Preliminary Analysis
The Cost and Characteristics of Maine's Higher Performing Public Schools

Report Prepared for
Joint Standing Committee on Education and Cultural Affairs
Maine State Legislature

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Introduction

In Spring 2005 the Maine Legislature passed legislation establishing an isolated small school adjustment in the Essential Programs and Services (EPS) funding formula. The adjustment for isolated small high schools (i.e. under 200 pupils) was a reduction in student-teacher ratios in the formula calculations, and in the case of isolated elementary schools (i.e. fewer than 15 pupils per grade level), the adjustment amounted to a 10% transition adjustment for the 2005-06 EPS per pupil rate. Island schools received an additional adjustment for operating and maintenance costs, and transportation costs. A more complete description of the adjustments appears in Appendix A.

In approving these adjustments, the Legislature directed the Maine Education Policy Research Institute (MEPRI) to conduct a review of high performing, cost-effective small schools. Specifically the language in the legislation was as follows:

> *"The Maine Education Policy Research Institute within the University of Southern Maine shall conduct a review of high-performing and cost-effective small schools in the state. The steering committee of the Maine Education Policy Research Institute shall include a targeted research project to the fiscal year 2005-06 work plan to permit the principal investigators of the Maine Education Policy Research Institute to provide such technical assistance as may be required to complete this study. Based upon its analyses, the Maine Education Policy Research Institute shall develop models of small schools that are both high performing and cost-effective. The Maine Education Policy Research Institute shall report its findings and recommendations, including the characteristics of high-performing and cost-effective small schools and proposed adjustments to the cost components of the Essential Programs and Services Funding Act, to the Joint Standing Committee on Education and Cultural Affairs by November 30, 2005. The Joint Standing Committee on Education and Cultural Affairs may introduce a bill related to the report to the Second Regular Session of the 122nd Legislature."* (PL05, C.12, (LD468), Sec. UU-6)

A four phase study was conducted to fulfill this Legislative directive. These included:

1. An examination of the applicability to Maine of some fairly widely held assumptions about the benefits of small schools.
2. The identification of higher performing Maine schools, of all sizes.
3. A calculation of the cost of different size higher performing schools in Maine.
4. An analysis of characteristics of higher performing Maine schools.

Based on the results of these analyses, a proposed adjustment to the cost components of EPS has been developed and is presented in the final section of this report.

The first phase of the study entailed examining Maine schools based on different average school sizes. But before presenting these analyses, a note about the extant literature on school size is in order. A partial listing of sources reviewed appears in Appendix B. A review of this literature did not prove very helpful in responding to the legislative directive. This was the case for three key reasons: (1) some of the literature consisted of opinion, and/or anecdotal accounts, and was not based on unbiased generalizable empirical evidence; (2) school sizes or school locations examined in many research studies were not applicable to Maine (e.g., small schools were defined as less than 750 or 1,000 students; or small urban city schools were studied, not small rural schools); or (3) the research was flawed and/or did not adhere to standard rigorous research procedures. Thus, the literature provided little guidance in analyzing small school efforts in Maine. Consequently, three different analyses were undertaken to explore the relationship between school sizes in Maine and several different school and performance related characteristics.

Analyzing Maine's Public Schools by Size

The first phase of the study focused on exploring the applicability of some fairly widely held assumptions about the benefits of small schools to Maine schools. One analysis involved determining the cost per graduate. Two

research studies, one in New York (Stiedel, et al.; 1998) and one in Nebraska (Frank and Bailey; 1999), have concluded that the cost of obtaining a high school graduate is less in smaller high schools. That is to say, although the yearly costs of educating high school students are often higher in small schools, the average cost of graduating a student from small high schools is less. Unfortunately, a review of these two studies revealed the conclusions over-reach the empirical evidence found in the studies, and that the results are somewhat misleading. However, the premise of the studies (i.e., cost per graduate in different size high schools) warranted examination in Maine.

What are the costs associated with obtaining a high school graduate in different size schools in Maine? Is the cost lower in smaller schools? To answer these questions an average 2004 four-year cost per graduate was calculated for each of Maine's public high schools. The summary analysis of this information appears in Table 1, and a more technical description of the calculation appears in Appendix C. The costs for three island high schools

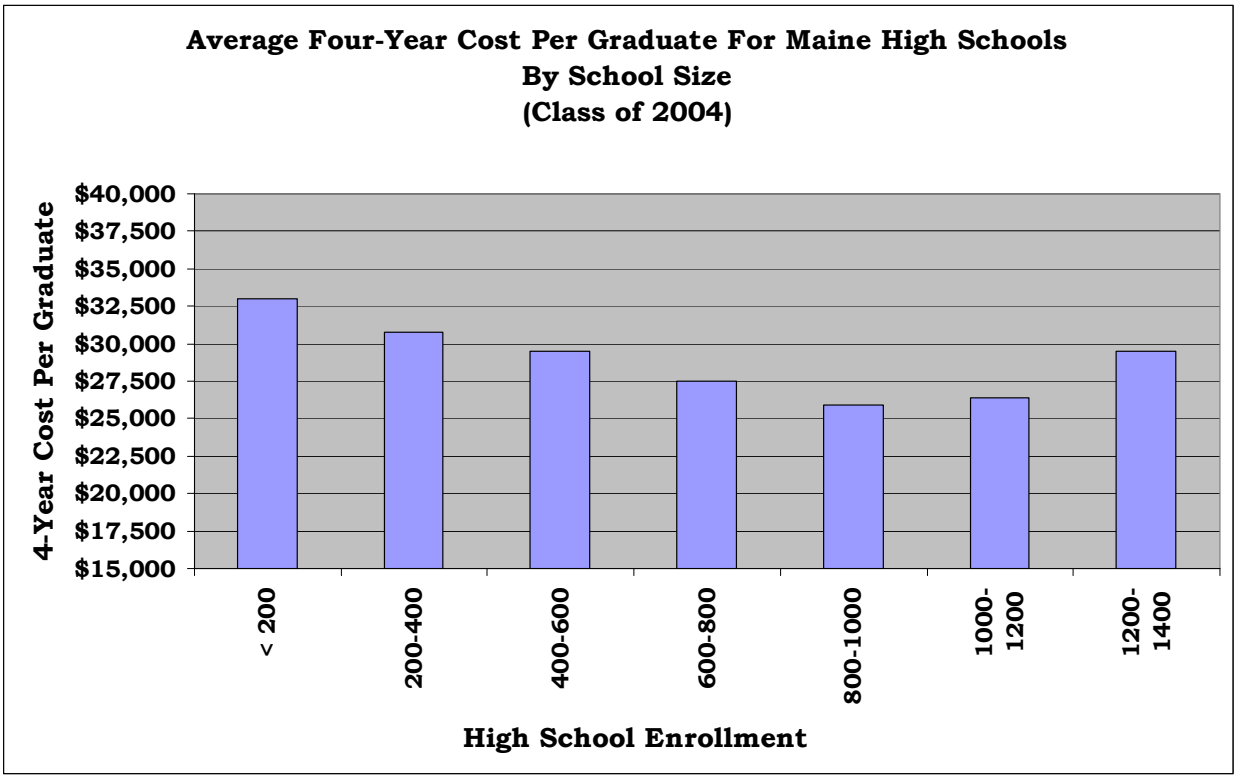
Table 1
Average 2004 Cost per Graduate for Maine High Schools

