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An experimental cost index model for the analysis of service cost differentials of Iowa school districts

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AN EXPERIMENTAL COST INDEX MODEL FOR THE ANALYSIS OF SERVICE COST DIFFERENTIALS OF IOWA SCHOOL DISTRICTS

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AN EXPERIMENTAL COST INDEX MODEL

FOR

THE ANALYSIS OF SERVICE COST DIFFERENTIALS

OF

IOWA SCHOOL DISTRICTS

A Dissertation

Submitted

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Approved:

Dr. Robert Krajewski

Dr. Marlene Strathe

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December 1986

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ABSTRACT

The purpose of the study was to construct a service cost index (SCI) for a sample of Iowa school districts and to use the SCI to examine the relationship school district size has to efficiency of educational services delivery. The SCI was based upon the computation of the cost of delivering a fixed market basket of services to a typical student in each of 44 randomly selected Iowa high schools. The Minimum Curriculum Requirements and Standards for Approved Schools, as outlined in the Code of Iowa, comprised the market basket of services. Instruction, administration, support, and transportation cost components comprised the SCI.

Relationships were examined by Pearson's product moment correlations between the SCI, component costs, average salary, pupil/teacher ratio, and school district enrollment. Significance of the correlation coefficients was tested at the .01 level. Simple regression analysis and curvilinear regression analysis were used to further analyze the data. Both a regression line and second degree polynomial curve were fitted to the data.

Study results indicated a significant negative relationship between the SCI and school district enrollment. Instructional, administrative, and transportation components were also negatively correlated with enrollment. A negative correlation was also obtained between pupil/teacher ratio and the SCI. A positive correlation between average teacher salary and the SCI was not found.

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CHAPTER I

INTRODUCTION

Iowa school funding laws provide nearly equal dollars to support the education of each child. In recent years, however, much concern has been expressed about small/rural schools' ability to deliver adequate educational services to their students. Inefficient school districts, whatever their size, are less able to deliver the quality and quantity of services than are more efficient districts.

Chambers (1985) claimed that Iowa's school finance laws, which provide approximately equal dollars for every Iowa student, are an example of equal expenditures providing unequal opportunity, depending on the district in which students live. Iowa Senator Brown (1985) echoed this concern that educational opportunities available to all children in Iowa will continue to be unequal and the inequality will grow in severity as enrollments continue to decline. Both questioned the variance of school districts' efficiency, especially as a factor of school size, and the variance of school districts' input costs. However, their proposed solutions for these problems differed. Brown favored reorganizing into districts of no less than 1,000 students, while Chambers preferred more money be allotted to inefficient schools (i.e., small rural districts) so they could offer equal educational services.

Monk (1982) claimed that any state finance plan, such as Iowa's, which provides equal per pupil spending discriminates against small/rural districts. Small/rural districts are less efficient because they necessitate small classes. Monk proposed that states develop an index which would allow for a more equitable distribution of educational dollars and which would consider factors of size and input costs.

In a 1986 Des Moines Register Opinion Poll, Elbert (1986) reported that only one-third of the Iowans responding favored a state law outlawing small school districts. Also, the Iowa Legislature in February 1986 defeated a proposal requiring school districts to have a minimum enrollment of 300 students (Elbert). Without a mandate from the state legislature, reorganization of Iowa's 434 schools into larger units will progress at a very slow rate. Consequently, students in small/rural schools will continue to study in an educational organization, judged by many, to be inefficient.

Since Iowa enacted its current Foundation Plan for financing its schools in 1972, the author has been employed in four Iowa school systems ranging in size from 220 students to 2,500 students. Although these systems have approximately equal per pupil spending, the educational services offered to students vary dramatically. Generally, the smaller the school system, the fewer the services. Such practice may be due more to the school size than to quality of administration or any other factor. Small schools would like to offer more services but cannot afford them.

Reorganization is not always the right answer. Community traditions, increased busing, effective utilization of buildings, coping with the small town way of life, community survival, etc., are all to be considered in a reorganization discussion. When reorganization is not judged appropriate, but improved education is still desired, the logical question is: How many more dollars are needed? Therefore, it seems important that a study be conducted which determines the relative abilities of schools to deliver services efficiently. This information could then be used to help improve the state's school finance plan.

The formulas described in this study and the choice of the market basket of services used were developed with the assistance of educational and financial experts. The theoretical concepts were first developed in consultation with Dr. George Chambers, University of Iowa Professor of Educational Administration, whose presentation at the National School Board Convention (Chambers, 1985) provided insight and direction in the development of the formulas used to create a Service Cost Index (SCI). Further help was provided by Mr. Leland Tack of the Data Analysis and Statistical Section of the Iowa Department of Education. Testing and refinement of the formulas were accomplished with the help of Mr. Tom Cooper, Superintendent of the Plainfield Community School District.

Purpose

The purpose of this study was to construct a Service Cost Index for a sample of Iowa school districts based on service cost differentials. The Service Cost Index was then applied to examine the cost of educational services as they relate to school size, teacher salaries, administrative costs, and other factors.

