

A Preliminary Investigation of School District Expenditures with Respect to School District Size in Iowa

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Introduction

Iowans are very supportive of primary and secondary education as evidenced by the sizeable share of state and local budgets devoted to education. As Iowans debate the priorities and levels of funding for state and local budgets, the sheer size of the educational investment relative to the state budget as a whole will require that some aspects of the educational investment be reviewed.

Iowa is not alone in this. In the December 26, 2002 Wall Street Journal, June Kronholz reported that, nationally, states spend about 48 percent of their budgets on education. Most of this money goes to local school districts, where it accounts for 46 percent of local school spending. The size of this commitment is a current issue in much of the nation, as at least 31 states still face budget gaps in the current (2003) fiscal year.

This report uses Internet-accessible revenue and expenditure data to examine the relative importance of primary education to the state's budget and to local government budgets. The analysis begins with a look at the overall disposition of state and local revenues and expenditures. Following this, data derived from the Certified Annual Report that each public school district files with the Iowa Department of Education are used to examine patterns of revenues and expenditures for all Iowa school districts relative to school district sizes and state averages.

Overall State and Local Budgets

During fiscal-year 1999 (July 1998 through June 1999, the most recent year for which consistent state and local fiscal data are available¹), the state of Iowa made \$6.67 billion of direct expenditures for general governmental functions and provided \$2.873 billion of inter-governmental revenues back to local governments, mostly for education (see Table 1). Separate Iowa Fiscal Service reports compiled from Department of Education and Department of Management data show that \$1.757 billion of these \$2.873 billion in state transfer dollars went for K-12 education.

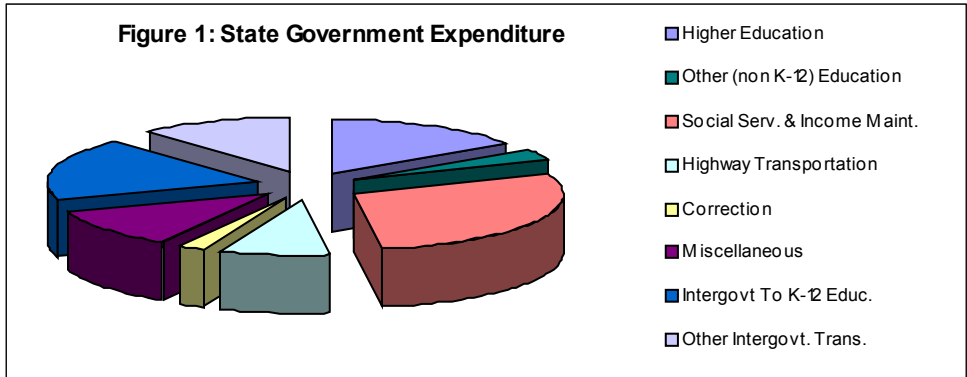
Table 1: Direct General Expenditures and Intergovernmental Fund Transfers Originating at the State Level, FY1999.

Total Direct General Expenditures	6,669,747
Higher Education	1,493,991
Other (non K-12) Education	298,572
Social Services & Income Maintenance	2,768,110
Highway Transportation	810,817
Corrections	206,126
Miscellaneous	1,092,131
Intergovernmental Transfers To K-12 Educ.	1,756,500
Other Intergovernmental Transfers	1,116,379
Total	9,542,626

Direct expenditures from Iowa's general fund for education other than K-12, including regents institutions and community colleges, totaled \$1.793 billion in FY1999. The total of these funds

¹ "Iowa State & Local Government Finances by Level of Government: 1998-99." U.S. Census Bureau. www.census.gov/govs/estimate/9916ia.html.

plus transfers to K-12 education represented 37.2 percent of all state government direct general expenditures plus inter-governmental transfers in FY1999 (Figure 1).

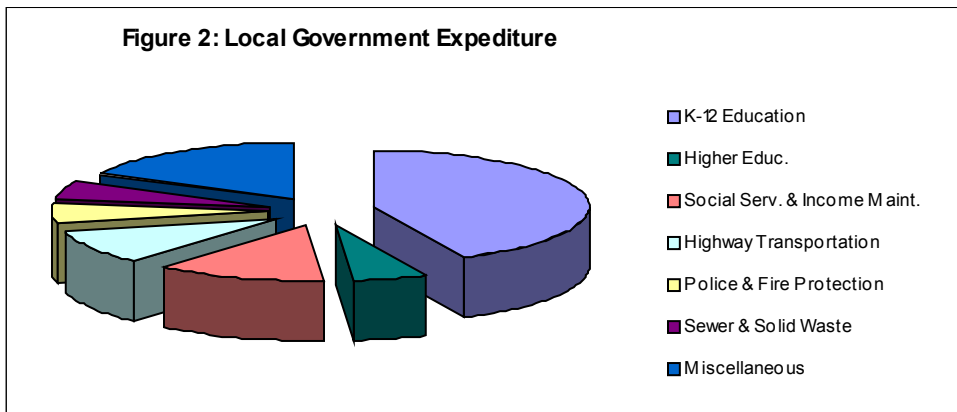


Other priorities of state government are reflected by the other major expenditure categories. At the state level, health and social services are the second largest budgeted priority, accounting for 29 percent of direct general expenditures and transfers. The third major state-level priority is transportation and roads, accounting for another 8.5 percent of these resources. Together, these priorities consumed 74.7 percent of the state general direct expenditures and transfers in FY 1999, leaving just 25.3 percent for all other activities.