School Size Enrollment	Number of SAUs	Average Graduation Rate	Range of Cost per Graduate	Average Four-Year Cost per Graduate
< 200	23	91%	$26,000 - $49,927	$32,994
200-400	33	86%	$21,745 - $41,778	$30,767
400-600	20	90%	$22,802 - $34,884	$29,473
600-800	17	89%	$23,546 - $32,039	$27,509
800-1000	10	89%	$22,027 - $29,435	$25,916
1000-1200	9	84%	$20,882 - $30,366	$26,424
1200-1400	3	84%	$26,123 - $33,104	$29,460
State Average				
500	**115**	**88%**	**$20,882 - $49,927**	**$29,710**

were excluded from the analysis because expenditures for these schools skewed the results for the smallest high school size category (i.e., these three schools all have unusually high per graduate costs compared to mainland high schools).

As may be gleaned from the information in the table and seen visually in Figure 1, the four year cost per graduate in Maine is highest for the smallest groups of Maine high schools, and lowest for Maine's high schools with

Figure 1



enrollments between 800-1,000 students, the third largest school size category. Further examination of this information reveals two additional observations. One is that the relationship between cost per graduate and school sizes is not linear, but in fact is curvilinear. That is to say, costs are highest in smaller schools, lowest in 800-1,000 student high schools, and higher again as the sizes of schools increase beyond 1,000 students. Second, there is a considerable range of costs per graduate **within** each school size category. For example, the range within the 23 smallest high schools is $26,000 per graduate to $49,927 per graduate. Likewise, the range within the 800-1,000 student schools is $22,027 to $29,435. Thus, the size of the high school alone does not insure lower or higher costs per graduate. Some small schools are more costly per graduate than others, and some small schools are less costly per graduate than larger schools. The same may be said about larger Maine

high schools (A complete list of cost per graduate for each high school appears in Appendix D).

A second analysis was undertaken to determine the relationships between school size and the performance of economically advantaged and disadvantaged pupils. Are some schools better for some students? Or do all students perform academically about the same regardless of school size?

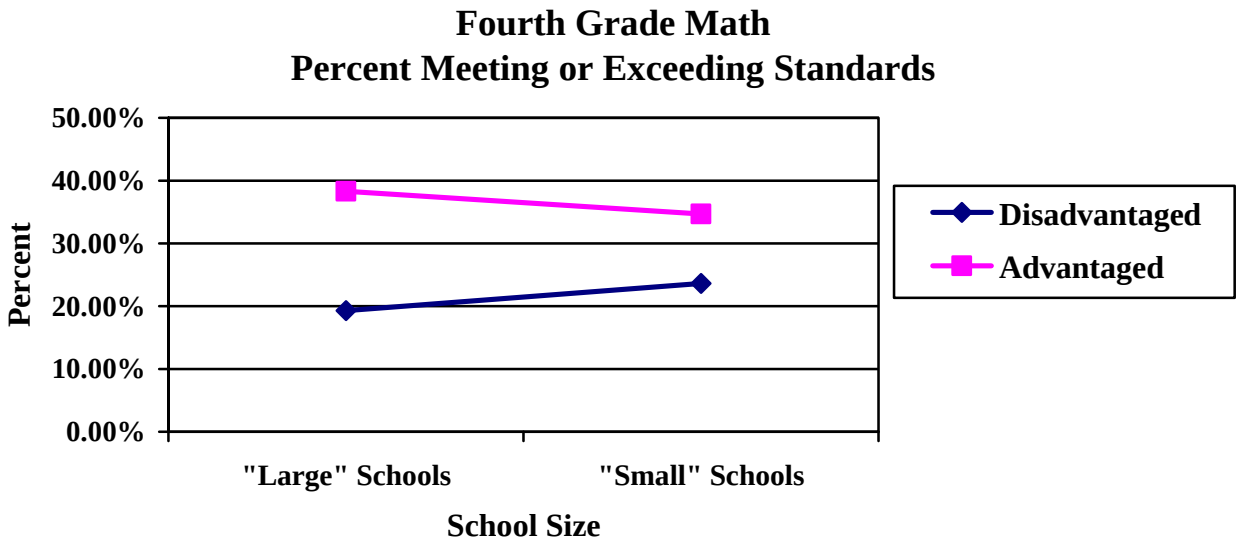
This analysis was seen as particularly important for both philosophical and empirical reasons. Philosophically, the goal is for all children to excel academically, and consequently any barrier to achieve this goal should be eliminated. If school size is a barrier this needs to be known and addressed. And at first blush school size may appear empirically to be a barrier for some children. A 2005 report published by the Rural School and Community Trust (Rural Policy Matters; 2005) concluded that Maine's smaller schools reduce the negative influence of poverty; that the gap between the performance of economically advantaged and disadvantaged students is smaller. Small schools were defined as any school below the state average (median) school size and large schools were defined as any school larger than the median size.

However, a secondary analysis does not support this conclusion. The secondary analysis entailed using similar criteria to define "small" and "large" elementary schools as was used in the initial study, but **student-level** MEA scores were analyzed, instead of school level scores. The analysis was conducted for each MEA grade level and each of four core disciplines.

The complete results of these analyses appear in Appendix E, and one example is reported in Table 2. An examination of the information in Table 2 on the next page does indeed show a smaller gap between the performance of economically advantaged and disadvantaged students in smaller schools, but not necessarily for the right reasons. The performance of disadvantaged students is indeed slightly higher, but the performance of advantaged students is **lower**. Other profiles that appear in Appendix E are not in all cases as clear-cut, but overall they do suggest that the decrease in the achievement gap related to poverty may not be due strictly to an increase in performance of the high-poverty students, but also a decrease in the performance of low-poverty

students. This suggests that a definitive conclusion regarding the relationship among school size, poverty, and achievement cannot be reached without further examination.

Table 2



Economically	"Large" Schools	"Small" Schools
Disadvantaged	19.29%	23.62%
Advantaged	38.31%	34.68%

A third analysis involved examining relationships between different school sizes in Maine and selected academic and school culture variables. For this analysis, Maine schools were divided into group sizes to reflect current Maine law for the 2005-06 funding formula (e.g., smallest grouping of high schools and elementary schools) and by dividing the school sizes into approximations of quintiles.

Tables 3 and 4 provide the results of this analysis for elementary schools (K-5 grade configuration schools). Similar information for middle and high schools appear in Appendix F. Variables that were examined were selected

because: (1) the literature suggested they are influenced by school size; and/or evidence was available for Maine schools.

