes established by the districts' with minimum school size policies listed in Table 2, above – 400 students for elementary schools, 600 students for middle schools, and 950 students for high schools; and
- an estimate of the average construction costs of the new, smaller schools and the average increase in annual school operating costs for the new, smaller schools compared to the larger school buildings they are replacing based on information provided by the Public School Construction Program office of the MSDE.

School construction cost information provided by the Public Schools Construction Program office of the MSDE shows that average costs per square foot for new and replacement schools in Maryland range from $260 per SF to $434 per SF, which equates to $44,300 per student to $99,400 per student respectively. Some of this variation is attributed to school level: elementary, middle, and high school. However, as was discussed in the Factors that Contribute to Small Schools section of this report, the cost per student is more directly related to the SF per student which has a large variation between school level and individual LEA. For purposes of this recommendation and analysis, the following initial cost per student will be used: $60,000 per elementary school student, $58,000 per middle school student, and $67,000 per high school student. These cost figures are based on 2014 data and they align with the higher quartile initial costs outlined by Abramson (2015). The reason the higher quartile figures are used is because Maryland is located in a higher cost region of the country when compared to the national dataset.

Based on the data presented in the Impacts of School Size in Maryland section of this report, it is recognized that instructional costs per student are higher in smaller schools. LEAs will need to consider the increased annual operational impact when constructing smaller school buildings. For purposes of this analysis, the annual instructional impact is consolidated into one number for the entire state. To project the annual operational impact, the following differential instructional cost per student will be used: $940 per elementary school student, $980 per middle school student, and $1,030 per high school student. These differential costs are based on the actual costs per student in Maryland.

At these average school sizes, a total of 42 new elementary schools would need to be constructed to accommodate the students currently enrolled in the 24 large, low performing schools. At the middle school level 18 new, smaller schools would need to be constructed to replace the existing 12 larger schools, and for high schools 14 new schools would be needed to replace the existing 9 larger schools. Table 7, below, summarizes the estimated maximum cost of this scenario.

Table 7: Small Schools Initiative Grant Maximum Cost Estimate

School Level	Cost Input	Amount
Elementary	Number of Eligible Schools	24
	Total Enrollment of Eligible Schools	16,653
	Proposed Enrollment Per New School	400
	Number of New Schools Needed	42
	Construction Cost Per Student	$60,000
	Cost Per School	$24,000,000
	Total Construction Cost	$1,008,000,000
	Annual Cost Differential Per Student	$940
	Ongoing Operational Annual Cost Impact	$15,792,000
Middle	Number of Eligible Schools	12
	Total Enrollment of Eligible Schools	10,758
	Proposed Enrollment Per New School	600
	Number of New Schools Needed	18
	Construction Cost Per Student	$58,000
	Cost Per School	$34,800,000
	Total Construction Cost	$626,400,000
	Annual Cost Differential Per Student	$980
	Ongoing Operational Annual Cost Impact	$10,584,000
High	Number of Eligible Schools	9
	Total Enrollment of Eligible Schools	12,966
	Proposed Enrollment Per New School	950
	Number of New Schools Needed	14
	Construction Cost Per Student	$67,000
	Cost Per School	$63,65,000
	Total Construction Cost	$891,100,000
	Annual Cost Differential Per Student	$1,030
	Ongoing Operational Annual Cost Impact	$13,699,000

School Level	Cost Input	Amount
Total Schools	Number of Eligible Schools	45
	Total Enrollment of Eligible Schools	40,377
	Number of New Schools Needed	74
	Total Construction Cost	$2,525,500,000
	Total Ongoing Operational Annual Cost Impact	$40,750,000

As Table 7, above, shows, if all eligible schools were to apply to grants for the new construction of smaller schools, given the assumed parameters described above, a total of 74 new, smaller schools would be funded at a total construction cost of $2.5 billion. The estimated increase in annual operating costs of the new, smaller schools compared to those of the current, larger schools is $40.7 million.

