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# 0451 Staff Report on School District Size Factors

Colorado Legislative Council

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Report to the

COLORADO

GENERAL ASSEMBLY

December 1998

Colorado Legislative Council
Research Publication No. 451

# ACKNOWLEDGMENTS

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# SCHOOL DISTRICT SIZE FACTORS

**Report to the**
**Colorado General Assembly**

**Colorado Legislative Council**
**Research Publication No. 451**
**January 1999**

**COLORADO GENERAL ASSEMBLY**





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To Members of the Sixty-second General Assembly:

Submitted herewith is the study of School District Size Factors. The study is required pursuant to Section 22-54-104 (5) (b) (I.3) (B), C.R.S.

Respectfully submitted,

Charles S. Brown
Director

CB/CW/cs

# TABLE OF CONTENTS

## EXECUTIVE SUMMARY

### Study Charge

Section 22-54-104 (5) (b) (I.3) (B), C.R.S., directs the Legislative Council to conduct a study of the size factors established for FY 1999-2000 and make a report of its findings to the General Assembly no later than January 15, 1999.

### Staff Activities

This study examines Colorado's size factor, as well as the concept of educational economies of scale. Our work was organized along the following three areas:

- background on Colorado's size factor, including a description of the formula, a summary of changes in the factor over time, and a comparison with similar factors in other states;
- a review of the actual factors and the funding that is driven by the factors in FY 1999-00; and
- a review of research and literature on economies of scale in general, and especially in the field of education.

### Study Findings

Colorado's school finance act includes factors intended to compensate districts for cost pressures that are beyond their control. The size factor is intended to compensate for differences in per pupil cost which are attributable to economies of scale and provides additional money based on each district's enrollment. In FY 1998-99, the size factor contributed $121 million toward total program, or nearly four percent of the total funding provided through Colorado's school finance act.

Ten states incorporate a factor similar to Colorado's size factor in their respective school finance formulas, but only Colorado provides additional funding to all districts in the state. Beginning in FY 1999-00, the factor affects districts as follows:

- districts with the fewest pupils receive the largest size factor (up to a maximum possible factor of 2.5884);
- medium-sized districts receive a size factor of at least 1.0120; and
- large districts receive a factor that increases up to 1.0342 for districts with 32,193 or more pupils.

Because the factor provides more additional funding to small and large districts than to medium-sized districts, it is often referred to as the "J" curve.

The concept of economies of scale implies that it costs more per pupil to educate pupils in small school districts than in large school districts. Several studies have documented the relatively high per pupil costs in small districts, especially those caused by pupil-teacher ratios, fixed overhead, or purchasing. However, not all researchers agree that bigger districts are more cost-efficient; some also support the idea that *dis*economies of scale may cause per pupil costs to increase again as the size of the school district increases beyond an optimal point.

The study of economies of scale usually involves analyzing the per pupil cost of educating students, or at least variables that approximate differences in per pupil costs attributable to economies of scale. Colorado's size factor is based on expenditure data modified to control for a number of factors and eliminate some potential biases. The "J" curve uses a methodology called LOWESS to compare a size variable (measured by pupil enrollment) and a per pupil cost proxy (modified per pupil expenditures).

The size factor directly increases a district's per pupil funding. For example, a size factor of 2.0000 effectively doubles a district's per pupil funding. On average, the size factor adds $186 to per pupil funding, although this figure varies greatly among individual districts. The value of the size factor to any particular district can be calculated by the following formula:

*Per Pupil Revenue from Size Factor = (district size factor - 1) x (statewide base)*

Based on the most recent FY 1999-00 estimates available, the Legislative Council Staff projects the following:

- the state's 155 smallest districts (less than 5,650 pupils each) will enroll about 25 percent of the state's students, receive size factors ranging from 2.5884 to 1.0120, and consume 64 percent of the money distributed through the size factor ($81 million);

- the 13 medium-sized districts (between 5,650 and 25,546 pupils each) will enroll about 25 percent of all students, receive the minimum size factor of 1.0120, and consume about six percent of the size factor money ($8 million); and

- the 8 largest districts (over 25,546 pupils each) will enroll about 50 percent of all students, receive size factors between 1.0120 and 1.0342, and consume the remaining 30 percent of size factor moneys ($38 million).

On average, districts in these three tiers receive $481, $45, and $112, respectively, per student from the size factor. The minimum dollar increase provided through the size factor is $45, while the maximum is $5,279.

# I. BACKGROUND

This chapter provides an introduction to Colorado's size factor as well as a review of how the size factor was established, how it has changed, and how it compares with similar factors in other states.

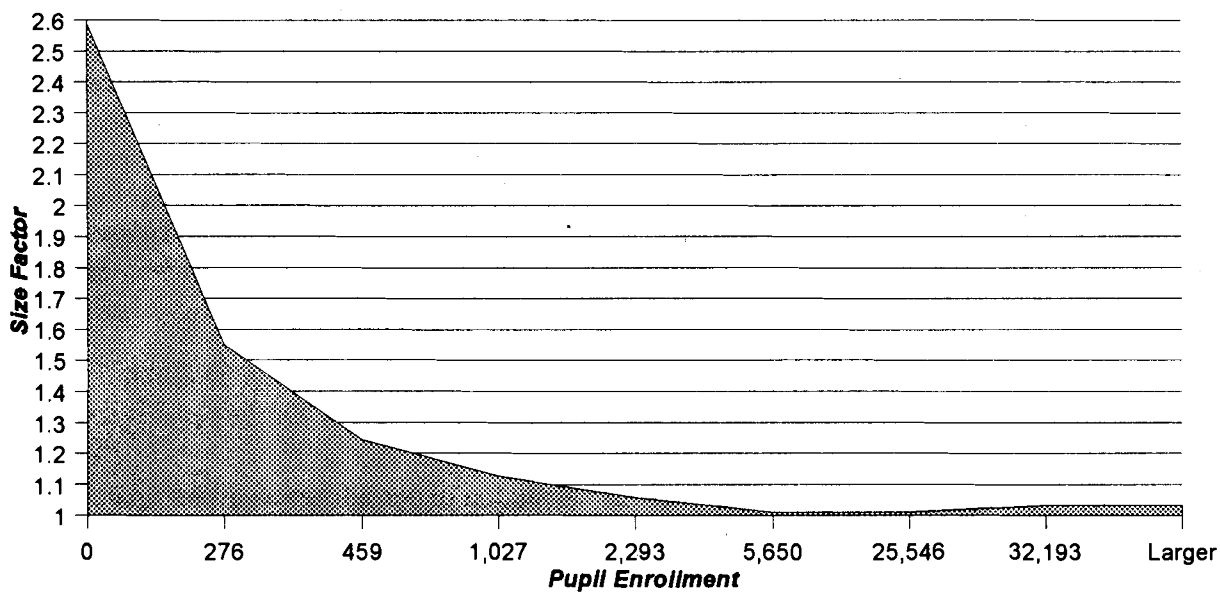
## Introduction to Colorado's Size Factor

The size factor (or "J" curve) in Colorado's school finance act is a key component of funding for public schools. In FY 1998-99, the size factor accounts for roughly $121 million, or nearly four percent of the act's total funding. The factor compensates districts based on the theory that per pupil costs are subject to economies of scale.

***What is the "J" curve?*** The term "J" curve is used to describe the shape resulting from school district size factors, when graphed by enrollment. Chart 1, below, depicts the size factor formula established for FY 1999-00. Please note the chart is not drawn to scale.

**CHART 1: The Size Factor ("J" Curve)**

NOT DRAWN TO SCALE




The Legislative Council Staff estimates that one quarter of the students funded under Colorado's school finance act will be enrolled in the state's 155 smallest districts in FY 1999-00. These districts enroll less than 5,650 pupils each and receive size factors ranging from 1.0120 to 2.5884. Another one quarter of students are expected to enroll in the 13 districts with between 5,650 and 25,546 pupils. Districts in this enrollment range receive the minimum size factor of 1.0120 in

FY 1999-00. The remaining half of the students are expected to enroll in the state's eight largest districts. These eight districts are expected to enroll more than 25,546 pupils each and will receive size factors between 1.0120 and 1.0342 in FY 1999-00. Over half of the students in large districts are enrolled in the three largest districts in the state and will receive a size factor of 1.0342.