As may be seen in these tables, the relationships of school size and various characteristics vary **between** school size groups, and vary considerably **within** any given school size group. For example, and as shown in Table 3,

Table 3
Elementary Schools Performance and Cost Information

Average Grade Size	MEA		Cost	
	Average	Range	Average	Range
Less than 15	531.1	524.3-537.5	$6,841	4,047-12,081
15-26	530.2	523.8-539.8	$5,960	4,135-9,029
27-39	531.1	523.8-536.0	$5,682	4,329-7,011
40-56	531.5	525.8-538.5	$5,763	4,100-7,215
57 or more	532.0	527.0-538.3	$5,682	4,369-7,804
All sizes	**531.2**		**$5,930**	

average MEA performance is highest in larger schools, but also similar in different size groupings. Average MEA performance is lowest in school size with average grade sizes between 15-26, but whereas at least one school in this size grouping has an average MEA score below the state average (e.g., 524.3) at least one school has an average above the state average (e.g., 537.5). In the case of expenditures, the variance within the smallest group is much larger. One school is spending 32% less than the state average where another is spending over twice as much as the state average.

School culture data also varies considerably between various school size groups. Little statewide consistent information is available on school culture, but what is available comes from principals' responses to a school resource survey distributed statewide every two years. Principals are asked to what extent selected individual and school characteristics pose a problem in their school, and information in Table 4 on the next page reports the percentage of principals who indicated the characteristics as a major problem in elementary schools. As may be seen from an examination of the information, the messages are mixed. For example, student tardiness is not viewed as a problem in Maine's smallest grade size schools, but student absenteeism is a problem.

Table 4
Elementary School Culture

Average Grade Size	Student Tardiness	Student Absenteeism	Student Bullying	Fighting / Violence	Students' Motivation to Learn	Lack of parental involvement
Less than 15	0%	16.7%	8.3%	8.3%	25.0%	16.7%
15-26	31.3%	18.8%	18.8%	6.3%	37.6%	50.1%
27-39	18.8%	12.5%	12.5%	0%	23.0%	25.1%
40-56	14.3%	14.3%	14.3%	7.1%	35.7%	28.6%
57 or more	6.7%	14.3%	6.7%	0%	20.0%	26.7%

Problems of student motivation to learn are at the lowest percentage in the largest schools, but vary considerably among the other size schools.

In summary, these three sets of analyses provide substantial evidence that some of the fairly widely help assumptions about the benefits of small schools do not hold true for Maine schools. The relationships between school size and various individual and school characteristics are mixed. In some cases the mixed results may be an indication of missing or less than precise data, but when these analyses are taken in the aggregate, it becomes apparent that school size is not the determinant of school benefits, and that the relationships between school characteristics such as size and deserved outcomes is multi-faceted and complex.

Identification of Higher Performing Maine Public Schools

The fundamental goal of Maine's education system remains the same regardless of school size – to maximize performance for all children wherever they live in Maine. Thus, the second phase of this study to fulfill the Legislative directive involved identifying higher-performing Maine schools of all sizes throughout Maine.

In order to identify Maine's higher performing schools, "higher performance" must be defined. Historically, and nationally and internationally, "higher performance" has often been defined as any performance scores above some average score (e.g., school average scores above the state average score

on some type of standardized test). Definitions like these have proven to be problematic for several reasons, not the least of which is that some of the differences in school average scores may be attributable to community characteristics (e.g. community education and poverty levels). In fact, some studies have shown community characteristics may account for as much as 50% of the differences in average school scores between different communities. This has resulted in many researchers re-defining higher performance by what is sometimes called a "value-added" definition of higher performance. Using a value-added definition, a school is designated as higher performing only when its average performance score is higher than would be expected based on that community's characteristics. In essence, the school is defined as adding value beyond the community. In this study, then, a value-added definition was used, along with other criteria.

Four specific types of criteria were used in this study to identify higher performing schools. To qualify as a higher performing school, the school must:

1. have MEA performance substantially above the state average;
2. have MEA performance substantially higher for both economically advantaged and disadvantaged children
3. have MEA performance substantially higher than expected by community characteristics (value-added criteria); and
4. include sufficient grades for attributing MEA performance.

More specific information describing the selection criteria appears in Appendix G. Whenever possible, three-year average MEA scores were used for schools to avoid the performance data being skewed by any single year performance. Schools without MEA data, as well as private schools, were excluded from the analysis. The fourth criterion was included because it was important to be able to attribute MEA performance to the school. Thus, for example, 4-6 grade schools were excluded from the analysis because the MEA scores for these schools are more likely attributable to another school (e.g., K-3 schools) than to the 4-6 grade schools. The same four criteria, but in the opposite directions, was used in identifying lower performing schools (e.g., MEA scores substantially below the state average, etc.). **It should be noted that the**

application of these criteria and exclusions to identify higher performing Maine schools was for research purposes only. The State of Maine has not officially established any set of criteria for defining higher and lower performing schools, nor has the State specifically endorsed the definitions and criteria used in this research study.

Approximately 500 Maine schools qualified for inclusion in this phase of the study, and the distribution of higher-performing and lower performing schools appears in Table 5. As shown in the data reported in the table, overall

Table 5
Higher and Lower Performing Maine Public Schools

School Level	Schools Evaluated	Higher Performing	Range in School Size	Lower Performing	Range in School Size
High School (9-12)	118	14 (11.9%)	99-1479	22 (18.6%)	102-1136
Middle School (6-8)	94	15 (16.0%)	165-794	21 (22.3%)	28-718
Grade School (K-5)	188	45 (23.9%)	59-697	43 (22.9%)	48-642
K-8 School	98	19 (19.4%)	65-522	18 (18.4%)	85-474
Total	**498**	**93 (18.7%)**	**59-1479**	**104 (20.9%)**	**28-1136**

approximately 19% of Maine's schools were designated as higher performing using the criteria in this study, and about 21% were designated as lower performing. The school level with the highest percentage of higher performing schools are K-5 type grade schools, but this school level also has the highest percentage of lower performing schools. The lowest percent of higher performing schools was identified at the high school level. **The analysis clearly reveals that higher performing, as well as lower performing schools come in all sizes. Some of each type are small and some of each type are among the largest schools in Maine.** There are approximately 690 public schools in Maine, and because only 498 were analyzed in this study, other Maine schools may qualify as higher and lower performing schools. But for purposes of this study, the schools described in Table 5 were used in calculating costs and distinguishing characteristics of higher performing schools in subsequent phases of this study.

The Cost of Maine's Higher Performing Public Schools

The third phase of this study involved determining the cost of Maine's higher performing schools, and determining if they varied by different grade configurations and school sizes. To do this, school level financial data was needed on all schools. At first blush this appears to be a fairly simple process – that is, conduct a review of the yearly financial information SAUs submit to the Maine Department of Education and calculate school level costs. However, while this process is possible at the secondary level, it is not readily feasible in the case of elementary schools. SAUs submit summary level financial expenditure information yearly to the Maine Department of Education, by two grade level groupings (by grade K-8 levels and grade 9-12 levels). Because only one Maine SAU has more than one high school, the financial expenditure data for secondary schools is, in essence, school level data. This is not the case at the K-8 level. If an SAU has more than one elementary school, the expenditure data the SAU submits no longer becomes school level, but rather SAU system level.