However, the research team does not believe that all eligible schools would apply for the grant, that all schools would apply to build new schools rather than renovate existing, large school building, or that all grant applications would be approved. Further, the Maryland Legislature could use the appropriation process to control the annual and overall cost of the grant program. For example, the grant program could be implemented over a five or 10-year period to reduce the annual costs of the program.

Conclusion

The findings from the literature and the lessons learned in many urban districts that have implemented small schools initiatives suggest that smaller schools are not, in themselves, a panacea for poor academic performance, but that they may play a significant role in establishing the conditions needed for implementing effective school improvement strategies. Smaller schools are also conducive to improving outcomes for students with special needs, a population that is expanding in Maryland and in other states. Statistical analyses carried out by the research team found a small, but significant, positive relationship between smaller school size and higher achievement on state assessments for elementary and high schools. There was also a small positive relationship between small school size and higher performance at the middle school level, but it was not statistically significant.

A thorough review of school size policies nationally found that currently no state mandates a maximum school size. The last state to do so, Florida, repealed the requirement after only two years due to concerns over the costs of building and operating smaller schools. However, the link between school size and costs, both initial construction costs and ongoing operating costs, is not as clear as one might imagine. A review of the literature finds that the per student costs of operating schools is likely U-shaped, with very small schools and very large schools experiencing higher per student costs to operate. Smaller schools may also be more cost-effective, that is, they may cost more per student to operate, but they produce higher student performance at a given level of resource inputs than larger schools. Strategies also exist for minimizing the costs of building and operating smaller schools by partnering with other schools and other types of organizations for sharing assets such as gymnasiums, playgrounds, and athletic fields.

The research team's analysis of the relationship between school size and per student costs found that generally per student costs decreased as enrollment increased. A policy to establish a relatively high maximum school size would accommodate this finding while preventing very large and potentially inefficient and ineffective schools from being built. The research team also concluded that the potential benefits of smaller schools and learning environments warrants consideration by the State of Maryland. Such a second recommendation proposes implementing a state-funded small schools incentive grant program to support the replacement of the state's largest, low-performing schools with new, smaller schools, or to renovate these larger school buildings to accommodate smaller learning communities.

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Appendix A: School Size Study Components and Study Elements

Study Element	Data Collection From State, LEA and Local Municipalities	Data Collection From Facility Planner Professionals	Literature Review	Analysis of Data and Recommendations
Local policies regarding size of schools	X			
Best and/or common practices in other states regarding school size	X	X		
Educational and extracurricular impacts of school size, and the impact, if any, on the surrounding neighborhoods	X	X		
Factors that contribute to large school size and recommendations for mitigating those factors	X	X		X
Recommendations for the ideal school size	X	X	X	X
Processes that can assist in ensuring public input into school size standards or guidelines		X	X	X
Models for the creation of smaller schools, including the subdivision of existing schools into multiple administrative units within the same campus, which share common areas such as cafeterias and sports fields		X	X	X
The costs and impacts of zoning laws that require new schools to be built to accommodate new development and how those costs can be reduced	X	X		X
The potential impacts on the Maryland Public School Construction program of establishing stricter policies regarding smaller schools, such as higher costs	X			X
How school boundaries and attendance areas affect school size	X		X	X
Whether opportunities are available for alternative methods to create space for smaller schools, including the purchase and renovation of existing buildings where available and including suburban and rural school design	X	X		X