***How does the "J" curve affect per pupil funding?*** The size factor directly increases a district's per pupil funding. For example, a size factor of 2.0000 effectively doubles a district's per pupil funding. A size factor of 1.5000 increases per pupil funding by about 50 percent. A size factor of 1.0120 increases per pupil funding by about 1.2 percent. A size factor of 1.0342 increases per pupil funding by about 3.42 percent. On average, the size factor adds $181 to per pupil funding in FY 1998-99, although this figure varies greatly among individual districts. The effect of the size factor on district funding is discussed in greater detail in Chapter II of this study.

## The Origin of Colorado's Size Factor

The size factor became law with the passage of House Bill 94-1001, which created the Public School Finance Act of 1994. It was recommended by the 1993 Interim Committee on School Finance to compensate school districts for economies-of-scale cost pressures that are beyond the district's control. The idea that it is appropriate for the state to compensate districts for the cost pressures created by the number of pupils enrolled was also recommended by an advisory committee comprised of school finance experts that met in 1992 and 1993 to discuss school finance in Colorado.

***The factor approximates differences in per pupil cost.*** Through the size factor, the General Assembly has established a policy of compensating districts for economies-of-scale cost pressures through the state's school finance formula. Implementing the policy, however, requires measuring exactly how economies of scale affects the per pupil costs faced by Colorado school districts and consistent and reliable cost data are not available. Therefore, the factor was based on a proxy using the best data available to approximate per pupil costs. The proxy was developed using actual district expenditures modified to control for a number of factors and eliminate some potential biases. It was then compared on a graph with district enrollment and a line was plotted to determine the central tendency of districts. This line is replicated in the size factor's statutory formula.[1]

## Changes to the Size Factor Under the School Finance Act

As previously mentioned, the size factor is calculated under a formula in the school finance act. Thus, a change in the formula requires an amendment to the law. Since enactment of the size factor formula in 1994, the General Assembly has considered several modifications, although the substance of the statutory formula had remained essentially unchanged between 1994 and 1998. Prior to FY 1998-99, the factor provided funding to only the smallest and the largest districts; beginning with FY 1998-99, the formula is modified to provide additional funding to *all* districts.

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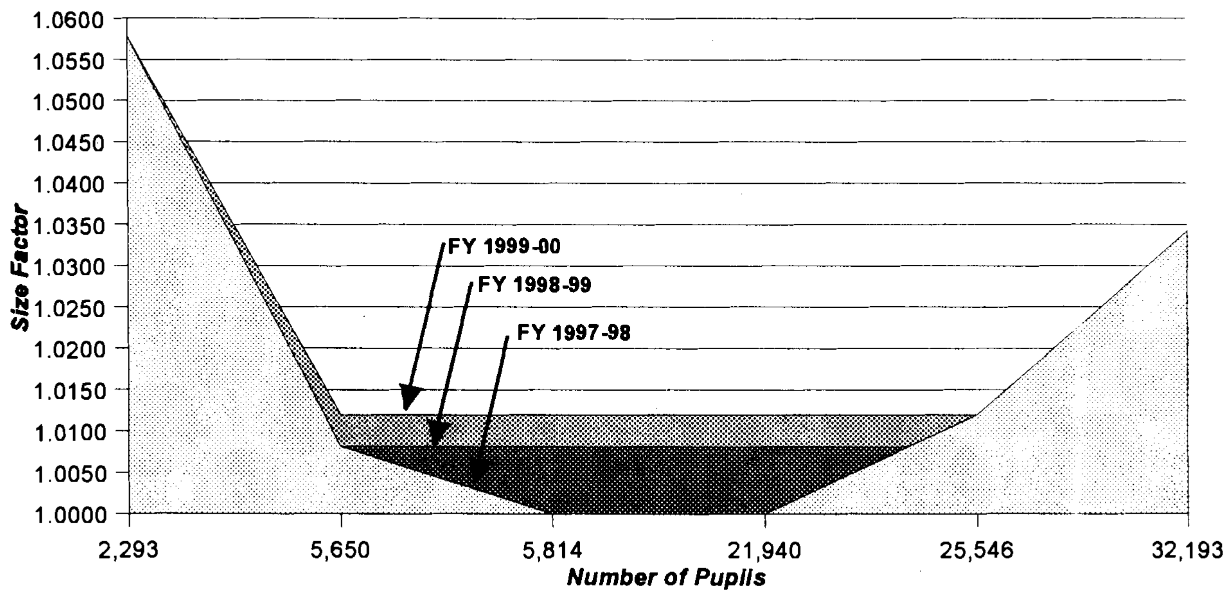
1. The line plotted against the data incorporated a method of weighting data called LOWESS. See Chapter III for further explanation of how the LOWESS methodology was applied in Colorado and Appendix 2 for a detailed explanation of LOWESS.

The first change occurred before the bill was even adopted. Relatively early in the debate, the legislature altered the interim committee's original formula so that a range of districts (with enrollments between 5,814 and 21,940) received a size adjustment factor of 1.0000, where before only one district (with enrollment of 17,659) received a size adjustment factor of 1.0000. Some legislators argued that there were little noticeable differences in the economies-of-scale cost pressures experienced by districts with between 5,814 and 21,940 pupils; others commented that the original formula adversely affected one district disproportionately. The net effect of the formula's alteration was to decrease the amount of funding received by all districts under the size factor. The legislature considered other changes as well, including at least two bills (outside the school finance bill) that would have guaranteed a minimum size factor.[2]

***A minimum size factor is established beginning in FY 1998-99.*** The most significant change to the size factor occurred in 1998. With the passage of House Bill 98-1234, the General Assembly modified the size factor formula to phase-in additional funding for districts with between 2,293 and 25,546. For FY 1998-99, the school finance act guarantees that no district will have a size factor less than 1.0081. For FY 1999-00 and thereafter, the law provides a minimum size factor of 1.0120. Chart 2, below, highlights these recent changes to the size factor formula.

**CHART 2: Recent Changes to the Size Factor**

NOT DRAWN TO SCALE




***Other changes affect reorganized districts and small districts with charter schools.*** Aside from the issue of a minimum size factor, there have been two other changes to the formula. First, the General Assembly modified the formula to account for school district reorganizations. Under the revised formula, when a reorganization results in a lower size factor, and less funding per pupil, the lower size factor is phased in over six years. Conversely, when a reorganization results in a higher

2. House Bill 97-1135 would have established a minimum size factor of 1.0342. House Bill 95-1051 would have established a minimum size factor of 1.0160.

size factor, and more funding per pupil, the district or districts involved in the reorganization receive the lower size factor of the original district. Thus, the act lessens the negative fiscal impact of reorganization while prohibiting a district from taking advantage of a higher size factor following a reorganization.

Second, the General Assembly provided additional money to minimize the effect that charter schools may have on the size factor of small school districts. Beginning in FY 1998-99, the size factor for districts with less than 500 pupils is calculated using the district's enrollment, minus 65 percent of the pupils enrolled in charter schools. This change provides a higher size factor, and higher per pupil funding, to small districts with charter schools than such districts would otherwise receive.

## Ten States Incorporate a Size Factor in their School Finance Formulas

We identified ten states that use district or school enrollment as a basis for providing additional funding in their school finance formulas. These states include Alaska, Arizona, California, Colorado, Florida, Kansas, Nebraska, New Mexico, Oklahoma, and Texas.[3] The Kansas formula is of particular interest because it was studied extensively by the legislature in 1994 while the supreme court in that state considered the constitutionality of the formula. The legislature's study confirmed some basic economy-of-scale ideas, including the following:

- it costs more per pupil to offer an equivalent educational program in smaller enrollment districts than it does in larger enrollment districts;
- pupil/teacher ratios appear to be the greatest contributor to high per pupil costs; and
- it can be difficult to identify variables related to cost which do not reflect historical expenditures.