Table 2: Direct General Expenditures at the Local Level, FY1999.

K-12 Education	3,453,577
Higher Education	445,775
Social Services & Income Maintenance	1,029,933
Highway Transportation	796,551
Police & Fire Protection	460,788
Sewer & Solid Waste	398,155
Miscellaneous	1,432,086
Total	8,016,865

At the local level, public K-12 school district budgets (including local, state and federal funds) totaled \$3.454 billion, statewide, in FY1999. This represented 43.1 percent of local government budgets in Iowa for that year (Table 2 and Figure 2).



The budget materials in these reports also identify the sources of funds, or revenues for state and local government operation (Tables 3 and 4). At the state level in FY1999, inter-governmental

transfers of money represented the single largest source of revenue at \$2.467 billion. By far the largest share of these transfers, \$2.378 billion, came from the federal government. From in-state revenue sources, the state personal income tax represents the single largest source of revenue (\$1.715 billion), followed by general sales tax (\$1.646 billion), and motor fuel and use taxes (\$655 million). Current charges, user fees and a miscellaneous set of other taxes make up the remaining sources of revenues for state government.

Table 3: State General Revenue, FY1999.

Intergovernmental Transfers	2,467,487
General Sales Tax	1,646,052
Motor Fuel and Use Tax	655,303
Individual Income Tax	1,715,117
Corporate Income Tax	234,540
Current Charges	1,180,431
Miscellaneous	1,308,864
Total	9,207,794

Local revenues for general governmental operation were a bit less diversified. In FY 1999, General Revenues from all sources totaled \$8.107 billion. Intergovernmental revenues, mostly from state government and mostly for school aid, made up the single largest category (\$3.131 billion or 38.6 percent) of local revenues. Revenue from property taxes was the single largest category of local own-source revenues, accounting for \$2.533 billion or 31.2 percent of local government revenues. Current charges and fees represented another 19.9 percent of local government revenues followed by other miscellaneous taxes.

Table 4: Local Government General Revenue, FY 1999.

Intergovernmental Transfers	3,130,673
Property Tax	2,532,735
Other Taxes	271,861
Current Charges	1,611,934
Miscellaneous	559,403
Total	8,106,606

Source of School District Data

Data files available on the Iowa Department of Education's web site provide information on enrollment, expenditures, and revenues for all of Iowa's public school districts for the 2000-2001 school year. Our source data is included in three Excel spreadsheet files that are downloadable from <http://www.state.ia.us/educate/fis/sft/car/index.html>. The files are labeled:

- Percentage of Function Categories to Total Expenditures in the General Fund
- Percentage of Object Categories to Total Expenditures in the General Fund
- Percentage of Source Categories to Total Revenues in the General Fund

These files provide breakdowns of individual school district revenue and expenditure categories as a percentage of total district revenues and expenditures. In addition, this data also is available from Midwest PROfiles². The staff at PROfiles has expanded the percentage by category

² Midwest PROfiles (www.profiles.iastate.edu) is an online source of community-level data on income, employment, public budgets and demographics maintained by the Department of Economics at Iowa State University.

numbers to approximate expenditures by category per student³ (see the “School Enrollment and Finance” listings at www.profiles.iastate.edu). Throughout the remainder of this report, expenditures and revenues expressed as percents of totals reflect the content of the files available directly from the Iowa Department of Education, and expenditures or revenues expressed on a per-student basis reflect the data reconstructions done by Midwest PROfiles staff.

School District Population

The Department of Education data files provide information on 374 Iowa school districts. These school districts reported 494,291 total students and \$3,154,904,525 in school district expenditures for the 2000-2001 school year. Average statewide expenditure per student, statewide, was \$6,383.

School district size can be measured in a number of ways. Some of the most obvious measurements give ranges of:

	Lowest/smallest		Highest/largest
Enrollments	100 (Lineville-Clio)	to	32,345 (Des Moines)
Total Expenditures	\$820,931 (Prescott)	to	\$232,766,652 (Des Moines)
Expenditures/student	\$5,294 (Le Mars)	to	\$10,271 (Diagonal).

Throughout the rest of this analysis, school district size will refer to district enrollment reported for the 2000-2001 school year unless an alternative measure is explicitly identified.

A Simple Analysis

This study does not attempt to do an exhaustive analysis of the factors that affect school district size, cost, or efficiency. Neither is this an attempt to qualify or quantify student outcomes or educational quality. There are many justifications put forth for the value of small (large) districts over large (small) districts, the importance (unimportance) of local control of the educational process, and whether more (less) state (local, federal) funds should be mandated to support the process. We have no expertise with which to pass judgment on any of these issues.

What we do see is these issues involve a number of options that leave us facing a number of choices, most of which have an expected cost. This study takes a simple look at the relationship between school district expenditure per student and school district size using administrative statistics that are readily available from official Web sources.