Appendix B: Maryland School Size Policies by LEA

LEA	BOE School Size	EFMP School Size	BOE Policy and/or Comments
Allegany	No	No	
Anne Arundel	No	No	BOE is updating all policies
Baltimore City	No	No	Has prototype educational specifications for three sizes for each school level
Baltimore County	No	No	Has educational specification: 700 students for new elementary school
Calvert	No	No	
Caroline	Yes	Yes	Preferred school enrollment: 450 to 700 students in elementary schools 500 to 850 students in middle schools 700 to 1,400 students in high schools Also has acreage for school sites policy
Carroll	No	Yes	Has a utilization policy: 600 students in elementary school 750 students in middle school 1,200 students in high school
Cecil	Yes	No	300-600 students in elementary school 450-700 students in middle school 800-1,200 students in high school
Charles	No	No	
Dorchester	No	Yes	200-550 students in elementary school 400-800 students in middle school 500-1,300 students in high school
Frederick	Yes	Yes	For new construction: 700 students in elementary schools 900 students in middle schools 1,600 students in high schools
Garrett	No	No	
Harford	Yes	Yes	500 to 750 students in elementary schools 900 to 1,200 students in middle schools 1,000 to 1,600 students in high schools 200 to 350 special schools Also has class size policy
Howard	No	No	Has educational specifications for each school level, including site size[10] requirement, and has utilization criteria
Kent	No	No	
Montgomery	Yes	Yes	300 to 750 students in elementary schools 600 to 1,200 students in middle schools 1,000 to 2,000 students in high schools

[10] Site size refers to the number of acres required for each school size.

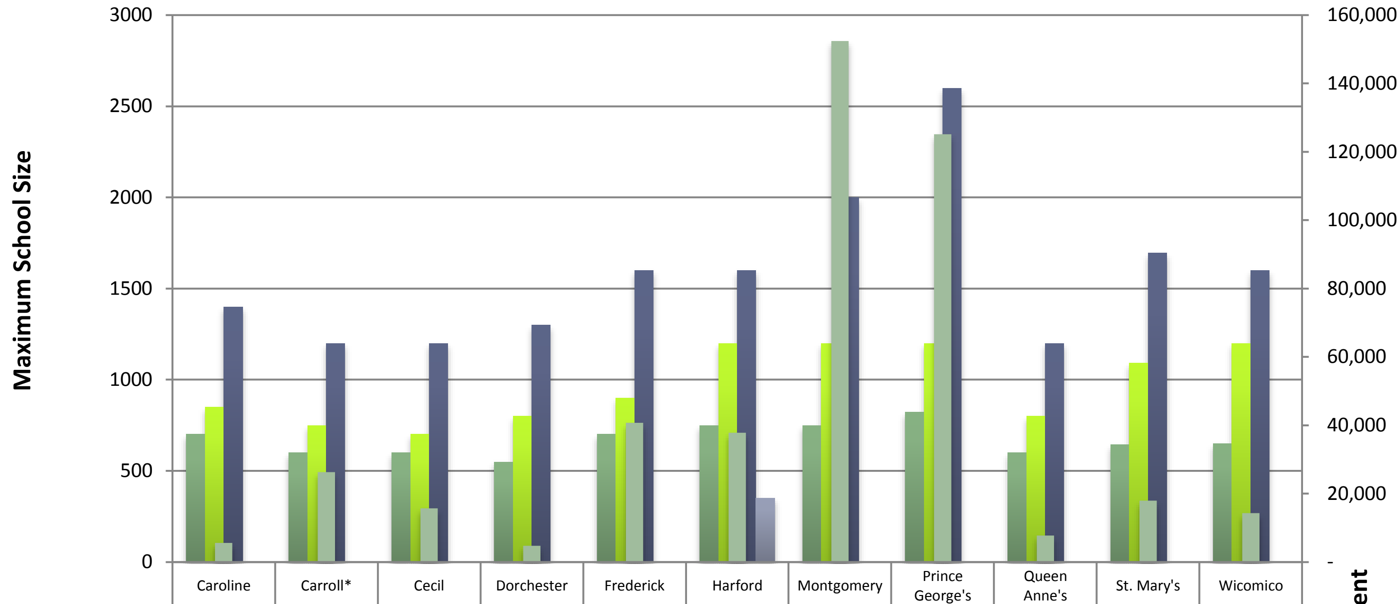
LEA	BOE School Size	EFMP School Size	BOE Policy and/or Comments
			Special and alternative program centers will differ from the above ranges and generally be lower in enrollment
Prince George's	No	Yes	411-822 students in elementary (K-5) 600-1,200 students in middle school (6-8) 950-2,600 students in high school (9-12)
Queen Anne's	No	Yes	600 students in elementary schools (PK-5) 800 students in middle schools (6-8) 1,200 students in high schools (9-12)
Somerset	No	No	
St. Mary's	No	Yes	400 to 644 students in elementary schools 790 to 1,090 students in middle schools 1,575 to 1,695 students in high schools
Talbot	No	No	
Washington	No	No	
Wicomico	No	Yes	Referenced in facility task force document: 650 students in elementary schools (PK-5) 1,200 students in middle schools (6-8) 1,600 students in high schools (9-12)
Worcester	No	No	