To overcome this data problem, an expenditure allocation process was created for this study. Since salaries and benefits account for 75% or more of a school's expenditures, these three year average costs were allocated to each school based on individual school level staff data submitted yearly by SAUs to the Maine Department of Education. These costs were then adjusted for teaching experience, education level, and regional salary differences. All other expenses (e.g., system office expenses, building and maintenance expenses, etc.) were allocated to schools on a per student basis using SAU level data. The result was expenditure amounts at the school level that were comparable across schools.

School size groupings were established following two different criteria. Current EPS law was used in establishing the smallest group size (smallest elementary group = schools with less than 15 students per grade level; smallest high school group = schools with less than 200 students). Larger school sizes were determined by an analysis of school size clusters. For purposes of describing the financial information four different grade level configurations

were used: (1) Grade schools = non-K-8 grade combinations; (2) Elementary Schools = K-8 schools; (3) Middle Schools = 6-8 grade combinations; and (4) High School = 9-12 grades. Average grade size categories were created to mirror current EPS law, and reflect cluster patterns found among the schools included in this analysis.

Tables 6-10 report the results of the expenditure analysis using the allocation process described above. Before discussing the results, three cautionary notes are in order. First, because these tables report allocated expenditures, the critical comparison is between relative amounts, not reported allocated amounts. Second, island schools were excluded from the analysis because their expenditures skewed results. Third, some school size groupings include very few schools, and thus, additional caution must be exercised in interpreting this data.

Given these caveats, the information in the tables still provides some important observations and findings. Table 6 reports the financial analysis for Grade Schools (non-K-8 grade configuration schools). Some major observations are:

- When all school size categories are considered, generally smaller school size categories are more costly, but not always (e.g., schools of 30-49 students per grade level vs. school sizes of 50 or more grade level students).

Table 6
Cost Analysis of Grade Schools†

Average Grade Size	Number of Schools			Mean 3-Year Per-Pupil Allocated Expense, Adjusted for Teacher Education & Experience and Region		
	Higher-Performing	Lower-Performing	All Schools	Higher-Performing	Lower-Performing	All Schools
Less than 15	9	7	28	$6,699	$6,762	$6,694
15 – 29	6	12	45	$6,428	$5,744	$5,957
30 – 49	13	11	53	$5,650	$5,668	$5,653
50 or more	16	13	55	$5,852	$5,805	$5,704
All Sizes	44	43	181	$6,044	$5,909	$5,905

† Includes EK/K-4, EK/K-5, EK/K-6, EK/K-7, 1-4, 1-5, 1-6, 2-4, 2-5, 2-6, but **not** EK-8 or K-8 schools. Island schools are excluded.

- Overall, higher performing schools are slightly more expensive than lower performing schools (i.e., $6,044 vs. $5,909; 2.3% difference),

but not in all school size categories (e.g., less than 15 students per grade level and 50 or more students per grade level).

- The smallest school size higher performing schools (less than 15 students per grade level) are approximately 13.4% more expensive than all school sizes (i.e., $6,699 vs. $5,905)
- Higher performing schools with 15-29 students per grade level are 8.8% more expensive than all school sizes (i.e., $6,428 vs. $5,905).

Table 7 and 8 report the financial information for K-8 Elementary Schools. In this case, all K-8 schools with higher or lower performance at the 8th grade level were included in the analysis. Some findings for these schools include:

- When all school size categories are considered, smaller school size categories are more costly.
- Overall, the cost of higher performing schools is similar to the cost of all schools (i.e., $6,774 vs. $6,617; 2.4% difference).
- The smallest category of higher performing schools cost, relatively speaking, only 3.8% more than the average cost for all schools; and the next largest size grouping (15-29 students per grade) cost only 6.8% higher than the average cost of all schools.

Table 7
Cost Analysis for Elementary K-8 Schools: 8th Grade Performance †

Average Grade Size	Number of Schools			Mean 3-Year Per-Pupil Allocated Expense, Adjusted for Teacher Education & Experience and Region		
	Higher-Performing 8th Grade	Lower-Performing 8th Grade	All Schools	Higher-Performing 8th Grade	Lower-Performing 8th Grade	All Schools
Less than 15	7	8	36	$6,870	$7,063	$7,162
15-29	8	5	36	$7,068	$5,986	$6,645
30 or More	4	2	22	$6,017	$5,006	$5,678
All Sizes	19	15	94	$6,774	$6,430	$6,617

† Also includes EK-8 schools. Island schools are excluded.

A secondary analysis of this data suggested that one type of higher performing schools (i.e., higher performing schools at the 4th grade, but not at the 8th grade, were skewing the results. Thus, the financial data were reanalyzed excluding this group of schools. Accordingly, Table 8 presents the

financial analysis for K-8 schools, which are higher performing (or lower performing) at both the 4th and 8th grade levels or only at the 8th grade level. There are fewer schools in each category, but an examination of this data indicated:

Table 8
Cost Analysis for Elementary K-8 Schools: 4th and 8th Grade Performance †

Average Grade Size	Number of Schools			Mean 3-Year Per-Pupil Allocated Expense, Adjusted for Teacher Education & Experience and Region		
	Higher-Performing 4th and 8th Grade	Lower-Performing 4th and 8th Grade	All Schools	Higher-Performing 4th and 8th Grade	Lower-Performing 4th and 8th Grade	All Schools
Less than 15	3	3	36	$7,422	$7,357	$7,162
15-29	3	3	36	$6,426	$5,232	$6,645
30 or More	2	1	22	$5,584	$5,364*	$5,678
All Sizes	8	7	94	$6,589	$6,162	$6,617

† Also includes EK-8 schools. Island schools are excluded. *Single school

- The cost of the smaller category of higher performing schools is 12.2% above the cost of all schools (i.e., $7,422 vs. $6,617).
- The cost of higher performing schools with an average of 15-29 students per grade level is approximately 3% **less** than the cost of all schools (i.e., $6,426 vs. $6,6117).

Table 9 reports the results of the financial analysis for middle schools.

Table 9
Cost Analysis for Middle Schools †

Average Grade Size	Number of Schools			Mean 3-Year Per-Pupil Allocated Expense, Adjusted for Teacher Education & Experience and Region		
	Higher-Performing	Lower-Performing	All Schools	Higher-Performing	Lower-Performing	All Schools
Less than 68	2	5	16	$6,690	$6,357	$5,873
68 – 96	2	4	16	$5,146	$5,822	$5,703
97 – 132	3	3	19	$6,178	$6,006	$6,001
133 – 199	5	4	17	$5,810	$6,004	$6,103
200 or More	3	3	20	$5,833	$5,206	$5,418
All Sizes	15	19	88	$5,917	$5,933	$5,811

† Includes 4-8, 5-8, 6-8, 7-8 schools. Island schools are excluded.