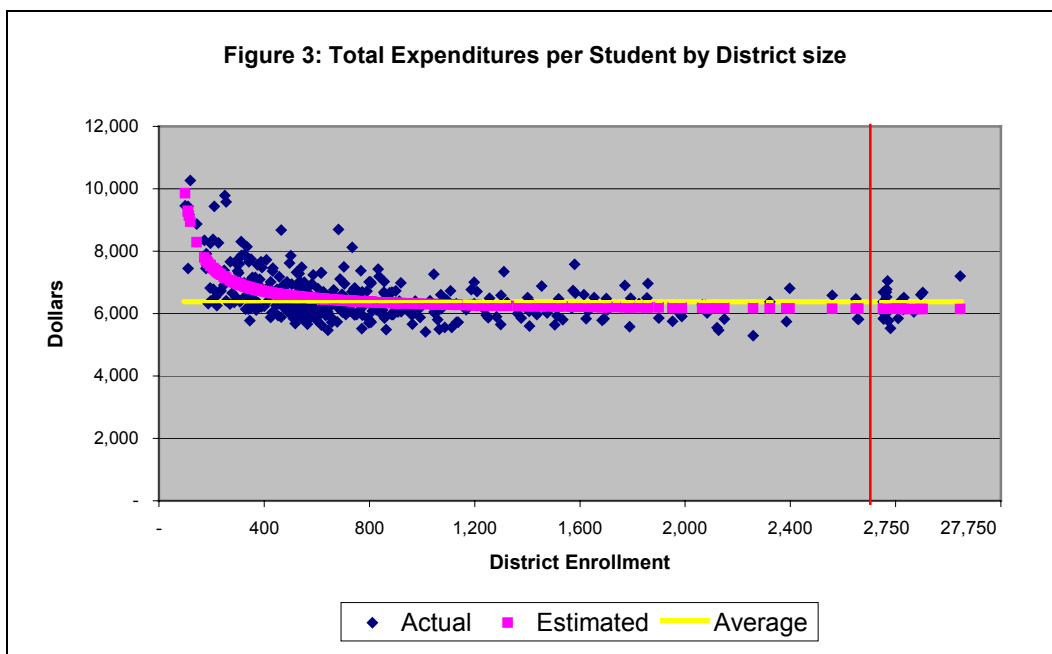
³ These approximations may vary slightly from actual reported numbers, due to rounding errors in the movement to and from a percentage by category basis.

Total Expenditures per Student by District Enrollment Size

We start with total expenditures per student by district calculated from the Iowa Department of Education spreadsheets. These data are plotted as a scatter diagram in Figure 3. Figure 3 displays three series of data:

- Blue diamonds are actual reported data derived from the Department of Education
- The yellow line shows the average total expenditure per student for all students, which is \$6,383 per student statewide
- Red squares show an estimation of total expenditures per student for every public school district in the state based on a statistical equation described below.

Note that the scale on this graph (and all subsequent graphs) changes at the enrollment level of 2,750 students (the red vertical line). The very small number of large districts in the state makes this necessary in order to create visible detail for the large number of smaller districts. While the scale on the graph was manipulated to make it more informative, all of the calculations and estimations done in this report were performed with the actual data contained in or derived from the Department of Education spreadsheets cited earlier.



The blue diamonds (actual reported data) on the scatter diagram provide some immediate insight. First, expenditures per student generally rise as district sizes fall below about 750 students. Given no additional knowledge about educational processes, it is possible there are economies of scale relative to school district size for these districts. It also is possible small districts have a tendency to spend more on education per student simply because they believe it is a valuable investment. There were 208 Iowa school districts with enrollment below 750 during the 2000-2001 school year, and they served 96,579 students. Total expenditures for districts of less than 750 students were \$639,263,081. Expenditure per student in this group was \$6,619 (compared to a statewide per-student average of \$6,383).

The scatter diagram of reported data has a general shape similar to the letter “J” lying on its back. This is not conducive to linear regression, where every increase in district size would result in a fixed decrease in expenditures per student. Such a relationship would imply constant economies

of scale throughout the range of possible school district sizes. That obviously is not the case here.

The data shows a relationship where changes in expenditures per student look like they would approach infinity (the graph line would turn vertical) at some point between zero and 100 students and stop decreasing (the graph line goes horizontal) as district size increases past 1,000 students. This general shape indicates there might be a reciprocal relationship between school district size and school district expenditure per student. It turns out that nearly 40 percent of this relationship can be described by the equation:

$$Y = \alpha + \beta/(X-38)$$

Where:

Y = District expenditure per student

X = District enrollment

α = 6,065

β = 233,430

And:

38 = minimum school district size ($X-38=0$).

This equation was used to derive the red squares that appear on Figure 1. The equation results in estimates of expenditure per student that approach infinity as district sizes fall towards a level of 38 students and that approach \$6,065 per student as district enrollments approach infinity. This is because the term, $\beta/(X-38)$, becomes infinitely large as $X-38$ approaches zero (when X approaches 38 students) and approaches zero as $X-38$ becomes very large.

The estimated expenditures per student generated with the equation match the reported statewide average (\$6,383 per student) at a district size of 772 students, which is consistent with our scatter plot observation that costs per student appeared to increase as district sizes fell below 750 students.