Appendix C: State Policies and/or Guidelines for School Facility Planning

State Policy/Best Practice	State
School Size Guidelines	Arizona, North Carolina
Classroom Space Guidelines	Alaska, Arizona, Arkansas, California, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Virginia, West Virginia
Square Footage/Student Guidelines	Alaska, Arizona, Arkansas, California, Florida, Kentucky, Massachusetts, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, West Virginia
Site Size Guidelines[11]	Alabama, Alaska, Arizona, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kentucky, Maine, Minnesota, Mississippi, Missouri, New Hampshire, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, Utah, Virginia, Washington, West Virginia, Wyoming
EFMP Requirement	Arizona, Arkansas, Colorado, Florida, Maryland, New Jersey, North Carolina, Ohio

[11] Site size guidelines are taken from Weihs, 2003.

Appendix D: Maryland LEAs with School Size Policies



	Caroline	Carroll*	Cecil	Dorchester	Frederick	Harford	Montgomery	Prince George's	Queen Anne's	St. Mary's	Wicomico
Elementary	700	600	600	550	700	750	750	822	600	644	650
Middle	850	750	700	800	900	1200	1200	1200	800	1090	1200
High	1400	1200	1200	1300	1600	1600	2000	2600	1200	1695	1600
Alternative						350					
2014 Enrollment	5,547	26,305	15,747	4,768	40,750	37,792	152,371	125,136	7,727	17,930	14,347

Appendix E: Multivariate School Size Analysis

While much can be learned from a bi-variate analysis of factors associated with school size, insights can also be taken from an examination of the influence of multiple variables at the same time. A multi-variate approach tells the reader more about influences on average than any information about why a particular case moves in a particular direction.

The literature reviewed for this part of the school size analysis (see References) is clear on the types of indicators that should be included in the analysis. The dependent variable examined here is composite test scores. Studies define this variable differently depending on the data that is available. In this analysis, the dependent variable is the proportion of students at a school who were proficient or advanced on the composite test score. The variables used to account for variation in this dependent variable include the following: indicators of student need (enrollment and student characteristics); size and building utilization; indicators of special usage of the building; and finally, education spending. For the purpose of this analysis, the study team has also chosen to analyze high schools, middle schools, and K-8 combined with regular elementary schools separately.

The study team conducted several descriptive multivariate analyses to understand how student and school characteristics, combined with school size, relate to the proportion of students with proficient or advanced test scores. The purpose of the analyses was to observe the influence of school size on student performance, while controlling for student characteristics and building utilization. These descriptive analyses were not designed to identify and to confirm causal relationships between predictor variables. The study team did not conduct any experimental studies so that its analyses are all correlational and do not result in causal claims.

According to the literature, it is not unusual to explain a significant part of the variation in test score results with the set of school characteristics that were used as independent variables in this analysis. The characteristics that children bring with them to school are strong predictors of achievement. Money, along with building configuration and utilization, may also make a difference in achievement, if allocated wisely and used appropriately.

In the multivariate analysis of composite test scores, there were several common themes across the three levels of schools. These themes include the following:

- The same set of school characteristics explained a similar percentage of the variation in composite test scores for each school level:
    - High school, 75 percent;
    - Middle school, 79 percent; and
    - K-8 and elementary, 68 percent;
- Total enrollment is negatively related to higher composite test scores factor in all three school categories;
- Square footage utilization is the only factor (positively related to test scores) in the K-8 and elementary school analysis;

- Characteristics of the student body including special education percentage, limited English proficient programming indicator, and free and reduced price meals percentage were significant (and negative) factors in most of the school settings;
- The K-8 indicator was a significant factor (negatively related to test scores) in the K-8 and elementary school analysis; and
- The staff salary expenditures per pupil was a significant factor (or nearly so) in each of the three analyses. (Negative in the case of high schools, and positive in the case of middle school and K-8 and elementary schools.)