All ten state formulas provide the most money to the smallest districts, on a per pupil basis, thus incorporating the idea that smaller school districts cannot take advantage of the economies of scale available to larger school districts. Colorado's formula provides the greatest per pupil increase for very small districts, followed by Alaska and Kansas. Colorado's size factor formula is the broadest, applying to *all* districts in the state. Alaska provides aid to all districts in the state except the state's largest. Meanwhile, Oklahoma provides size adjustment funding to the smallest enrollment range of districts — only those with less than 529 pupils.

Seven of the ten states have size adjustment formulas which provide additional funding only for small districts or schools (i.e., those with less than a specific enrollment level). The other three states — Colorado, Nebraska, and New Mexico — have formulas which mirror a "J" curve, such that the smallest enrollment districts receive the largest size adjustment but the largest districts also receive additional funding. Of these states, New Mexico provides the most per pupil to large districts.

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3. Other states may offer size-adjustment programs but differences in school finance formulas make comparisons to Colorado difficult.

Most of the ten state formulas measure size using the number of pupils in the district. However, there are two notable exceptions: New Mexico's size adjustment formula also considers the number of pupils in each school; and Alaska's size adjustment formula uses community populations which represent only a portion of the district's population.

It is worth noting that some states also provide funding to account for geographic isolation as a barrier to economies of scale. For example, Colorado allocates money to small, isolated schools; Texas provides additional funding to districts larger than 300 square miles; and Oklahoma allows districts to use either the size adjustment formula or an isolation formula, whichever provides greater assistance.

# II. ECONOMIES OF SCALE LITERATURE AND RESEARCH

This chapter examines literature and research on economies of scale in education. First, we define economies of scale and introduce the firm (or the school district) as the primary basis for measuring economies of scale. Second, we review research and literature related to economies of scale and, in particular, research that examines how the number of pupils in a school district affects the per pupil cost of educating students. Third, we discuss issues related to measuring economies of scale such as the availability of data and alternatives for analyzing data, giving particular emphasis on the LOWESS method used to develop the size factor in Colorado. A portion of this chapter builds upon previous research published by the Legislative Council Staff.[4]

**Economies of Scale, Defined**

Economic theory holds that the cost to produce an individual item decreases with an increase in the number of items produced. This phenomenon is often called "economies of scale" because it implies that a firm can achieve economic savings by increasing its scale of production.

In education, the theory of economies of scale implies that it costs more per pupil to educate pupils in small school districts than in large school districts. One way to illustrate this is to compare fixed costs spread over a district's enrollment. For example, all districts must employ a superintendent, whose salary can be converted into a per pupil cost. If the salary for a superintendent is $100,000, this translates into costs of $10 per pupil in a district with 10,000 pupils and $1,000 per pupil in a district with 100 pupils.

Economic theory also supports the idea that reduced costs of providing education may only be present for larger school districts up to an optimal size. In other words, *dis*economies of scale may cause per pupil costs to increase again as the size of the school district increases beyond an optimal point.

To acknowledge that economies of scale exist in providing education services in Colorado, it logically follows that they be considered in educational funding. The General Assembly compensates school districts for enrollment-based cost pressures through a size factor in the state's school finance act.

4. This earlier research is contained in three published studies: *Legislative Council Staff Report on the School District Setting Category Study*, Colorado Legislative Council Research Publication No. 376, March 1993; *Legislative Council Staff Report on the Senate Bill 93-87 Setting Category Study*, Colorado Legislative Council Research Publication No. 378, August 1993; and *School Finance Study*, Colorado Legislative Council Research Publication No. 398, January 1995.

## A Review of Economies of Scale Research and Literature

Most economy of scale research is based on production by a firm. The general consensus among researchers is that larger firms can capitalize on the financial benefits of mass production such as more efficient use of resources and specialization of labor. For example, a large firm might have more capital resources available to automate the production of goods, whereas a small firm could not afford such efficiencies. Similarly, a large firm purchasing large quantities of raw materials might pay less per unit than a small firm purchasing smaller amounts of raw materials.

Some research also points to inefficiencies for very large production firms, implying that there is something like an "optimal" size operation. As the size of a firm increases up to a certain point, average unit costs decrease and then level off. Above this size, average unit costs may actually increase where the production curve of the firm becomes "U-shaped."[5] One possible explanation for this diseconomies-of-scale phenomenon is that the infrastructure upon which the firm relies is inadequate to handle the volume of goods produced.

***Economies of scale in education.*** Research and literature also point to economies of scale in education, implying that students can be taught most efficiently, or at a lower per pupil cost, in districts of a certain size. Nearly all of the relevant research tends to support the idea that small school districts face relatively high per pupil costs. These relatively high per pupil costs in small districts are often created by the required minimum level of education inputs. Using the example from earlier in this chapter, the district with 10,000 pupils might have 800 high school seniors and 32 high school teachers, producing a pupil-teacher ratio of 25:1. Keeping proportions the same, the district with 100 pupils would have 8 high school seniors and one high school teacher, producing a pupil-teacher ratio of 8:1. If the salary for a teacher is $25,000, the cost in the district with 10,000 pupils is $1,000 per pupil while the cost in the district with 100 pupils is $3,125 per pupil. These costs are illustrated in Table 1.

### TABLE 1: Comparison of Per Pupil Costs in Large and Small Districts

| | District A | District B |
|---|---|---|
| Enrollment | 10,000 pupils | 100 pupils |
| Estimated High School Seniors (1/12th of total) | 800 | 8 |
| Number of High School Teachers | 32 | 1 |
| Pupil-Teacher Ratio | 25:1 | 8:1 |
| Teacher Salary | $25,000 | $25,000 |
| Per Pupil Cost | $1,000 | $3,125 |

5. The "U-shaped" production curve is replicated, to a limited extent in Colorado's size factor, which is often called the "J" curve. The concept is the same, however, in that they both indicate higher unit costs for organizational units that grow beyond an optimal size.

Besides educational inputs, researchers have found that economies of scale can affect the per pupil cost of administration, building maintenance, support programs, and purchasing of equipment, supplies, and other materials. One study found economies of scale to exist in all nine of the states included in the research.

To lower the cost of education, some small districts have turned to the following:

- collective purchasing of equipment, supplies, and other materials;
- technology improvements so students can access programs offered at other districts or higher education institutions; and
- cooperative arrangements to jointly provide expensive educational services, such as those for severely handicapped students.

As a last resort, many states have pursued school district consolidation, although these efforts have subsided. School district consolidation often means closing smaller schools and combining (or eliminating) programs with a high per pupil cost. There are several barriers, however, that may affect the ability of a school district to achieve economies of scale: communities may object to the loss of control over local schools; citizens may object to closing schools that contribute to a community's identity; and it may cost more to transport students in the new district. In addition, some research also confirms a U-shaped cost curve with increasing per pupil costs for districts that grow beyond an optimal size. The nine-state study noted above found evidence to support the theory that diseconomies of scale arise when size exceeds the optimum, although the optimum size varied in each state. Another study found evidence that average costs decrease at a decreasing rate as enrollment increases and that instructional unit costs begin to rise again as institutions become very large. These and other studies have found that relatively large institutions had higher unit costs than mid-sized institutions, confirming a U-shaped cost curve.

## Measuring Economies of Scale

While researchers may agree that economies of scale exist, they often disagree on the appropriate means for measuring these economies of scale. In particular, there may be disagreement over both the type of data and the type of analysis. These and other important issues are described in detail below.

***Data availability.*** The most widely accepted method of measuring economies of scale involves analyzing the cost of inputs such as raw materials and the means of production. When data are available, economies of scale can be measured using regression or other statistical techniques. For service industries like education, however, consistent and reliable data are often difficult to obtain.

Without accurate, consistent, and reliable cost data, some statistical analyses rely on other variables as proxies. Proxies are variables used in econometric modeling that are thought to be highly correlated to the unavailable data. In education, per pupil expenditures are often used as a proxy for per pupil cost, sometimes in conjunction with pupil-teacher ratios and average teacher salaries. When measuring the effect of economies of scale in education, a proxy may also include expenditures for certain fixed inputs which are necessary for a district's operation regardless of the number of students enrolled in the district. These fixed inputs include items such as building maintenance, overhead, and some administrative and support services.