Observations included:

- All middle schools may be considered moderate in size.
- The average per pupil expenditure varies very little between school size categories.
- In some cases higher performing schools are more expensive (e.g. less than 68) and sometimes lower performing schools are more expensive (e.g., 68-96 students).
- There is no clear pattern of expenses between different school size categories.

In the case of high schools, the information in Table 10 reveals:

- When all school size categories are considered, per pupil expenditures consistently increase with smaller size schools.
- Overall, lower performing schools are more expensive than higher performing schools (i.e., $7,636 vs. $7,277; 4.9% difference).
- For some school sizes, higher performing schools are more expensive than lower performing schools (e.g., sizes 350-599, 850 or more).
- Because there is only one higher performing school with less than 200 students, and because the cost of this school is skewed, it is difficult to determine the cost of the smallest high schools.

Table 10
Cost Analysis for High Schools †

School Size	Number of Schools			Mean 3-Year Per-Pupil Operating Expense, Adjusted for Teacher Education & Experience and Region		
	Higher-Performing	Lower-Performing	All Schools	Higher-Performing	Lower-Performing	All Schools
Less than 200	1	4	9	$12,456*	$8,697	$8,861
200 – 349	2	7	24	$7,049	$8,698	$7,787
350 – 599	4	5	27	$7,494	$6,657	$7,201
600 – 849	4	4	20	$6,408	$6,380	$6,568
850 or More	2	1	23	$6,219	$5,868*	$6,086
All Sizes	13	21	103	$7,277	$7,636	$7,110

† Includes 7-12, 8-12, 9-12 schools. Island and alternative schools are excluded.
*Single school

To summarize these findings on expenditures, some higher performing schools are more expensive, but not in all cases. Some higher performing small school sizes are more expensive at the Grade School and Elementary K-8 School levels, but a similar pattern is not found for middle or high schools. Even within school size groupings some are more expensive, some less expensive.

What then is the cost of higher performing, cost effective small schools in Maine? It is important to note that even within the higher performing school groups, expenditures may vary considerably. For example, within the smallest group of higher performing Grade Schools allocated costs range from $9,037 per pupil to $4,449 per pupil, a difference of 100 percent. In the case of Elementary K-8 Schools, the costs range from approximately $12,000 per pupil to $6,400 per pupil. Lower expenditures may or may not reflect cost effectiveness. Thus, more extensive audits would be needed to ascertain cost effectiveness. This would be a complicated process, but one most definitely needed in the future.

Characteristics of Higher Performing Maine Public Schools

The fourth phase of this study involved an attempt to identify distinguishing characteristics of higher performing schools of all sizes. Some progress has been made in completing this analysis, but because only a limited amount of accurate information is available on many school characteristics, a comprehensive analysis could not be completed at this time. But even with the limited data, some distinguishing characteristics were apparent between schools.

Four data sources were used in the characteristics analysis:

1. Data submitted by SAUs to the Maine Department of Education in the areas of staffing, school demographics, and expenditures.
2. Survey data submitted by students and schools as part of the yearly Maine Education Assessment (MEA) program.
3. School resource survey data provided by Maine school principals (MEPRI).

4. Student Speak II survey data provided by middle and high school students to the National Center for Student Aspiration (University of Maine).

Because in some cases the amount of data was limited (e.g., small number of schools within school size grouping; survey data available only for a limited number of schools etc.), only patterns of differences could be identified using an Effect Size (ES) criteria wherever possible. Effect size (ES) is a statistical tool for measuring the magnitude of differences between two groups; in this case differences between higher performing and lower performing schools. An ES equal to or greater than .50 is considered a substantial difference.

Table 11 summarizes this analysis for three broad categories of characteristics: Context, Resource, and Outcome characteristics. An asterisk denotes a substantial difference between the two groups of schools (i.e., Effect size greater than .50). In the case of school context characteristics, there are no

Table 11
Distinguishing Characteristics of Higher Performing Schools
Context Characteristics

Characteristic*	K-5 Grade Schools	K-8 Grade Schools	Middle Schools	High Schools
1. Enrollment Size	N.D.	N.D.	*Larger	* Larger
2. Percent Free & Reduced Lunch	*Lower	N.D.	*Lower	*Lower
3. Percent Special Education	N.D.	*Lower	*Lower	N.D.
4. Teacher Salaries				*Lower
5. Average Expenditures per pupil	N.D.	N.D.	N.D.	N.D.

*Effect size in favor of higher performing schools.
N.D. = No difference between higher and lower performing schools.
NA = Not applicable

differences in expenditure levels between higher and lower performing schools, at any level. School size does not differ for Grade and Elementary schools, but overall, higher performing Middle and High Schools are larger than their lower performing counterparts. The percent of students who qualify for free and reduced lunch programs, or for special education services are higher in lower

performing schools. However, like the larger size of higher performing Middle and High Schools, there is considerable variance **within** the two groups of schools. Some higher performing schools are smaller and have a higher percentage of students who qualify for free and reduced lunch or special education services. Reverse contexts may be found among lower performing schools.

In the case of resource characteristics, some patterns appear to surface. As shown in Table 12, pupil-teacher ratios are similar across higher and lower

Table 12
Distinguishing Characteristics of Higher Performing Schools
Resource Characteristics

Characteristic*	K-5 Grade Schools	K-8 Grade Schools	Middle Schools	High Schools
1. Teacher Experience	*Longer	N.D.	N.D.	N.D.
2. Teacher Education Level (MS or MS+)	N.D.	N.D.	*Higher	*Higher
3. Percent High Qualified Teachers	N.D.	N.D.	*Higher	*Higher
4. Pupil-Teacher Ratio	N.D.	N.D.	N.D.	N.D.
5. Administrator-Teacher Ratio	N.D.	*Lower	N.D.	N.D.
6. Total Instructional Time	*More	N.D.	N.D.	N.D.
7. Instructional Time in Mathematics	N.D.	N.D.	N.D.	NA
8. Instructional Time ELA	*More	*More	*More	NA
9. Total Professional Development Time	*More	*More	N.D.	*Less
10. Course Completion Patterns	NA	NA	*More *Deeper	*More *Deeper
11. Amount of Homework	N.D.	N.D.	*More	*More
12. Read at Home	*More	*More	*More	*More
13. Curriculum Match MEA	*Greater	*Greater	*Greater	*Greater
14. Academics are Important in School	NA	NA	*More Important	*More Important
15. Arts are Important in School	NA	NA	N.D.	*More Important
16. Sports are Important in School	NA	NA	N.D.	*Less Important

performing schools, but for higher performing Middle and High Schools, teachers are more highly educated and a higher percent of classes are taught by teachers with the federal designation of Highly Qualified Teachers. In higher performing lower grade schools, more instructional time is devoted to English/Language Arts, and at the Middle and High School level students are completing higher level courses, and completing more homework in the evenings. At all levels, the curriculum in higher performing schools matches more closely what is assessed on the MEA, and students in all levels of higher performing schools read more. And where information is available, more middle school and high school students report academics are considered important in their schools.