For most observations, the curve provides a reasonable approximation of the data derived from the Department of Education. For thirteen districts the estimated expenditure per student was not reasonably close to the actual reported data. Of these 13, the equation significantly overestimated per student expenditures for two districts (the second and 11th smallest districts in the state) and significantly underestimated expenditures per student for the other eleven. Nine of these districts were among the 100 smallest districts in Iowa. While the estimation shows a definite relationship between district size and expenditure per student, there is significantly more variation within small districts than there is in larger districts.

Expenditures per Student by Function Relative to District Enrollment

One of the spreadsheets we obtained from the Iowa Department of Education, "Percentage of Function Categories to Total Expenditures in the General Fund," provides a breakdown of district expenditures with respect to the overall expenditure purpose. For example, expenditures directly related to the instruction of students are grouped, regardless of whether those expenditures went to salaries, supplies, purchased services, etc. Studying this data gives a good idea of what proportion of total budgets go directly to purposes like instruction, district administration, transportation, etc.

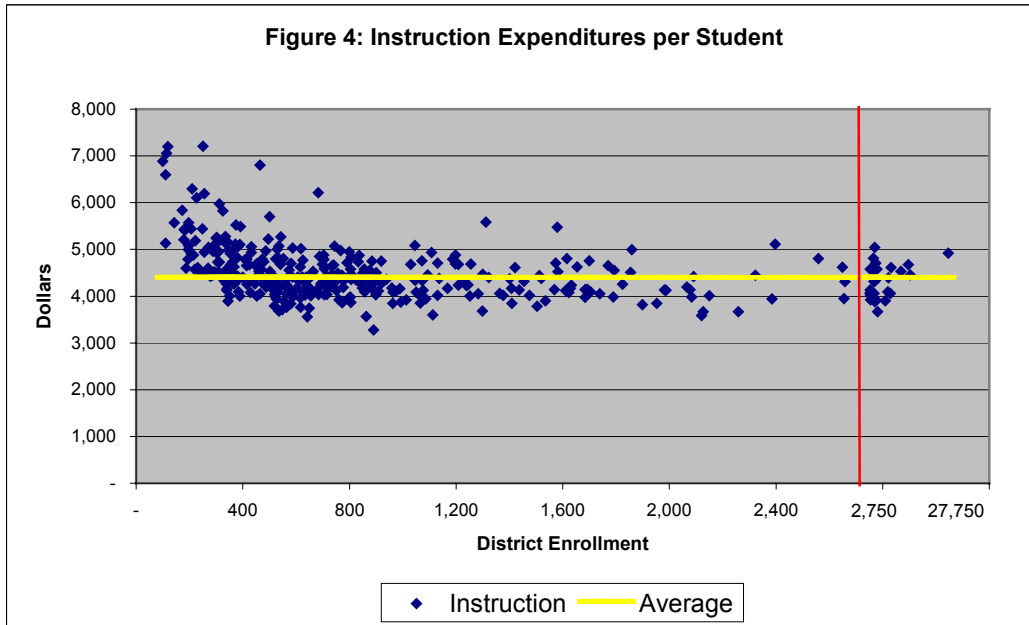
Table 5 shows the statewide average per student expenditures by functional categories detailed in the data set.

Table 5: Statewide Average Expenditures per Student by Functional Categories

	Expenditures	
	Per Student	Percent
Total Expenditure	6382.7	100.0
Instruction	4397.7	68.9
Student Service	242.5	3.8
Staff Service	255.3	4.0
Administrative Service	606.4	9.5
Operations and Maintenance	593.6	9.3
Student Transportation	248.9	3.9
Central Support Service	25.5	0.4
Food Service Subsidy	6.4	0.1
Community Education & Support	12.8	0.2

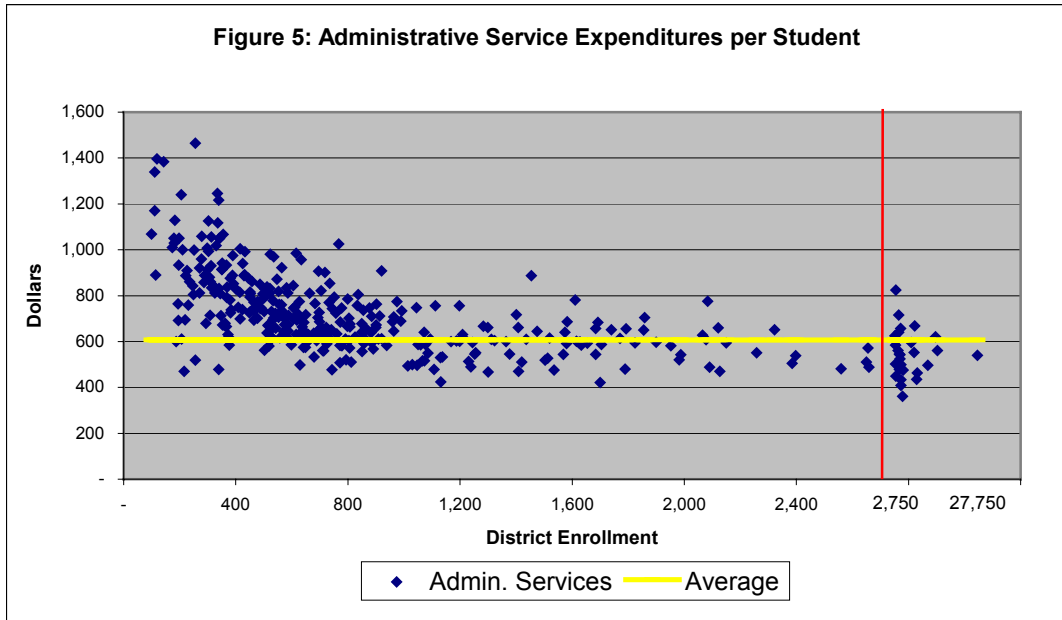
Instruction is, by far, the largest of the reported functional expenditure categories. With a statewide per student average expenditure of \$4,398, instruction accounts for nearly 69 percent of the total educational budget. The second largest category, administrative service, expends only \$606 per student, statewide, or about 9.5 percent of the educational budget.⁴