In Colorado, data are available on many of the variables that affect the cost of education, such as student characteristics, average salaries, pupil-teacher ratios, and overhead expenditures. Data are not available, however, on the actual cost to educate students or how much each variable contributes to this cost. Thus, to estimate costs in Colorado a proxy was developed using actual district expenditures modified to reflect per pupil costs. The expenditures were modified to control for a number of factors and eliminate some potential biases. After modification, the figures represented the best data available to approximate per pupil costs.

***Data analysis.*** The debate over how to measure economies of scale is not limited to the data; it also encompasses the method for analyzing data. Several statistical alternatives are available, including regression analysis and a method of weighting data called LOWESS. Regression analysis is often applied to this type of research and confirmed a relationship between size and per pupil costs. Limitations on the data, however, caused the regression models we examined during development of the size factor to indicate a static relationship between size and per pupil costs over all enrollment levels. Thus, to measure whether the relationship between size and per pupil costs changes over different enrollment levels using regression modeling would have required segregating the data into categories, reducing the data elements available for analysis, and possibly reducing the quality of the analysis. LOWESS, on the other hand, seems to better accommodate the possibility of a dynamic relationship between size and per pupil costs using all the available data.

Colorado's size factor applies the LOWESS methodology to a size variable (measured by pupil enrollment) and a per pupil cost proxy (modified per pupil expenditures). To develop the proxy, the expenditure data were modified to control for a number of factors and eliminate some potential biases. Specifically, the data were subject to the following four modifications:

- first, 1991 expenditures were inflated to reflect then-current FY 1993-94 school finance moneys, after phase-in of the 1988 school finance act;
- second, total expenditures were divided by pupil enrollment to determine an average per pupil amount;
- third, the per pupil amount was divided by each district's cost-of-living factor to account for regional differences in the costs of housing, goods, and services; and
- fourth, the per pupil amount was reduced by $313 to account for the fact that all districts were required by law to devote at least that much per pupil for instructional supplies and materials, capital reserve, and insurance reserve.

The LOWESS line resulting from the graph of modified per pupil expenditures and pupil enrollment revealed that the relationship between size and costs was dynamic and curvilinear. It also revealed specific enrollment levels where the relationship between size and costs seemed to change. The per pupil expenditure levels at these enrollment levels were converted into factors (dividing by the lowest so that the minimum size factor was 1.00) and the mathematical slope of the line between the factor at each enrollment level was calculated. This line is replicated in the size factor's statutory formula which can be found in Appendix 1.

***Additional issues.*** At the same time researchers generally support the idea that economies of scale exist, and that states should compensate districts for the resulting cost pressures, they also point out the difficulty of considering enrollment as a cost factor in isolation. Even at a theoretically "efficient" enrollment level, districts may face different cost pressures based on one or more of the following:

- available facilities and capacity utilization;
- cost of pupil transportation;
- community expectations; and
- geographic sparsity.

The trade-off between costs and benefits, and the decisions made by local school boards in this trade-off, add to the difficulty of measuring economies of scale. Also adding to the difficulty, according to many researchers, is the problem of how to measure the consistency and quality of educational outputs. A firm can measure the quality of each unit produced and impose quality control systems to ensure consistency, but quality is much more difficult to measure in education, where students may respond differently to different educational settings.

The most common measure of educational output is standardized test scores, although output is also sometimes measured by the number of graduates or their grade point average. Many authors note that the output of the educational system goes far beyond measurable test scores, and that a proper economy-of-scale model would need to account for these outputs as well. However, just as with the cost of educational inputs, good surrogates for output measures are usually difficult to obtain. By not including a measure of output, Colorado's size factor, by implication, assumes that all districts are providing the same quality, or at least an acceptable quality, of education.

# III. SIZE FACTORS AND FUNDING FOR FY 1999-00

The size factor provides a direct, measurable, and sometimes large share of a district's per pupil funding. This chapter illustrates exactly how the size factor affects Colorado school districts. First, it illustrates how the factor is calculated. Second, it discusses the impact of the size factor on per pupil funding. Third, it provides an estimate of the FY 1999-00 factor for each district and amount of money driven by the factor in total and on a per pupil basis.

### Calculating the Size Factor

Each district's size factor is calculated under a formula contained in law which uses the count of pupils. The complete formula for calculating school district size factors is in Appendix 1. For a district with 150 pupils, the size factor is calculated below:

| | | |
|---|---|---|
| *statutory formula:* | = | *1.5502 + (0.00376159 x the difference between the funded pupil count and 276)* |
| *size factor* | = | *1.5502 + (0.00376159 x (276-150))* |
| *for a district* | = | *1.5502 + (0.00376159 x 126)* |
| *with 150 pupils* | = | *1.5502 + 0.4740* |
| | = | *2.0242* |

### Impact of the Size Factor on Per Pupil Funding

As noted above, the size factor can have a large impact on a district's per pupil funding. On average, the size factor adds $186 to per pupil funding, although this figure varies greatly among individual districts. The value of the size factor to any particular district can be calculated by the following formula:

*Per Pupil Revenue from Size Factor = (district size factor - 1) x (statewide base)*[6]

Smaller districts tend to have a larger size factor and higher per pupil funding. For example, the factor for a district with 150 pupils (2.0242) provides 19 times more of an increase in per pupil funding than the factor for a district with 2,500 pupils (1.0550) and 85 times more than the factor for a district with 15,000 pupils (1.0120). The impact levels out, however, so that the factor for the district with 2,500 pupils provides five times more of an increase in per pupil funding than the factor for the district with 15,000 pupils and double the increase for a district with 35,000 pupils (1.0342). The factor for the district with 35,000 pupils provides an increase in per pupil funding three times higher than the factor for the district with 15,000 pupils. Table 2, on the next page, illustrates these figures.

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6. The statewide base is set annually by the General Assembly. For FY 1998-99, the statewide base is $3,783.

**TABLE 2: A Sample of Size Factors and Size Factor Funding FY 1999-00**

| District Funded Pupil Count | FY 1999-00 Size Factor | Per Pupil Funding Increase from Size Factor (base X size factor) | Total Funding Increase from Size Factor (base X size factor X pupils) |
|---|---|---|---|
| 150 | 2.0242 | $3,875 | $581,182 |
| 2500 | 1.0550 | $208 | $520,162 |
| 15,000 | 1.0120 | $45 | $680,940 |
| 35,000 | 1.0342 | $129 | $4,528,251 |

*Note: numbers may not sum due to rounding.*

The size factor also creates a compounding effect on per pupil revenue, because it is applied to a figure that has already been adjusted for cost of living. For example, in FY 1998-99, the formula is expected to provide roughly $475 million from the cost-of-living factor, $121 million from the size factor, and $18 million from the compounding of the two factors.

### Estimated FY 1999-00 Enrollment and Size Factors

Table 3, on the next few pages, illustrates the estimated enrollment, the calculated size factor, and the estimated revenue produced by the size factor for each school district in Colorado.

Based on the most recent FY 1999-00 estimates available, the 155 smallest districts — those with enrollments of 5,650 or less — will consume 64 percent of the money distributed through the size factor, while accounting for about one quarter of the students funded under the school finance act. Eighty-one million dollars of the $127 million allocated through the size factor will be distributed to these districts. The next tier of districts — those with enrollments between 5,650 and 25,546 — will receive just over six percent, or about $8 million, of the size factor money. As mentioned previously, the 13 districts in this tier enroll another one quarter of the students in Colorado. Finally, the last tier of districts — those with enrollments greater than 25,546 — will receive the remaining 30 percent of size factor moneys. This 30 percent translates into about $38 million for the half of the state's students enrolled in these eight districts. On average, districts in these three tiers receive $481, $45, and $112, respectively, per student from the size factor.

While the size factor tends to provide most districts with roughly $500,000 in total, the amount received per pupil from the factor varies widely. The minimum dollar increase provided through the size factor is $45, while the maximum is $5,279. When examined in terms of total per pupil funding from the school finance act, the money received under the size factor ranges from a low of nine-tenths of one percent to a high of 54 percent.