Table 13
Distinguishing Characteristics of Higher Performing Schools
Outcome Characteristics

Characteristic*	K-5 Grade Schools	K-8 Grade Schools	Middle Schools	High Schools
1. MEA Scale Score	*Higher	*Higher	*Higher	*Higher
2. SAT Math Score	NA	NA	NA	*Higher
3. SAT Verbal Score	NA	NA	NA	*Higher
4. Percent Taking AP Courses	NA	NA	NA	*Higher
5. Percent Passing AP Exam Scores	NA	NA	NA	*Higher
6. Dropout Rate	NA	NA	NA	*Lower
7. Graduation Rate	NA	NA	NA	*Higher
8. Intend to go to College	NA	NA	NA	*Higher

In terms of Outcome characteristics (Table 13), outside of the MEA, there are no statewide standardized performance results available. But at the high school level other outcome data exist, and in all cases, higher performing high schools outperform lower performing high schools. Dropout rates are lower, graduation rates are higher, more students are taking AP courses and passing AP examinations, and students score higher on the SAT. And finally, more students in higher performing schools indicate they intend to attend some type of post-secondary higher education institution.

Conclusion

The results of this four phase study point to several conclusions. The sizes of Maine's public schools are not the key determinant of school success. Some smaller schools are more effective than others, and some larger schools are more effective. Regardless of school size, approximately one in five of Maine's public schools may be considered higher performing and performing beyond expectations. The cost of higher performing smaller schools is greater at the lower grades, but not in the case of middle schools, and it is unclear at the high school level. In terms of distinguishing characteristics of higher performing schools, the available data is limited, but what does exist suggests these schools are clearly focused on academics and support professional development activities for improving teachers and teaching. And this academic focus may be seen in performance; more students are taking higher level courses, scoring higher on national tests, and graduating from high school. But, overall, the information available about higher performing schools, particularly as it relates to the teaching and learning processes, and what goes on in these schools on a daily basis, is unknown. Clearly, obtaining this information, and helping others adopt these practices, approaches and dispositions, is important for providing all Maine students opportunities to academically excel.

Recommendations

Finally, and as requested by the Joint Standing Committee on Education and Cultural Affairs, the findings and conclusions from this four phase study point to several recommendations. These are:

1. The State should develop a long-range policy and plan for addressing declining student population, declining school sizes, and school academic performance.
2. The State should endorse a short-term policy for ensuring equal educational opportunities for students in smaller Maine public schools. This policy should be:
    A. Continuation of present policy governing small isolated high schools, and all island schools.

B. Increased allocation for smaller isolated lower grade level schools as follows:
    1. 13.4% for non-K-8 schools with less than 15 students per grade level.
    2. 8.8% for non-K-8 schools with 15-29 students per grade level.
    3. 12.2% for K-8 schools with less than 15 students per grade level.

C. Continuation of increased allocations for individual schools be contingent upon:
    1. implementation of plans to achieve or maintain higher academic performance status,
    2. making substantial yearly progress toward achieving or maintaining higher academic performance status.

3. The short-term policy should be enacted for a three year period beginning 2006-07.
4. The state should implement a plan for identifying distinguishing characteristics of higher performing Maine public schools and disseminating this information to all SAUs.

Implementing these recommendations should help Maine's policy makers and educators alike reach the goal of providing a high quality education for all the children of Maine.

Appendices

Appendix A
Isolated Small School Adjustment

Isolated Mainland Small Elementary Schools
QUALIFICATIONS: a. Fewer than 15 students per grade level b. Number of school options available fewer than 5. c. Nearest school is more than 8 miles away. ADJUSTMENT: a. 10% transition adjustment to K-8 EPS rate.
Isolated Mainland Small Secondary Schools
QUALIFICATIONS: a. Fewer than 200 students per school. b. Distance from furthest point in the district to nearest high school is at least 18.5 miles. c. Distance between the high school and nearest high school is more than 10 miles. ADJUSTMENT: a. Student-teacher ratios reduced to 11:1 for schools with fewer than 100 students and 13:1 for schools with 100-199 students.
Island Elementary and Secondary Schools
QUALIFICATIONS: a. Islands operating schools or transporting students to mainland schools. ADJUSTMENT: a. Isolated small secondary schools student-teacher adjustment for high schools with fewer than 200 students. b. 10% transition adjustment in K-8 EPS rate for elementary schools. c. 13%-26% adjustment to EPS operating and maintenance costs, depending upon school level and size, for islands operating schools. d. Transportation adjustment equal to approved transportation expenditures.

Appendix B

Selected References

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Appendix C

Calculating Cost of Four-Year High School Graduate

To calculate the 2004 cost per graduate, the class of 2004 cohort was defined by taking all the 2004 graduates and adding in those students who dropped out in the previous four years who would have graduated in 2004, (i.e., the 12th grade dropouts from 2003-04, the 11th grade dropouts from 2003-03, and so on). For each of the four years, the number of students in the cohort was multiplied by the secondary per-pupil cost in that year. This four-year total was divided by the number of 2004 graduates to yield the four-year cost per graduate.

Secondary per-pupil cost excludes transportation, leases, major capital outlay and debt service.

Appendix D

Four-Year Cost Per Graduate for Maine Public High Schools
Class of 2004

School Code	Location	School Name	Attending Enrollment	Graduation Rate	Post-Secondary Intentions	4-Year Cost Per Graduate
State Average Cost Per Graduate (average of SAUs)			***488***	***88%***	***70%***	***$30,580***
211	Islesboro	Islesboro Central School	20	100%	89%	$59,766
507	North Haven (SAD 7)	North Haven Community School	21	92%	75%	$76,086
519	Lubec (SAD 19)	Lubec Consolidated School	52	75%	67%	$44,504
508	Vinalhaven (SAD 8)	Lincoln Elem/Vinalhaven High School	56	88%	47%	$55,987
514	Danforth (SAD 14)	East Grand School	62	94%	71%	$31,204
512	Jackman (SAD 12)	Forest Hills Consolidated School	63	90%	72%	$34,708
137	Easton	Easton Jr.-Sr. High School	64	100%	100%	$49,927
360	Rangeley	Rangeley Lakes Regional School	74	100%	75%	$32,877
533	Saint Agatha (SAD 33)	Wisdom Middle/High School	86	94%	83%	$32,142
236	Limestone	Limestone Community School	92	96%	59%	$29,064
917	Jonesport (CSD 17)	Jonesport-Beals High School	97	83%	52%	$36,897
513	Bingham (SAD 13)	Upper Kennebec Valley Jr.-Sr. High School	106	86%	52%	$32,681
180	Greenville	Greenville Middle/High School	107	97%	88%	$32,459
545	Washburn (SAD 45)	Washburn District High School	119	100%	65%	$29,450
253	Machias	Machias Memorial High School	126	92%	81%	$30,158
909	Dyer Brook (CSD 9)	Southern Aroostook CSD School	129	91%	59%	$32,919
532	Ashland (SAD 32)	Ashland Community High School	132	86%	67%	$31,328
525	Stacyville (SAD 25)	Katahdin Middle/High School	136	91%	67%	$35,040
524	Van Buren (SAD 24)	Van Buren District Sec. High School	145	94%	77%	$35,297
542	Mars Hill (SAD 42)	Central Aroostook Jr.-Sr. High School	157	93%	86%	$27,222