The scatter diagrams of per student expenditures relative to district enrollments for these two categories are shown as Figures 4 and 5. Both of these plots have shapes similar to the total expenditure per student plot from Figure 3. These plots give good reason to believe that a reciprocal relationship exists between both instruction and administration with respect to district enrollment size.



⁴ Most of the numbers in this report refer to per-student averages or percents of total. To keep this in perspective, bear in mind that every 1 percent of the total expenditures of Iowa's 374 public school districts represents about \$31,549,045 in total spending.

The administrative service expenditure per student relationship with enrollment size is more well-defined than those of either total expenditure per student or instruction expenditure per student. Fitting the reciprocal relationship used in the total expenditure equation ($Y = \alpha + \beta/(X-38)$) to both instruction and administration expenditures per student resulted in a noticeably better fit for administration and a slightly less accurate fit for instruction than was obtained for total expenditures. While we are not arguing that the same intercepts and limits are appropriate to each of these data sets, we are confident that a more thorough attempt to fit the individual relationships would continue to bear out this result.



The reciprocal relationship between total expenditures per student and school district size could be attributed to economies of scale in education, a cultural difference in the value of investments in education that is tied to district size, or other factors. The relative strength of the reciprocal relationship between administration expenses per student would lend some weight to the economies-of-scale theory.

Looking at instruction expenditures and administrative services expenditures as a percent of total expenditures relative to district enrollment provides some additional insight. If increasing per-student expenditures indicate that smaller districts inherently placed more value on educational investments in students, instructional expenditures as a percent of total budgets also would consistently rise among districts with smaller enrollments. A look at Figure 6 shows this is not the case. While there is significant variance in this measure across the entire range of district enrollments, there is not immediate visual evidence that smaller districts spend a consistently larger portion of their budgets on instruction. This would tend to go against arguments that small-district expenditures per student are higher due to a cultural predisposition to invest more on education in smaller environments.