## TABLE 3. Estimated Enrollment, Size Factors, and Size Factor Funding, FY 1999-00

| | COUNTY | DISTRICT | EST. OCT 99 FUNDED PUPIL COUNT | EST. FY99-00 SIZE FACTOR | TOTAL REVENUE FROM SIZE FACTOR * | PER PUPIL REVENUE FROM SIZE FACTOR * |
|---|---|---|---|---|---|---|
| 1 | ADAMS | MAPLETON | 4,711.6 | 1.0248 | 442,035 | 94 |
| 2 | ADAMS | NORTHGLENN | 27,710.0 | 1.0192 | 2,012,677 | 73 |
| 3 | ADAMS | COMMERCE CITY | 5,696.0 | 1.0120 | 258,576 | 45 |
| 4 | ADAMS | BRIGHTON | 4,839.0 | 1.0231 | 422,867 | 87 |
| 5 | ADAMS | BENNETT | 967.8 | 1.1382 | 505,976 | 523 |
| 6 | ADAMS | STRASBURG | 599.0 | 1.2142 | 485,381 | 810 |
| 7 | ADAMS | WESTMINSTER | 11,034.0 | 1.0120 | 500,899 | 45 |
| 8 | ALAMOSA | ALAMOSA | 2,415.8 | 1.0561 | 512,696 | 212 |
| 9 | ALAMOSA | SANGRE DECRISTO | 316.0 | 1.4831 | 577,511 | 1,828 |
| 10 | ARAPAHOE | ENGLEWOOD | 4,377.0 | 1.0294 | 486,811 | 111 |
| 11 | ARAPAHOE | SHERIDAN | 2,099.0 | 1.0683 | 542,337 | 258 |
| 12 | ARAPAHOE | CHERRY CREEK | 40,237.0 | 1.0342 | 5,205,807 | 129 |
| 13 | ARAPAHOE | LITTLETON | 15,797.5 | 1.0120 | 717,143 | 45 |
| 14 | ARAPAHOE | DEER TRAIL | 178.3 | 1.9177 | 618,997 | 3,472 |
| 15 | ARAPAHOE | AURORA | 27,833.0 | 1.0196 | 2,063,728 | 74 |
| 16 | ARAPAHOE | BYERS | 453.0 | 1.2531 | 433,737 | 957 |
| 17 | ARCHULETA | ARCHULETA | 1,594.5 | 1.0954 | 575,452 | 361 |
| 18 | BACA | WALSH | 233.5 | 1.7101 | 627,253 | 2,686 |
| 19 | BACA | PRITCHETT | 95.0 | 2.2310 | 442,403 | 4,657 |
| 20 | BACA | SPRINGFIELD | 359.3 | 1.4104 | 557,829 | 1,553 |
| 21 | BACA | VILAS | 78.1 | 2.2946 | 382,493 | 4,897 |
| 22 | BACA | CAMPO | 81.8 | 2.2807 | 396,312 | 4,845 |
| 23 | BENT | LAS ANIMAS | 728.8 | 1.1874 | 516,671 | 709 |
| 24 | BENT | MCCLAVE | 261.1 | 1.6062 | 598,769 | 2,293 |
| 25 | BOULDER | ST VRAIN | 17,638.0 | 1.0120 | 800,695 | 45 |
| 26 | BOULDER | BOULDER | 26,371.0 | 1.0148 | 1,476,470 | 56 |
| 27 | CHAFFEE | BUENA VISTA | 888.90 | 1.1544 | 519,202 | 584 |
| 28 | CHAFFEE | SALIDA | 1,286.1 | 1.1120 | 544,915 | 424 |
| 29 | CHEYENNE | KIT CARSON | 133.5 | 2.0862 | 548,564 | 4,109 |
| 30 | CHEYENNE | CHEYENNE R-5 | 327.4 | 1.4639 | 574,565 | 1,755 |
| 31 | CLEAR CREEK | CLEAR CREEK | 1,367.5 | 1.1077 | 557,159 | 407 |
| 32 | CONEJOS | NORTH CONEJOS | 1,181.0 | 1.1177 | 525,851 | 445 |
| 33 | CONEJOS | SANFORD | 351.0 | 1.4243 | 563,400 | 1,605 |
| 34 | CONEJOS | SOUTH CONEJOS | 443.6 | 1.2689 | 451,252 | 1,017 |
| 35 | COSTILLA | CENTENNIAL | 355.1 | 1.4174 | 560,711 | 1,579 |
| 36 | COSTILLA | SIERRA GRANDE | 334.5 | 1.4520 | 571,967 | 1,710 |
| 37 | CROWLEY | CROWLEY | 619.0 | 1.2100 | 491,752 | 794 |
| 38 | CUSTER | WESTCLIFFE | 392.0 | 1.3555 | 527,184 | 1,345 |
| 39 | DELTA | DELTA | 4,554.0 | 1.0269 | 463,427 | 102 |
| 40 | DENVER | DENVER | 65,470.5 | 1.0342 | 8,470,482 | 129 |
| 41 | DOLORES | DOLORES | 330.9 | 1.4580 | 573,322 | 1,733 |
| 42 | DOUGLAS | DOUGLAS | 30,979.0 | 1.0301 | 3,527,526 | 114 |
| 43 | EAGLE | EAGLE | 4,293.0 | 1.0305 | 495,333 | 115 |
| 44 | ELBERT | ELIZABETH | 2,552.0 | 1.0543 | 524,224 | 205 |
| 45 | ELBERT | KIOWA | 357.0 | 1.4142 | 559,390 | 1,567 |
| 46 | ELBERT | BIG SANDY | 374.5 | 1.3848 | 545,159 | 1,456 |
| 47 | ELBERT | ELBERT | 260.5 | 1.6085 | 599,659 | 2,302 |