Generally, the results of the multivariate analysis track better with the findings from the literature, that academic performance begins to decline as schools get larger, that wealthier schools tend to have higher performance, and that schools serving high-need students tend to have lower performance. Though it might be possible to tease out the direction and strength of certain relationships, such a detailed modeling exercise was beyond the scope of this multivariate analysis.

Separate models examined these relationships at the elementary, middle, and high school levels. Presented below are the results of the high school analysis, the middle school analysis and finally, the K-8 and elementary schools analysis. Each analysis will present the descriptive statistics for the dataset used, the multivariate results for the composite test score percent proficient analysis, and finally, commentary about what is worth noting in those results.

High School Analysis

Descriptive statistics for the variables used in the high school analysis are as follows.

High School Descriptive Statistics

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Total Enrollment	189	1273.61	525.49	95.00	2790.00
Square Foot Utilization	181	0.89	0.26	0.32	3.18
Square Foot Per Student Figure	181	196.85	69.63	10.00	182.00
Free and Reduced Meals Percentage	189	39.02	22.38	2.50	93.00
Limited English Proficient Percentage	189	3.25	4.87	0.00	26.30
Special Education Percentage	189	10.73	4.93	0.00	30.00
VoTech Indicator	189	0.07	0.25	0.00	1.00
Composite Test Score Percentage Proficient	189	0.84	0.15	0.35	1.00
Education Salary Expenditure per Pupil	189	6,343.67	1,534.29	4,125.00	17,192.00

Though there were 189 high schools in the data set, eight of those high schools were not able to report the square footage associated exclusively with their school. This is due to the fact that common space (for example, library and cafeteria space) was shared with other co-located schools. These high schools were for the most part (though not exclusively) transformation schools in Baltimore City. These eight schools were excluded from the high school analyses.

Composite Test Scores

Simple multivariate regression was run using a dependent variable of the proportion of high school students proficient on the composite test score. Explanatory variables used in the model included special education percentage, limited English proficient percentage, free and reduced meals percentage, square footage per student, an indicator of whether the school was a Vocational /Tech school, total enrollment, and staff salary expenditures per pupil.

The regression equation explained 75 percent of the variation in the composite test scores percent proficient. The strength of the model is described in the table immediately below.

Explanatory Strength of the Model: High School Composite Test Scores						
Source	**SS**	**df**	**MS**	**Number of obs**	=	181
				F(8, 172)	=	65.25
Model	2.11976488	8	0.26497061	**Prob > F**	=	0
Residual	0.69844904	172	0.00406075	**R-squared**	=	0.7522
				Adj R-squared	=	0.7406
Total	2.81821392	180	0.015656744	**Root MSE**	=	0.06372

The next table shows the relative strength of the explanatory variables.

Contribution of the Explanatory Variables: High School Composite Test Scores						
Variables	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf. Interval]**	
Total Enrollment	-0.0000282	0.0000131	-2.15	0.033	-5.41E-05	-2.34E-06
Square Foot Utilization	0.0158585	0.0248212	0.64	0.524	-0.033135	0.0648519
Square Foot Per Student Figure	-0.0002578	0.0001067	-2.42	0.017	-0.000468	-0.0000472
Free and Reduced Meals Percentage	-0.0030332	0.0003312	-9.16	0.000	-0.003687	-0.0023795
Limited English Proficient Percentage	-0.0007567	0.0011856	-0.64	0.524	-0.003097	0.0015835
Special Education Percentage	-0.0094732	0.0015383	-6.16	0.000	-0.01251	-0.0064367
VoTech Indicator	-0.0308374	0.0213347	-1.45	0.150	-0.072949	0.011274
Education Salary Expenditure per Pupil	-8.58E-06	4.41E-06	-1.95	0.053	-1.73E-05	1.17E-07
constant	1.199734	0.0474339	25.29	0.000	1.106106	1.293361

Observations

- Special education percent, free and reduced meals percentage, square footage per student, total enrollment and staff salary expenditures per student all had significant relationships with the dependent variable and were all associated with lower proportions of proficient students.