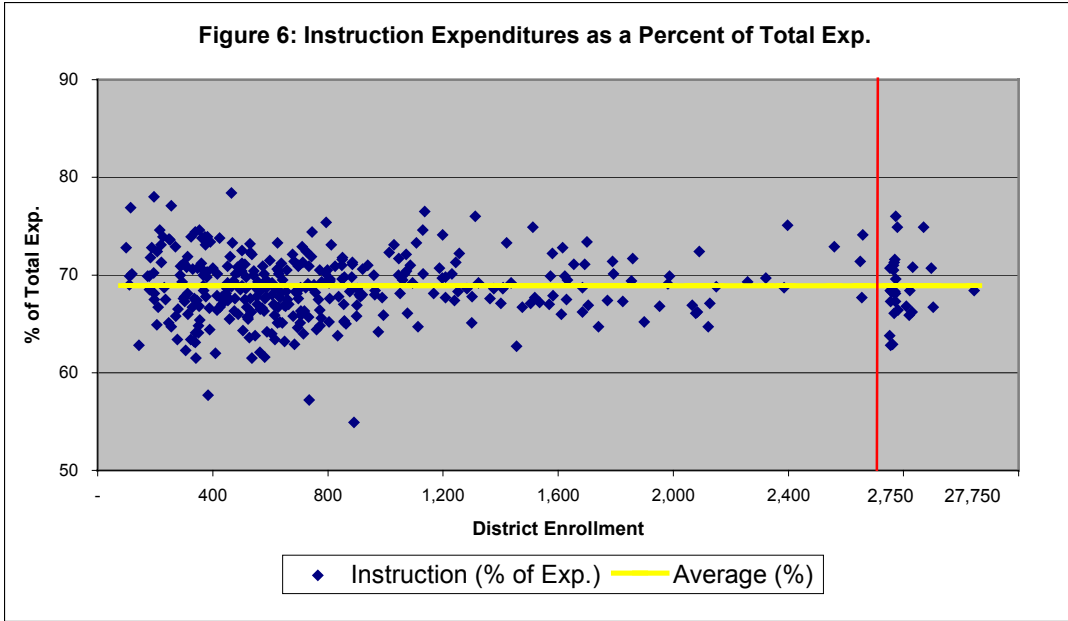
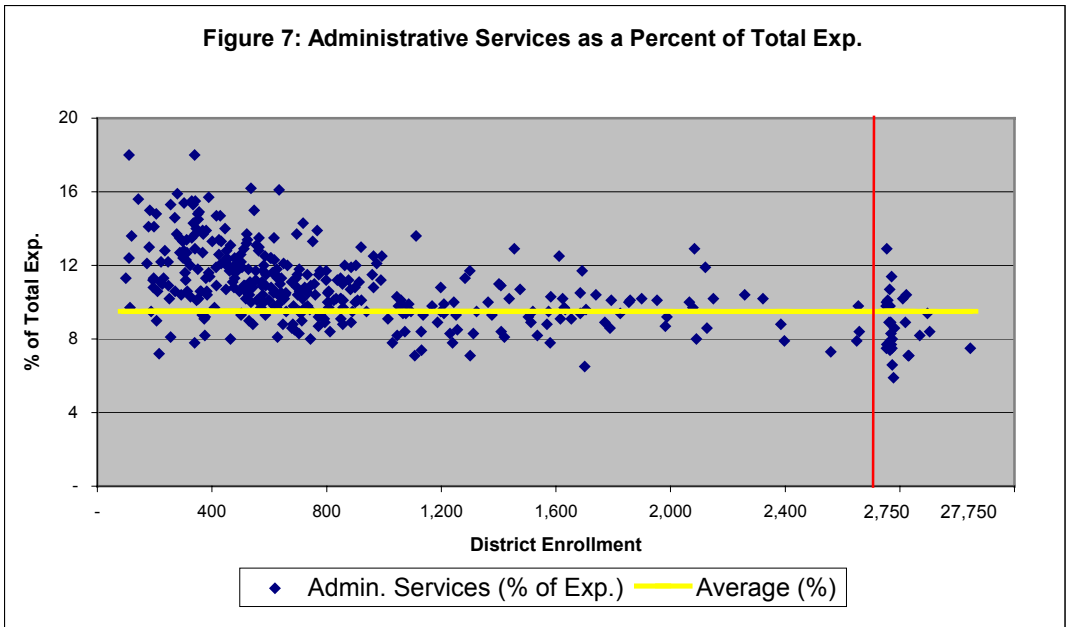
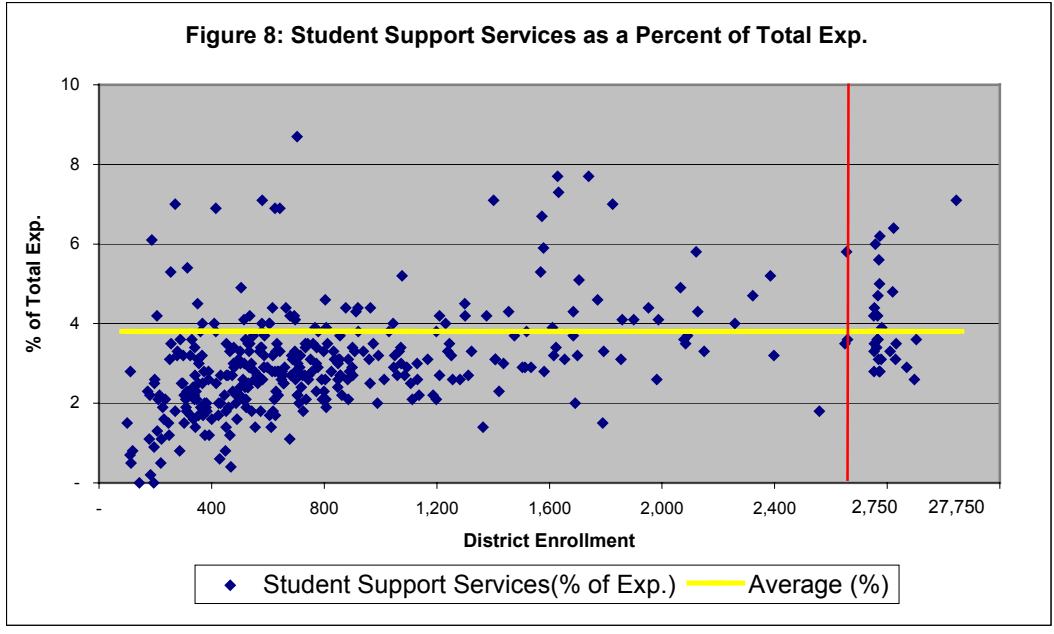


Figure 7 shows there may be a reciprocal relationship between district enrollments and the proportion of district budgets expended upon administrative services. There is little room for doubt that districts with lower enrollments expend larger proportions of their total education-related investments on administrative services.



Among all of the functional categories reported in the data set, administrative services is the only one that displays a strong positive reciprocal tendency. Among the other functional categories, only student support services as a percent of total expenditures (Figure 8) shows a potentially reciprocal relationship in its scatter diagram. But this relationship, if borne out by further analysis, would be negative (the smaller the district, the lower the proportion of the budget it spends upon student services).



Expenditure Variation and Enrollment Size

With the exception of student support services and staff support services, smaller districts appear to display a higher variation in expenditures by function than larger districts do. This is consistent throughout the scatter diagrams on both a per-student and a percent-of-total-expenditures basis. A couple of things may be at work here.