| | COUNTY | DISTRICT | EST. OCT 99 FUNDED PUPIL COUNT | EST. FY99-00 SIZE FACTOR | TOTAL REVENUE FROM SIZE FACTOR * | PER PUPIL REVENUE FROM SIZE FACTOR * |
|---|---|---|---|---|---|---|
| 48 | ELBERT | AGATE | 80.1 | 2.2871 | 390,015 | 4,869 |
| 49 | EL PASO | CALHAN | 577.5 | 1.2186 | 477,572 | 827 |
| 50 | EL PASO | HARRISON | 10,236.3 | 1.0120 | 464,687 | 45 |
| 51 | EL PASO | WIDEFIELD | 8,231.0 | 1.0120 | 373,654 | 45 |
| 52 | EL PASO | FOUNTAIN | 4,455.0 | 1.0283 | 476,947 | 107 |
| 53 | EL PASO | COLORADO SPRINGS | 31,491.8 | 1.0319 | 3,800,358 | 121 |
| 54 | EL PASO | CHEYENNE MOUNTAIN | 3,879.0 | 1.0362 | 531,208 | 137 |
| 55 | EL PASO | MANITOU SPRINGS | 1,368.5 | 1.1076 | 557,049 | 407 |
| 56 | EL PASO | ACADEMY | 15,886.5 | 1.0120 | 721,184 | 45 |
| 57 | EL PASO | ELLICOTT | 829.0 | 1.1668 | 523,103 | 631 |
| 58 | EL PASO | PEYTON | 720.0 | 1.1892 | 515,335 | 716 |
| 59 | EL PASO | HANOVER | 213.0 | 1.7872 | 634,309 | 2,978 |
| 60 | EL PASO | LEWIS-PALMER | 4,165.0 | 1.0323 | 508,925 | 122 |
| 61 | EL PASO | FALCON | 5,334.0 | 1.0163 | 328,910 | 62 |
| 62 | EL PASO | EDISON | 67.0 | 2.3364 | 338,725 | 5,056 |
| 63 | EL PASO | MIAMI-YODER | 317.5 | 1.4805 | 577,130 | 1,818 |
| 64 | FREMONT | CANON CITY | 4,311.0 | 1.0303 | 494,148 | 115 |
| 65 | FREMONT | FLORENCE | 1,937.5 | 1.0770 | 564,376 | 291 |
| 66 | FREMONT | COTOPAXI | 334.0 | 1.4528 | 572,123 | 1,713 |
| 67 | GARFIELD | ROARING FORK | 4,806.5 | 1.0235 | 427,300 | 89 |
| 68 | GARFIELD | RIFLE | 3,473.0 | 1.0417 | 547,870 | 158 |
| 69 | GARFIELD | PARACHUTE | 726.0 | 1.1880 | 516,334 | 711 |
| 70 | GILPIN | GILPIN | 372.0 | 1.3890 | 547,430 | 1,472 |
| 71 | GRAND | WEST GRAND | 534.0 | 1.2276 | 459,780 | 861 |
| 72 | GRAND | EAST GRAND | 1,234.5 | 1.1148 | 536,129 | 434 |
| 73 | GUNNISON | GUNNISON | 1,649.0 | 1.0925 | 577,030 | 350 |
| 74 | HINSDALE | HINSDALE | 63.8 | 2.3484 | 325,444 | 5,101 |
| 75 | HUERFANO | HUERFANO | 861.9 | 1.1600 | 521,691 | 605 |
| 76 | HUERFANO | LA VETA | 304.8 | 1.5019 | 578,720 | 1,899 |
| 77 | JACKSON | NORTH PARK | 305.6 | 1.5005 | 578,620 | 1,893 |
| 78 | JEFFERSON | JEFFERSON | 86,151.5 | 1.0342 | 11,146,160 | 129 |
| 79 | KIOWA | EADS | 285.5 | 1.5343 | 577,069 | 2,021 |
| 80 | KIOWA | PLAINVIEW | 85.0 | 2.2687 | 407,957 | 4,799 |
| 81 | KIT CARSON | ARRIBA-FLAGLER | 232.0 | 1.7157 | 628,138 | 2,707 |
| 82 | KIT CARSON | HI PLAINS | 115.0 | 2.1558 | 502,825 | 4,372 |
| 83 | KIT CARSON | STRATTON | 286.7 | 1.5322 | 577,217 | 2,013 |
| 84 | KIT CARSON | BETHUNE | 168.5 | 1.9546 | 608,496 | 3,611 |
| 85 | KIT CARSON | BURLINGTON | 844.0 | 1.1637 | 522,670 | 619 |
| 86 | LAKE | LAKE | 1,213.3 | 1.1160 | 532,430 | 439 |
| 87 | LA PLATA | DURANGO | 4,733.0 | 1.0245 | 438,671 | 93 |
| 88 | LA PLATA | BAYFIELD | 1,053.0 | 1.1246 | 496,344 | 471 |
| 89 | LA PLATA | IGNACIO | 1,089.0 | 1.1227 | 505,486 | 464 |
| 90 | LARIMER | POUDRE | 22,735.0 | 1.0120 | 1,032,078 | 45 |
| 91 | LARIMER | THOMPSON | 13,934.0 | 1.0120 | 632,548 | 45 |
| 92 | LARIMER | ESTES PRK | 1,304.0 | 1.1111 | 548,060 | 420 |
| 93 | LAS ANIMAS | TRINIDAD | 1,525.5 | 1.0991 | 571,903 | 375 |
| 94 | LAS ANIMAS | PRIMERO | 187.9 | 1.8816 | 626,664 | 3,335 |
| 95 | LAS ANIMAS | HOEHNE | 334.0 | 1.4528 | 572,123 | 1,713 |
| 96 | LAS ANIMAS | AGUILAR | 167.8 | 1.9572 | 607,618 | 3,621 |
| 97 | LAS ANIMAS | BRANSON | 51.3 | 2.3954 | 270,802 | 5,279 |
| 98 | LAS ANIMAS | KIM | 79.0 | 2.2912 | 385,884 | 4,885 |

| | COUNTY | DISTRICT | EST. OCT 99 FUNDED PUPIL COUNT | EST. FY99-00 SIZE FACTOR | TOTAL REVENUE FROM SIZE FACTOR * | PER PUPIL REVENUE FROM SIZE FACTOR * |
|---|---|---|---|---|---|---|
| 99 | LINCOLN | GENOA-HUGO | 295.0 | 1.5183 | 578,415 | 1,961 |
| 100 | LINCOLN | LIMON | 628.5 | 1.2081 | 494,782 | 787 |
| 101 | LINCOLN | KARVAL | 88.4 | 2.2559 | 419,995 | 4,751 |
| 102 | LOGAN | VALLEY | 2,742.5 | 1.0617 | 536,381 | 196 |
| 103 | LOGAN | FRENCHMAN | 221.5 | 1.7552 | 632,808 | 2,857 |
| 104 | LOGAN | BUFFALO | 270.2 | 1.5720 | 584,679 | 2,164 |
| 105 | LOGAN | PLATEAU | 155.5 | 2.0035 | 590,315 | 3,796 |
| 106 | MESA | DEBEQUE | 170.0 | 1.9489 | 610,247 | 3,590 |
| 107 | MESA | PLATEAU | 551.4 | 1.2240 | 467,252 | 847 |
| 108 | MESA | MESA VALLEY | 18,399.0 | 1.0120 | 835,241 | 45 |
| 109 | MINERAL | CREEDE | 156.0 | 2.0016 | 591,092 | 3,789 |
| 110 | MOFFAT | MOFFAT | 2,622.3 | 1.0533 | 528,745 | 202 |
| 111 | MONTEZUMA | MONTEZUMA | 3,497.0 | 1.0414 | 547,687 | 157 |
| 112 | MONTEZUMA | DOLORES | 637.8 | 1.2062 | 497,519 | 780 |
| 113 | MONTEZUMA | MANCOS | 534.5 | 1.2275 | 460,008 | 861 |
| 114 | MONTROSE | MONTROSE | 5,125.0 | 1.0192 | 372,247 | 73 |
| 115 | MONTROSE | WEST END | 501.0 | 1.2344 | 444,254 | 887 |
| 116 | MORGAN | BRUSH | 1,500.5 | 1.1005 | 570,477 | 380 |
| 117 | MORGAN | FT MORGAN | 3,035.5 | 1.0477 | 547,753 | 180 |
| 118 | MORGAN | WELDON | 149.0 | 2.0279 | 579,393 | 3,889 |
| 119 | MORGAN | WIGGINS | 565.8 | 1.2210 | 473,033 | 836 |
| 120 | OTERO | EAST OTERO | 1,935.3 | 1.0771 | 564,468 | 292 |
| 121 | OTERO | ROCKY FORD | 1,083.9 | 1.1229 | 503,938 | 465 |
| 122 | OTERO | MANZANOLA | 276.3 | 1.5497 | 574,570 | 2,080 |
| 123 | OTERO | FOWLER | 380.9 | 1.3741 | 539,057 | 1,415 |
| 124 | OTERO | CHERAW | 226.3 | 1.7372 | 631,112 | 2,789 |
| 125 | OTERO | SWINK | 344.5 | 1.4352 | 567,172 | 1,646 |
| 126 | OURAY | OURAY | 247.0 | 1.6593 | 616,051 | 2,494 |
| 127 | OURAY | RIDGWAY | 283.3 | 1.5379 | 576,480 | 2,035 |
| 128 | PARK | PLATTE CANYON | 1,525.4 | 1.0992 | 572,442 | 375 |
| 129 | PARK | PARK | 578.5 | 1.2184 | 477,961 | 826 |
| 130 | PHILLIPS | HOLYOKE | 643.5 | 1.2050 | 499,044 | 776 |
| 131 | PHILLIPS | HAXTUN | 305.8 | 1.5002 | 578,652 | 1,892 |
| 132 | PITKIN | ASPEN | 1,274.5 | 1.1127 | 543,376 | 426 |
| 133 | PROWERS | GRANADA | 297.5 | 1.5141 | 578,590 | 1,945 |
| 134 | PROWERS | LAMAR | 1,936.3 | 1.0770 | 564,027 | 291 |
| 135 | PROWERS | HOLLY | 348.5 | 1.4285 | 564,924 | 1,621 |
| 136 | PROWERS | WILEY | 344.0 | 1.4360 | 567,389 | 1,649 |
| 137 | PUEBLO | PUEBLO CITY | 17,118.5 | 1.0120 | 777,111 | 45 |
| 138 | PUEBLO | PUEBLO RURAL | 6,627.0 | 1.0120 | 300,839 | 45 |
| 139 | RIO BLANCO | MEEKER | 716.1 | 1.1900 | 514,711 | 719 |
| 140 | RIO BLANCO | RANGELY | 728.6 | 1.1875 | 516,805 | 709 |
| 141 | RIO GRANDE | DEL NORTE | 767.6 | 1.1794 | 520,947 | 679 |
| 142 | RIO GRANDE | MONTE VISTA | 1,426.0 | 1.1045 | 563,731 | 395 |
| 143 | RIO GRANDE | SARGENT | 419.9 | 1.3086 | 490,205 | 1,167 |
| 144 | ROUTT | HAYDEN | 528.5 | 1.2287 | 457,243 | 865 |
| 145 | ROUTT | STEAMBOAT SPRINGS | 1,911.5 | 1.0784 | 566,926 | 297 |
| 146 | ROUTT | SOUTH ROUTT | 460.0 | 1.2428 | 422,516 | 919 |
| 147 | SAGUACHE | MTN VALLEY | 187.5 | 1.8831 | 626,394 | 3,341 |
| 148 | SAGUACHE | MOFFAT | 196.0 | 1.9640 | 714,775 | 3,647 |
| 149 | SAGUACHE | CENTER | 702.9 | 1.1928 | 512,669 | 729 |