Middle School Analysis

Descriptive statistics for the variables used in the middle school analysis are as follows.

Middle School Descriptive Statistics					
Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Total Enrollment	215	740.861	230.078	247	1604
Square Foot Utilization	204	0.826	0.157	0.4	1.28
Square Foot Per Student Figure	215	167.342	63.151	0	445.56
Free and Reduced Meals Percentage	215	41.403	23.897	2.5	95
Limited English Proficient Offered	215	0.47	0.5	0	1
Special Education Percentage	215	11.203	3.993	2.5	26.3
Grade 9 Indicator	215	0.009	0.096	0	1
Composite Test Score Percentage Proficient	215	0.794	0.13	0.286	0.98
Education Salary Expenditure per Pupil	215	6697.502	1117.736	4484	10397

As with high schools, a figure for square footage was missing for 11 middle schools. These 11 schools were eliminated from the middle school analysis. The analysis was run on 204 middle schools. For middle schools, since a large number of schools (approximately 30) had some students identified as limited English proficient but less than 5 percent of the total number of students identified, we were not able to use LEP percentage figure in the analysis because the data was not available. Instead, an indicator of whether limited English proficient programming was offered was used in the analysis.

Composite Test Scores

Simple multivariate regression was run using middle school composite test scores percent proficient as dependent variable. Special education percentage, limited English proficient programming offered indicator, free and reduced meals percentage, square footage per student, grade 9 indicator, total enrollment, and staff salary expenditures per pupil were included as predictor variables.

The regression equation explained 79 percent of the variation in the composite test scores percent proficient. The strength of the model is described in the table immediately below.

Explanatory Strength of the Model: Middle School Composite Test Scores						
Source	SS	df	MS	Number of obs	=	204
				F(7, 196)	=	105.52
Model	2.36058355	7	0.337226222	Prob > F	=	0
Residual	0.62641534	196	0.003195997	R-squared	=	0.7903
				Adj R-squared	=	0.7828
Total	2.98699889	203	0.01471428	Root MSE	=	0.05653

The grade nine indicator was eliminated during the calculation of the equation for the model due to its very high correlation with other explanatory variables in the regression equation. The contribution of individual variables is shown below.

Contribution of the Explanatory Variables: Middle School Composite Test Scores						
Variables	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf. Interval]**	
Total Enrollment	-1.76E-06	0.0000227	-0.08	0.938	-0.0000465	0.000043
Square Foot Utilization	0.0520198	0.0444609	1.17	0.243	-0.0356635	0.139703
Square Foot Per Student Figure	2.88E-06	0.0001369	0.02	0.983	-0.0002671	0.0002729
Free and Reduced Meals Percentage	-0.0042521	0.0002264	-18.78	0.000	-0.0046986	-0.0038056
Limited English Proficient Percentage	-0.0269279	0.0091463	-2.94	0.004	-0.0449658	-0.0088901
Special Education Percentage	-0.0026577	0.0014222	-1.87	0.063	-0.0054624	0.000147
Grade 9 Indicator	Eliminated from the analysis					
Education Salary Expenditure per Pupil	9.64E-06	4.39E-06	2.20	0.029	9.88E-07	0.0000183
constant	0.9073189	0.0639552	14.19	0.000	0.7811903	1.033447

Observations

- Free and reduced meals, LEP percentage, and staff salary expenditures per pupil were all significantly related to the outcome variable. Free and reduced meals and limited English proficient percentage were associated with lower proportion of proficient students, while staff salary expenditures per student was associated with higher proportions of proficient students.
- The grade nine indicator was eliminated from the analysis.