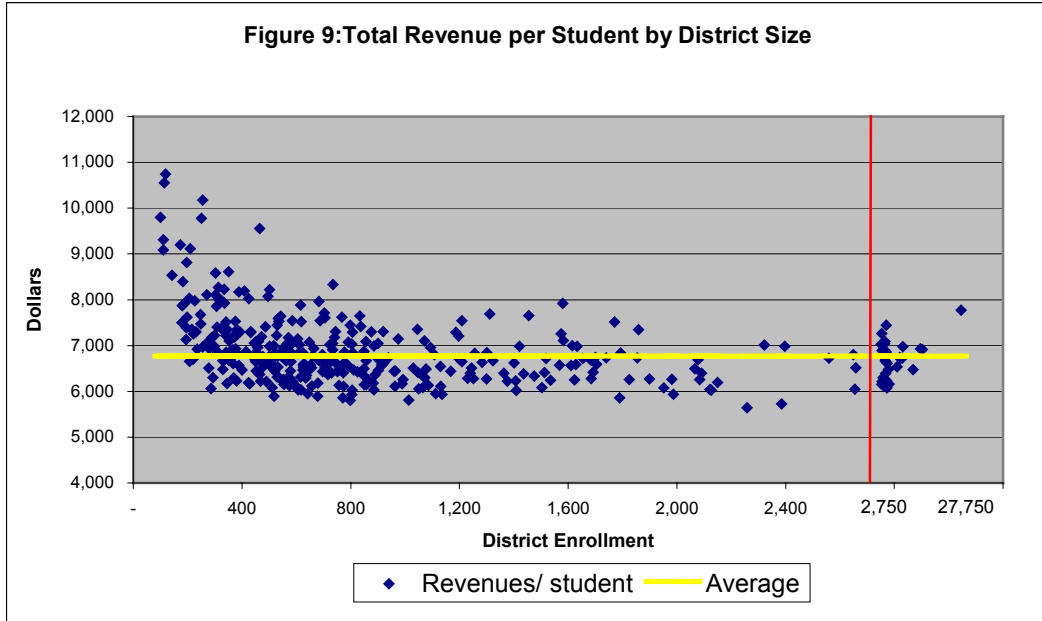
First, the smaller organizations undoubtedly have less fiscal and operational inertia. This simply means that individual events and circumstances have more pervasive effects upon small organizations and budgets than on large ones. Unexpected events of equal size require reallocations that are relatively larger and farther-reaching in the context of small budgets than in the context of large budgets. This is much like the physical laws of inertia, and will almost always result in more variance among smaller organizations.

Second, despite allocating a higher proportion of their overall budgets to administrative services, smaller districts may be struggling with less effective management than larger districts. It may be there are substantial economies of scale to management itself, and that small school districts simply are not able to meet that scale. On the other hand, there may be pervasive incentives for quality school administrators to move from small-enrollment environments to large-enrollment environments. Some of these incentives may have to do with potential compensation and prestige. Others may have to do with any economies of scale in management that may exist, such as more staff support, the availability of in-house expertise, etc.

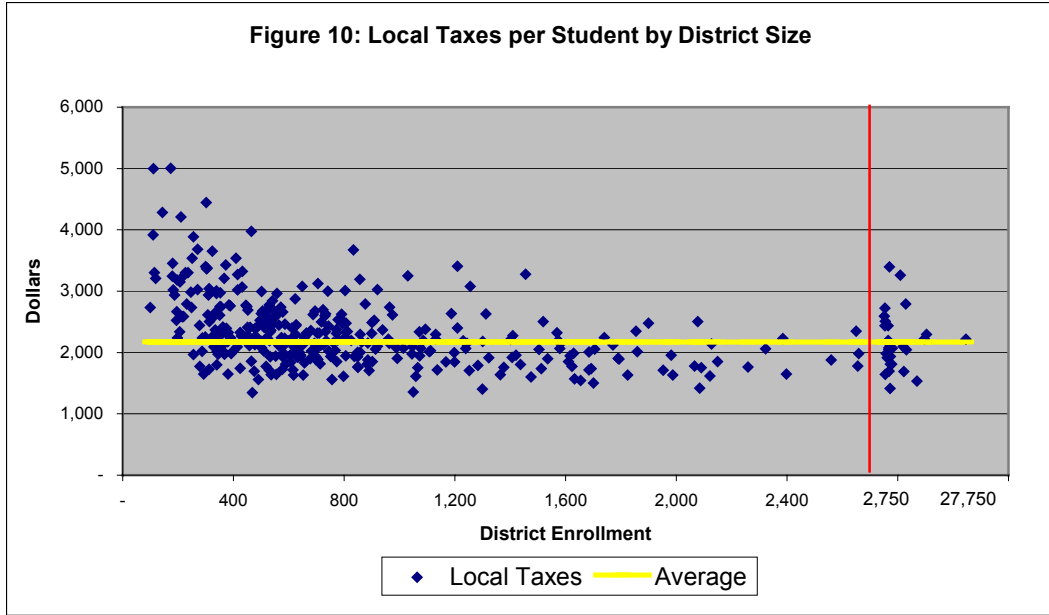
Whatever the reasons, if smaller districts do have an institutionalized disadvantage in attaining or maintaining top-quality administration, this could be a significant factor in the increasing variation in functional expenditures we observed as district enrollments decline through the range. It would also be a significant factor in the increasing costs of administrative services (on both a per-student basis and a percent-of-total expenditure basis) that accompanies decreases in enrollment size.