138	Eastport	Shead Memorial High School	159	79%	50%	$28,480
365	Richmond	Richmond High School	170	91%	74%	$26,000
913	Deer Isle (CSD 13)	Deer Isle-Stonington Jr.-Sr. High School	178	85%	53%	$33,075
570	Hodgdon (SAD 70)	Hodgdon High School	191	93%	58%	$29,521
539	Buckfield (SAD 39)	Buckfield Jr.-Sr. High School	193	78%	64%	$30,287
136	East Millinocket	Schenck High School	198	95%	73%	$33,624
024	Baileyville	Woodland Jr.-Sr. High School	207	85%	76%	$39,706
531	Howland (SAD 31)	Penobscot Valley High School	216	98%	46%	$27,433
520	Fort Fairfield (SAD 20)	Fort Fairfield Middle/High School	218	80%	71%	$33,489
070	Calais	Calais High School	229	76%	75%	$36,889
556	Searsport (SAD 56)	Searsport District High School	240	70%	65%	$41,778
256	Madawaska	Madawaska Middle/High School	241	88%	78%	$35,326
281	Monmouth	Monmouth Academy	252	90%	76%	$26,429
537	Harrington (SAD 37)	Narraguagus High School	256	78%	76%	$31,512
277	Millinocket	Stearns High School	256	98%	74%	$29,032
504	Guilford (SAD 4)	Piscataquis Community High School	262	89%	57%	$21,745
541	Milo (SAD 41)	Penquis Valley High School	268	81%	53%	$27,750
574	Anson (SAD 74)	Carrabec High School	274	83%	65%	$26,634
536	Livermore Falls (SAD 36)	Livermore Falls High School	284	79%	69%	$33,064
558	Kingfield (SAD 58)	Mount Abram Regional High School	284	92%	61%	$29,026
559	Madison (SAD 59)	Madison Area Memorial High School	288	83%	83%	$32,292
903	Boothbay Harbor (CSD 3)	Boothbay Region High School	289	92%	66%	$29,310
544	Bethel (SAD 44)	Telstar High School	295	78%	80%	$40,299
550	Thomaston (SAD 50)	Georges Valley High School	308	82%	54%	$31,718
529	Houlton (SAD 29)	Houlton High School	308	95%	69%	$33,496
904	Sullivan (CSD 4)	Sumner Memorial High School	313	70%	63%	$33,951
521	Dixfield (SAD 21)	Dirigo High School	315	94%	80%	$24,185

214	Jay	Jay High School	316	97%	79%	$35,084
485	Winthrop	Winthrop High School	317	91%	77%	$26,275
223	Kittery	Robert W. Traip Academy	336	79%	67%	$35,012
546	Dexter (SAD 46)	Dexter Regional High School	340	77%	53%	$29,401
320	Old Orchard Beach	Old Orchard Beach High School	343	91%	78%	$28,716
486	Wiscasset	Wiscasset High School	346	86%	66%	$33,875
324	Orono	Orono High School	357	89%	74%	$30,110
527	Fort Kent (SAD 27)	Fort Kent Community High School	363	98%	77%	$24,075
564	Corinth (SAD 64)	Central High School	370	81%	70%	$26,748
555	Hiram (SAD 55)	Sacopee Valley Jr.-Sr. High School	371	91%	54%	$28,018
516	Farmingdale (SAD 16)	Hall-Dale High School	375	79%	76%	$28,092
567	Lincoln (SAD 67)	Mattanawcook Academy	377	95%	69%	$24,843
242	Lisbon	Lisbon High School	424	87%	62%	$32,425
160	Freeport	Freeport High School	426	87%	69%	$33,641
065	Bucksport	Bucksport High School	455	87%	60%	$26,682
503	Thorndike (SAD 3)	Mount View High School	457	81%	48%	$26,409
197	Hermon	Hermon High School	470	83%	69%	$31,746
491	Yarmouth	Yarmouth High School	476	98%	85%	$34,884
505	Rockland (SAD 5)	Rockland District High School	479	88%	52%	$27,306
501	Presque Isle (SAD 1)	Presque Isle High School	488	91%	85%	$29,854
910	Readfield (CSD 10)	Maranacook Community School	492	100%	71%	$26,067
918	Wells (CSD 18)	Wells High School	492	90%	63%	$33,944
077	Caribou	Caribou High School	493	93%	82%	$28,281
144	Ellsworth	Ellsworth High School	506	75%	70%	$28,525
915	Wales (CSD 15)	Oak Hill High School	535	87%	64%	$27,879
075	Cape Elizabeth	Cape Elizabeth High School	537	97%	94%	$34,412
543	Rumford (SAD 43)	Mountain Valley High School	544	92%	66%	$24,352
350	Poland	Poland Regional High School	548	94%	85%	$34,006

481	Winslow	Winslow High School	569	89%	75%	$22,802
151	Falmouth	Falmouth High School	587	99%	90%	$33,031
534	Belfast (SAD 34)	Belfast Area High School	591	92%	75%	$27,073
456	Waterville	Waterville High School	594	88%	73%	$26,135
515	Gray (SAD 15)	Gray-New Gloucester High School	649	90%	76%	$26,861
551	Cumberland (SAD 51)	Greely High School	651	95%	92%	$30,476
540	Waldoboro (SAD 40)	Medomak Valley High School	665	92%	57%	$23,546
919	Rockport (CSD 19)	Camden Hills Regional High School	675	90%	70%	$32,039
465	Westbrook	Westbrook High School	678	94%	81%	$29,281
492	York	York High School	686	91%	61%	$31,909
907	Bar Harbor (CSD 7)	Mt. Desert Island High School	691	88%	76%	$29,635
561	Naples (SAD 61)	Lake Region High School	699	94%	79%	$24,969
321	Old Town	Old Town High School	699	88%	53%	$25,239
030	Bath	Morse High School	709	76%	67%	$27,315
548	Newport (SAD 48)	Nokomis Regional High School	719	90%	66%	$24,289
552	Turner (SAD 52)	Leavitt Area High School	724	93%	66%	$25,362
511	Gardiner (SAD 11)	Gardiner Area High School	725	83%	59%	$28,382
522	Hampden (SAD 22)	Hampden Academy	749	93%	74%	$26,691
509	Farmington (SAD 9)	Mount Blue High School	759	86%	72%	$26,645
171	Gorham	Gorham High School	779	96%	78%	$25,896
053	Brewer	Brewer High School	787	79%	62%	$29,123
571	Kennebunk (SAD 71)	Kennebunk High School	805	94%	73%	$29,435
549	Fairfield (SAD 49)	Lawrence High School	820	86%	52%	$25,578
535	South Berwick (SAD 35)	Marshwood High School	835	84%	76%	$23,526
040	Biddeford	Biddeford High School	836	86%	60%	$25,715
478	Windham	Windham High School	855	92%	79%	$23,723
021	Augusta	Cony High School	864	86%	71%	$27,616