Elementary and K-8 School Analysis

Descriptive statistics for the variables used in the elementary and K-8 school analysis.

K-8 and Elementary School Descriptive Statistics					
Variable	**Observation**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Total Enrollment	840	497.963	175.716	36	1369
Square Foot Utilization	839	0.972	0.241	0	2.85
Square Foot Per Student Figure	839	140.07	50.457	0	568.89
Free and Reduced Meals Percentage	834	52.527	28.563	2.5	95
Limited English Proficient Offered	840	0.638	0.481	0	1
Special Education Percentage	832	11.244	4.635	2.5	35.9
K-8 Configuration Indicator	840	0.092	0.289	0	1
Composite Test Score Percentage Proficient	840	83.726	12.067	38.02	100
Education Salary Expenditure per Pupil	840	6442.914	1581.919	4231	28214

As with high schools and middle schools, information was missing for a few elementary schools. Seven schools of 840 were missing a percentage for free and reduced meals. Eight schools were missing a special education percentage. As a consequence 15 schools of 840 were eliminated from the K-8 and elementary school analysis. For K-8 and elementary schools, since a large number of schools (approximately 50) had some students identified as limited English proficient but less than 5 percent of the total number of students identified, we were not able to use LEP percentage figure in the analysis because the data was not available. Instead, an indicator of whether limited English proficient programming was offered was used in the analysis. The analysis was run on 825 K-8 and elementary schools.

Composite Test Scores

Simple multivariate regression was run with the proportion of students with proficient K-8 and elementary school composite test scores as dependent variable. Special education percentage, limited English proficient programming offered indicator, free and reduced meals percentage, square footage per student, grade 9 indicator, total enrollment, and staff salary expenditures per pupil were included as predictor variables.

The equation explained 68 percent of the variation in the composite test scores percent proficient. The strength of the model is described below.

Explanatory Strength of the Model: K-8 and Elementary School Composite Test Scores						
Source	**SS**	**df**	**MS**	**Number of obs**	=	825
				F(8, 816)	=	212.44
Model	80710.0458	8	10088.7557	**Prob > F**	=	0
Residual	38751.8036	816	47.4899554	**R-squared**	=	0.6756
				Adj R-squared	=	0.6724
Total	119461.849	824	144.977973	**Root MSE**	=	6.8913

The contribution of individual variables is shown below.

Contribution of the Explanatory Variables: K-8 and Elementary School Composite Test Scores						
Variables	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf. Interval]**	
Total Enrollment	-0.005395	0.001837	-2.94	0.003	-0.0090008	-0.0017891
Square Foot Utilization	2.631681	1.224194	2.15	0.032	0.2287395	5.034622
Square Foot Per Student Figure	-0.0306615	0.006095	-5.03	0.000	-0.0426251	-0.0186978
Free and Reduced Meals Percentage	-0.283792	0.0095254	-29.79	0.000	-0.3024891	-0.2650948
Limited English Proficient Offered	0.7059395	0.5748162	1.23	0.22	-0.4223531	1.834232
Special Education Percentage	-0.2068326	0.0605382	-3.42	0.001	-0.3256616	-0.0880036
K-8 Configuration Indicator	-9.107127	0.9190295	-9.91	0.000	-10.91107	-7.303186
Education Salary Expenditure per Pupil	0.0004323	0.0001813	2.39	0.017	0.0000765	0.0007881
constant	102.8609	2.121796	48.48	0.000	98.69612	107.0258

Observations

- Factors that were significantly related to the proportion of proficient students included total enrollment, percentage of special education students, percentage of FARMs-eligible students, square footage per student, the K-8 indicator, square footage utilization, and staff salary expenditures per student. Total enrollment, special education percentage, free and reduced meals percentage, square footage per student, and the K-8 indicator were associated with lower proportions of proficient students. Staff salary expenditures per student and square footage utilization were associated with higher percentages of proficient students.
- The K-8 indicator was also very significant and negative, meaning those schools have lower proportions of proficient students than elementary schools.