Revenue Sources by School District Size

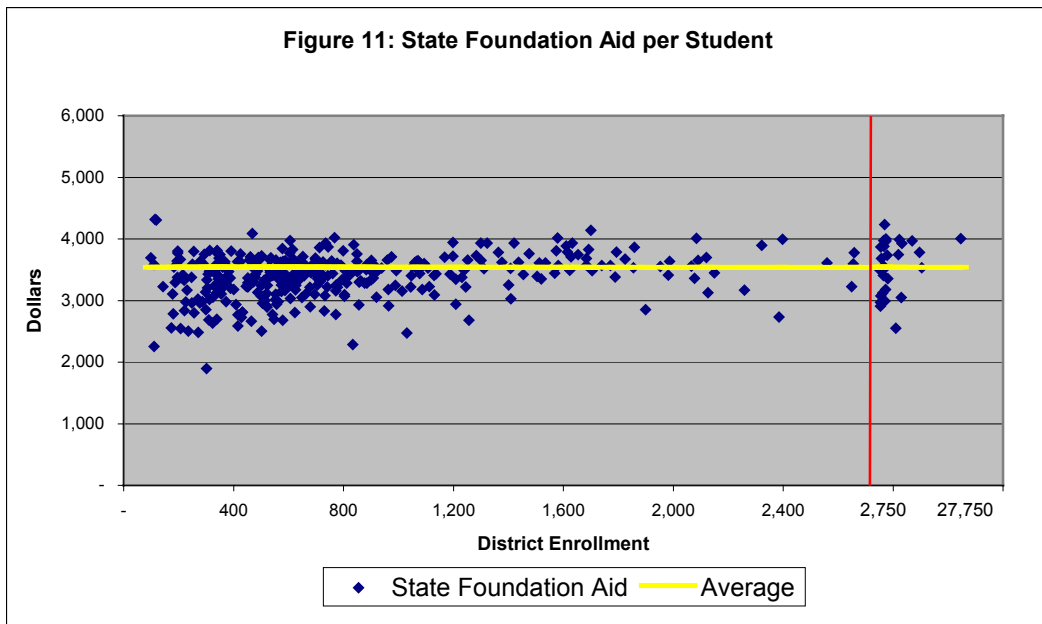
Figure 9 shows the distribution of total reported revenue per student by school district size. The shape of this plot is very similar to the shape of the total expenditures per student diagram (Figure 3).



School district revenues come from a number of sources. Statewide, the data indicate that about 38.6 percent of public school district revenues come from local sources. The largest of these is direct local taxation, which accounts for 32.1 percent of district revenue. Figure 10 shows a tendency for local tax revenue per student to increase as district size declines. This is also true of local tax revenue as a percent of total revenue relative to district size. The data show smaller districts shoulder a larger share of the expenditures involved in their educational investment locally, from their own sources, than do larger districts.



During the 2000-2001 school year, Iowa public school districts received 57.6 percent of their revenue from state sources. The largest of these sources, state foundation aid, provided 52.3 percent of total reported school district revenue. State foundation aid per student relative to district size is shown in Figure 11. State foundation aid per student declines as school district sizes decline. The data shows state foundation aid as a percent of total revenues also declines relative to district size.



The trends in local tax and state foundation support as district size declines are consistent with a state policy that discourages or, at the very least, does not reward the maintenance of very small districts. Given local control of the decision to maintain districts that fall within the zone of rising costs per student, it is consistent that local populations (decision makers) bear the higher costs of maintaining these districts as size diminishes.

Summary

This study looks at easily accessible public data to illuminate relationships between school district enrollment and expenditures and revenues per student.

It is clear expenditures per student rise at an accelerating rate as enrollment sizes fall below about 750 students. It also is clear expenditures per student are relatively constant at enrollment levels above 1,000 students. In fact, it is relatively easy to fashion a simple statistical relationship between district enrollments and total expenditures per student that accounts for nearly 40 percent of the expenditure per student variation across these districts. While we cannot be certain this is due to economies of scale among the smaller districts, data on instructional and administrative expenditures as percents of total expenditures tend to support this conclusion. This suggests a significant portion of the debate on school district organization can be based upon budget considerations.

State foundation aid formulas do not appear to favor smaller districts on either a per pupil or a percent of total revenue basis. Per pupil aid remains relatively constant across the population. Given the increasing cost structure, per pupil, as district size decreases, state foundation aid as a percent of total district budgets decreases substantially as district sizes fall below 750 students. The corollary to this is that local tax revenues per student and as a percent of total budgets increase substantially as district size falls below 750 students. This is consistent with the per pupil expenditure increases that also were seen in this district size range.

There are a multitude of factors that go into successful educational outcomes that are not accounted for in this report. Clearly, however, there are financial trends within the system that are more closely related to district size than to outcomes. These trends should be included in the debate on educational funding.

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