|  | COUNTY | DISTRICT | EST. OCT 99 FUNDED PUPIL COUNT | EST. FY99-00 SIZE FACTOR | TOTAL REVENUE FROM SIZE FACTOR * | PER PUPIL REVENUE FROM SIZE FACTOR * |
|---|---|---|---|---|---|---|
| 150 | SAN JUAN | SILVERTON | 93.1 | 2.2382 | 436,091 | 4,684 |
| 151 | SAN MIGUEL | TELLURIDE | 498.0 | 1.2350 | 442,724 | 889 |
| 152 | SAN MIGUEL | NORWOOD | 313.3 | 1.4876 | 577,910 | 1,845 |
| 153 | SEDGWICK | JULESBURG | 319.0 | 1.4780 | 576,839 | 1,808 |
| 154 | SEDGWICK | PLATTE VLY | 139.3 | 2.0644 | 560,909 | 4,027 |
| 155 | SUMMIT | SUMMIT | 2,491.0 | 1.0551 | 519,232 | 208 |
| 156 | TELLER | CRIPPLE CREEK | 597.5 | 1.2145 | 484,843 | 811 |
| 157 | TELLER | WOODLAND PARK | 3,176.0 | 1.0457 | 549,077 | 173 |
| 158 | WASHINGTON | AKRON | 477.4 | 1.2392 | 431,996 | 905 |
| 159 | WASHINGTON | ARICKAREE | 128.5 | 2.1050 | 537,158 | 4,180 |
| 160 | WASHINGTON | OTIS | 194.3 | 1.8575 | 630,294 | 3,244 |
| 161 | WASHINGTON | LONE STAR | 92.0 | 2.2423 | 432,365 | 4,700 |
| 162 | WASHINGTON | WOODLIN | 128.0 | 2.1069 | 535,988 | 4,187 |
| 163 | WELD | GILCREST | 1,899.9 | 1.0790 | 567,798 | 299 |
| 164 | WELD | EATON | 1,327.3 | 1.1098 | 551,325 | 415 |
| 165 | WELD | KEENESBURG | 1,505.0 | 1.1002 | 570,480 | 379 |
| 166 | WELD | WINDSOR | 2,404.0 | 1.0563 | 512,011 | 213 |
| 167 | WELD | JOHNSTOWN | 1,476.0 | 1.1018 | 568,421 | 385 |
| 168 | WELD | GREELEY | 14,370.0 | 1.0120 | 652,341 | 45 |
| 169 | WELD | PLATTE VLY | 1,108.5 | 1.1216 | 509,924 | 460 |
| 170 | WELD | FORT LUPTON | 2,477.0 | 1.0553 | 518,188 | 209 |
| 171 | WELD | AULT-HGHLND | 893.0 | 1.1536 | 518,894 | 581 |
| 172 | WELD | BRIGGSDALE | 131.5 | 2.0937 | 544,077 | 4,137 |
| 173 | WELD | PRAIRIE | 120.6 | 2.1348 | 517,730 | 4,293 |
| 174 | WELD | GROVER | 137.9 | 2.0697 | 558,036 | 4,047 |
| 175 | YUMA | WEST YUMA | 1,018.0 | 1.1279 | 492,555 | 484 |
| 176 | YUMA | EAST YUMA | 960.5 | 1.1397 | 507,610 | 528 |
|  | **STATE | TOTAL** | 683,040.5 | 1.0492 | $127,185,089 | $186 |

* The funding shown is calculated using the FY 1998-99 base per pupil funding amount ($3,783).

***Minimum per pupil funding is often confused with the size factor.*** One aspect of the school finance act that sometimes creates confusion is the relationship between the minimum size factor and "minimum per pupil funding" districts. Prior to FY 1998-99, the minimum size factor was 1.0000 and districts with a size factor of 1.0000 received no additional funding from the size factor. Meanwhile, a different provision of the act guaranteed that some districts would receive a minimum per pupil amount that was greater than what the district would have received from its factors. These eight districts are often called "minimum per pupil funding" districts.

Some districts with a very low size factor also receive minimum per pupil funding, so many people confuse the issues as the same. In reality, factors other than the size factor may contribute to a district's eligibility under the minimum per pupil funding provisions in the act. Table 4, below, provides data on minimum per pupil funding districts and districts receiving the minimum size factor in FY 1998-99.

**TABLE 4: FY 1998-99 Data for Selected Districts[7]**

| County | District | Minimum Per Pupil Funding District? | FY 1998-99 Size Factor | FY 1998-99 Cost-of-Living Factor | FY 1998-99 At-Risk Factor | Est. FY 1998-99 Per Pupil Funding |
|---|---|---|---|---|---|---|
| Adams | Commerce City | no | 1.0081 | 1.207 | 20.16% | $4,887 |
| Adams | Westminster | no | 1.0081 | 1.207 | 14.31% | $4,700 |
| Arapahoe | Littleton | no | 1.0081 | 1.227 | 11.50% | $4,632 |
| Boulder | St. Vrain | no | 1.0081 | 1.227 | 11.50% | $4,689 |
| El Paso | Academy | yes | 1.0081 | 1.208 | 11.50% | $4,572 |
| El Paso | Harrison | no | 1.0081 | 1.198 | 16.21% | $4,718 |
| El Paso | Widefield | yes | 1.0081 | 1.168 | 11.50% | $4,574 |
| Fremont | Canon City | yes | 1.0267 | 1.146 | 12.23% | $4,556 |
| Larimer | Poudre | yes | 1.0081 | 1.178 | 11.50% | $4,563 |
| Larimer | Thompson | yes | 1.0081 | 1.178 | 11.50% | $4,562 |
| Mesa | Mesa Valley | yes | 1.0081 | 1.137 | 13.30% | $4,566 |
| Moffat | Moffat | yes | 1.0519 | 1.127 | 11.50% | $4,569 |
| Pueblo | Pueblo City | no | 1.0081 | 1.167 | 19.29% | $4,716 |
| Pueblo | Pueblo Rural | yes | 1.0081 | 1.157 | 11.50% | $4,516 |
| Weld | Greeley | no | 1.0081 | 1.177 | 16.35% | $4,650 |

7. These selected districts include those funded under the minimum per pupil funding provisions and those that receive the minimum size factor in FY 1999-00. The data are estimated based on House Bill 98-1234, as adopted by the General Assembly.

## APPENDIX 1 - CALCULATING THE SIZE FACTOR

Table 5, below, provides the formula for calculating a school district's size factor for FY 1999-00 under the provisions of House Bill 98-1234. The statutory formula is found in Section 22-54-104 (5) (b), C.R.S.