554	Skowhegan (SAD 54)	Skowhegan Area High School	873	83%	49%	$27,847
547	Oakland (SAD 47)	Messalonskee High School	875	93%	69%	$25,194
383	Scarborough	Scarborough High School	903	99%	82%	$22,027
403	South Portland	South Portland High School	997	88%	69%	$28,497
517	Paris (SAD 17)	Oxford Hills Comprehensive High School	1,031	85%	74%	$25,284
575	Topsham (SAD 75)	Mount Ararat High School	1,039	85%	51%	$27,462
557	Waterboro (SAD 57)	Massabesic High School	1,070	93%	74%	$20,882
063	Brunswick	Brunswick High School	1,091	91%	68%	$26,032
353	Portland	Portland High School	1,143	82%	60%	$30,366
560	North Berwick (SAD 60)	Noble High School	1,143	82%	56%	$24,646
381	Sanford	Sanford High School	1,154	80%	65%	$25,720
233	Lewiston	Lewiston High School	1,175	78%	69%	$27,740
020	Auburn	Edward Little High School	1,183	81%	86%	$29,684
506	Standish (SAD 6)	Bonny Eagle High School	1,205	86%	71%	$26,123
353	Portland	Deering High School	1,354	78%	76%	$33,104
027	Bangor	Bangor High School	1,385	88%	82%	$29,153

Appendix E

MEA Score Analysis by Economically Disadvantaged and Advantaged Youth

Fourth Grade
2003-2004 MEA: Percent Meeting or Exceeding Standards

	"Large" Schools (Students Per Grade > 30.4)		"Small" Schools (Students Per Grade < 30.4)	
Content Area	**Not Disadvantaged***	**Disadvantaged***	**Not Disadvantaged***	**Disadvantaged***
Reading	59.20%	35.80%	51.38%	34.62%
Writing	12.14%	4.46%	10.09%	4.74%
Math	38.31%	19.29%	34.68%	23.62%
Science and Technology	7.47%	2.72%	7.14%	2.03%

* Disadvantaged is defined as students eligible for the National School Free Lunch Program.

Eighth Grade
2003-2004 MEA: Percent Meeting or Exceeding Standards

	"Large" Schools (Students Per Grade > 43.2)		"Small" Schools (Students Per Grade < 43.2)	
Content Area	**Not Disadvantaged***	**Disadvantaged***	**Not Disadvantaged***	**Disadvantaged***
Reading	43.80%	20.71%	39.85%	23.87%
Writing	43.11%	23.57%	42.43%	30.11%
Math	26.37%	9.54%	22.19%	13.18%
Science and Technology	17.79%	6.60%	13.90%	7.76%

* Disadvantaged is defined as students eligible for the National School Free Lunch Program.

Eleventh Grade
2003-2004 MEA: Percent Meeting or Exceeding Standards

	"Large" Schools (Students Per Grade > 101.25)		"Small" Schools (Students Per Grade < 101.25)	
Content Area	**Not Disadvantaged***	**Disadvantaged***	**Not Disadvantaged***	**Disadvantaged ***
Reading	52.11%	28.26%	48.00%	32.91%
Writing	38.60%	20.13%	35.76%	23.85%
Math	28.00%	12.19%	21.84%	11.10%
Science and Technology	13.48%	5.70%	10.35%	4.72%

* Disadvantaged is defined as students eligible for the National School Free Lunch Program.

Appendix F

Characteristics of Middle and High Schools of Different Sizes

Middle Schools

Average Grade Size	Cost		MEA	
	$\bar{X}$	sd		sd
Less than 68	$5,873	4,525-7,022	531.2	527.3-536.8
68-96	$5,750	4,646-6,860	531.5	526.0-535.8
97-132	$6,001	4,060-7,392	532.8	528.8-541.0
133-199	$6,053	5,210-8,321	533.6	528.0-541.3
200 or more	$5,418	4,420-6,833	532.4	528.8-539.8

Middle School Culture

Average Grade Size	Student Tardiness	Student Absenteeism	Student Bullying	Fighting / Violence	Students' Motivation to Learn	Lack of parental involvement
Less than 68	20.0%	40.0%	20.0%	0%	40.0%	40.0%
68-96	12.5%	37.5%	87.5%	0%	100.0%	62.5%
97-132	33.3%	22.2%	44.4%	0%	66.6%	55.5%
133-199	57.1%	57.2%	28.6%	0%	57.2%	42.9%
200 or more	11.1%	11.1%	55.6%	0%	55.6%	55.6%

Data from the 2005 Maine Public School Census Survey

High Schools

School Size	Cost		MEA	
	$\bar{X}$	sd		sd
Less than 200	$7,545	5,587-9,992	531.2	527.8-537.0
200-349	$6,505	5,472-7,513	531.2	527.3-538.5
350-599	$6,259	4,860-8,739	533.4	528.5-544.8
600-849	$6,000	5,389-7,492	533.3	529.3-540.3
850 or more	$5,348	4,189-6,458	532.7	530.3-537.0

High School Culture

School Size	Student Tardiness	Student Absenteeism	Student Bullying	Fighting/ Violence	Students' Motivation to Learn	Lack of parental involvement
Less than 200	50.0%	50.0%	25.0%	0%	50.0%	50.0%
200-349	50.0%	41.7%	50.0%	0%	83.3%	83.8%
350-599	52.9%	53.0%	35.3%	0%	88.2%	58.9%
600-849	80.0%	80.0%	50.0%	0%	100.0%	80.0%
850 or more	57.1%	57.1%	35.7%	28.6%	85.7%	85.7%

Data from the 2005 Maine Public School Census Survey

Appendix G

Criteria for Higher and Lower Performing Maine Schools

There are two ways for a school to meet the criteria for being higher-performing. First, a school was considered higher performing if the following were true:

a) its school average combined MEA score is substantially better than the state average,

b) the school average combined MEA score is substantially better than would be predicted using regression analysis, a widely used statistical method, given the following:
    1) the percentage of students in the school who receive free or reduced price lunches,
    2) the percentage of households in the community with at least one member who holds a bachelors degree, and
    3) for 11th grade students, the average MEA score of the town or district's 8th graders.

c) its economically-disadvantaged students are scoring substantially better on the MEA than economically disadvantaged students in the state, on average,

d) its non-economically-disadvantaged students are scoring substantially better on the MEA than non-economically-disadvantaged students in the state, on average

Or, in place of c) and d),

e) the percentage of students achieving at least a "Meets" proficiency rating is substantially better than the state average,

f) the percentage of students achieving at least a "Partially Meets" proficiency rating is substantially better than the state average.

Similarly, there were two ways a school could meet the criteria for being considered lower-performing. Instead of the students in criteria a) through f) scoring substantially better, however, in lower performing schools the students score substantially worse.

Note: "Substantially better" was defined in the study as being at least a third of a standard deviation higher.