**TABLE 5. Statutory Formula for Calculating School District Size Factors in FY 1999-00**

| If a district's funded pupil count is: | The district's size factor shall be: |
|---|---|
| Less than 276 | 1.5502 + (0.00376159 x the difference between the funded pupil count and 276) |
| 276 or more but less than 459 | 1.2430 + (0.00167869 x the difference between the funded pupil count and 459) |
| 459 or more but less than 1,027 | 1.1260 + (0.00020599 x the difference between the funded pupil count and 1,027) |
| 1,027 or more but less than 2,293 | 1.0578 + (0.00005387 x the difference between the funded pupil count and 2,293) |
| 2,293 or more but less than 5,650 | 1.0120 + (0.00001642 x the difference between the funded pupil count and 5,650) |
| 5,650 or more but less than 25,546 | 1.0120 |
| 25,546 or more but less than 32,193 | 1.0120 + (0.00000334 x the difference between the funded pupil count and 25,546) |
| 32,193 or more | 1.0342 |

# APPENDIX 2 - LOWESS
## A Statistical Method to Determine Lines of Best Fit

LOWESS[8] is a statistical smoothing method that employs weighted least squares to fit a curve to a scatter plot. To start, an $x$-value on the scatter plot is chosen as the point of interest to which a $y$-value will be matched for the LOWESS curve. Next, the user establishes a percentage of the total points on the plot that will be used to create a range around the point of interest (i.e., if there are 40 points on the scatter plot and the user chooses 50 percent, then the 20 nearest points, as measured by their distance along the $x$-axis from the point of interest, would be used). Weights are then assigned to the points being used, with the nearest point to the $x$-value of interest receiving the highest weight and the furthest point receiving the lowest weight. A line is then fit by weighted least squares to the points being used. The $y$-value for the point on the fitted line that corresponds to the chosen $x$-value is then used as the $y$-value for the LOWESS curve at that $x$-value. At this time, one $x,y$-point on the LOWESS curve has been found. A new $x$-value is chosen, and the process is repeated until the entire LOWESS curve has been created.

**Example:**

Chart 3, on the next page, illustrates the steps used to find one $x,y$ point for the fitted LOWESS curve. There are 20 points in the scatter plot and 50 percent of the points will be used at any one time. In step 1, the point $x_6$ has been chosen as the point of interest. The ten closest points (50 percent of 20) to $x_6$ along the $x$-axis are isolated as the points that will be used to draw the fitted line. Step 2 assigns a weight function to the points so that the points closest to $x_6$ receive the most weight and those points outside of the range receive no weight. The weight given to a point is the height of the curve at $x_i$ in the lower left panel. Most importantly, the point at $x_6$ must have the largest weight; the weight function must decrease smoothly as $x$ values are further away from $x_6$; the weight function must be symmetrical around $x_6$; and the weight function must decline to zero as $x$ reaches the 50 percent boundary.

The formula used to find the weight $t_i$ for the specific point $(x_k,y_k)$ when computing a smoothed value at $x_i$ is:

$$t_i(x_k) = T((x_i - x_k) / d_i).$$

**Where:**

| | | |
|---|---|---|
| $x_i$ | = | the $x$-value that has been chosen as the point of interest. |
| $d_i$ | = | the distance from $x_i$ to its qth nearest neighbor along the $x$-axis. Where q is $f_n$ rounded to the nearest integer and f is approximately the fraction of points to be used in the computation of the fitted value (50 percent in this case). |
| $(x_k,y_k)$ | = | the coordinates of the point which is being weighted. |

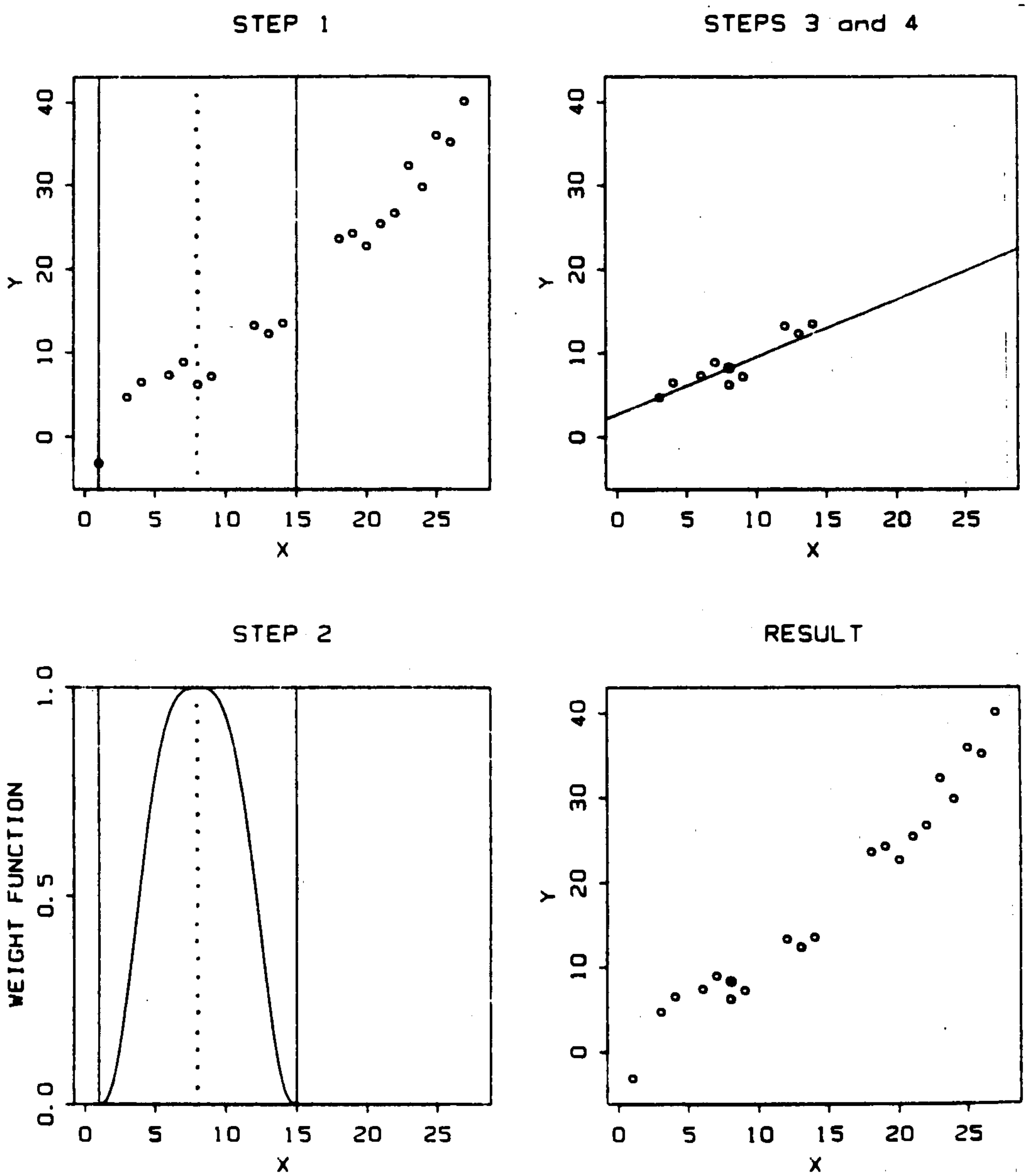
8. Chambers, J.M., W.S. Cleveland, B. Kleiner, and P.A. Tukey. *Graphic Methods for Data Analysis*, Belmont, California, Wadsworth International Group: Boston; Duxburg Press, 1983.

And, where the functional form of T is:

$$T(u) = (1 - |u|^3)^3 \text{ for } |u| < 1 \text{ and } T(u) = 0 \text{ otherwise (the tricube weight function).}$$

After the weights are assigned, a line is fit to the points on the scatter plot that have been isolated (50 percent of the values closest to $x_i$). The fitted line describes in a linear way how $y$ depends on $x$ within the interval. Steps 3 and 4 show the points within the 50 percent interval along with the fitted line. The fitted value for the LOWESS curve is defined to be the value of the fitted line at $x = x_6$. This point has been added to the scatter plot and is the solid point on the line. The process is repeated for every $x$ value until all of the points for the LOWESS curve have been found.

**CHART 3. Computing a Smoothed Value at $x_6$ Using Neighborhood Weights (LOWESS)**



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