Objectives

In this study a Service Cost Index was constructed for a sample of Iowa schools based on service cost differentials, and then the SCI was applied to analyze the impact a school's size has on its ability to deliver educational services efficiently. The major objectives of this study were:

1. To determine the cost of delivering a "market basket" of educational services to a student in each of 44 randomly selected Iowa schools. This cost was defined as the Service Cost of the school district.

2. To use the Service Cost of each district to compute a Service Cost Index.

3. To determine the relationship between the SCI and school size.

4. To determine the relationship between components of the Service Cost of a district, including average teacher salaries, instructional costs, administrative costs, support costs, and transportation costs.

Research Hypotheses

The purpose of this study was to determine the relationship between school district size and the cost of various components needed to deliver a fixed market basket of services to the students of a school district. This study examined the following research hypotheses:

1. There is a significant negative correlation between school district enrollment and the instructional cost component of the SCI.

2. There is a significant negative correlation between school district enrollment and the administrative cost component of the SCI.

3. There is a significant negative correlation between school district enrollment and the support cost component of the SCI.

4. There is a significant negative correlation between school district enrollment and the transportation cost component of the SCI.

5. There is a significant positive correlation between average teacher salary and the SCI.

6. There is a significant negative correlation between pupil/teacher ratio and the SCI.

7. There is a significant negative correlation between school district enrollment and the SCI.

Statistical Hypotheses

Corresponding to the research hypotheses the following statistical hypotheses were tested:

1. There is no significant correlation between school district enrollment and the instructional cost component of the SCI.

2. There is no significant correlation between school district enrollment and the administrative cost component of the SCI.

3. There is no significant correlation between school district enrollment and the support cost component of the SCI.

4. There is no significant correlation between school district enrollment and the transportation cost component of the SCI.

5. There is no significant correlation between average teacher salary and the SCI.

6. There is no significant correlation between pupil/teacher ratio and the SCI.

7. There is no significant correlation between school district enrollment and the SCI.

Significance of the Study

The study of educational finance has been marked by an increasing degree of sophistication regarding "what counts" as the fiscal capacity of school districts to produce educational outcomes. A recent concern is the concept that input costs can vary across school districts within a state (Monk, 1982).

The rationale for treating educational input cost differentials as an element of fiscal capacity is straightforward. If the costs of productive inputs vary, school districts facing higher costs would be less able, all else equal, to produce educational outcomes. They must either spend more or be satisfied with a more limited educational offering compared to otherwise equivalent lower cost districts.

Most cost index studies are based on the premise that the state is or ought to be interested in offsetting the effects of differences in costs on the ability of school districts to provide educational programs. Existing efforts to construct cost of education indices have focused attention on the costs of educational inputs while neglecting differences in the cost of educational services (Monk, 1982). There is a fundamental difference between the cost of an input such as a biology teacher's salary and the cost of a service such as biology instruction. A service, as referred to by Monk, is a combination of inputs, which different schools combine in different ways. Conventional cost of education indices attend to differences in the prices of inputs but neglect differences in how districts combine those inputs.

It is important to note that the cost of a service can be high even if the costs of the inputs that comprise the service are low. Indeed, this is likely to occur in a rural district operating small classes. Even though a rural district may pay a low salary to its biology teacher, the fact that biology instruction is provided for 10 students rather than 25 students can make the cost of that instruction prohibitively high. The standard cost of education index, even if accurately measured, suggests that costs are lower in the rural district. This deceptive perception stems directly from the emphasis conventional cost of education indices place on input cost differences and the lack of attention given to differences in how inputs are combined.

Therefore, it seems reasonable as Iowa wrestles with the problems of financing its schools, that a consideration be given to the contribution of scale to service costs by constructing a Service Cost Index. The state legislature could then use the Service Cost Index in its decision-making process as the problems of adequate and equitable school financial support and reorganization are considered. A Service Cost Index allows decisions to be made on a knowledge basis, not on assumption and emotion.

Assumptions

The basic assumption of this study was that the quality of a given service was not directly related to school district size. While this study attempted to measure the costs of the market basket of services in the sample of schools, higher costs were assumed to be related to variation in efficiency and not to a variation in the quality of the educational services offered.

A second major assumption was that administrative, support, and transportation costs were distributed evenly over all school programs. While small differences did probably exist, no records were kept to allow a measurement of such differences. Therefore, it was safest to assume equal distribution rather than to assign arbitrary differences.

A third assumption was that average teacher salary was an indication of the cost of instruction for a district. Again, most districts did not have sufficient financial records on the instructional cost of each service offered to accurately determine instructional cost. As salaries typically represented a large proportion of instructional cost, salaries served as an excellent representation of instructional cost.

Limitations

Three limitations were established at the outset. First, the scope of the study was confined to Iowa and Iowa School Districts. This precludes transposition of the findings of the study to other states since other states operate under different financial, curriculum, and enrollment circumstances.

Second, the Service Cost Index computed in this study was limited to a fixed market basket of services. Choosing a different market basket could have produced a difference in how a school district mixed the inputs available, therefore, resulting in a different SCI.

Third, the validity of the formulas used to measure the SCI was established to have content validity rather than empirical validity. While empirical validity is desirable, it falls outside the scope of this study. To strengthen support for content validity, the author established criteria for the formulas development based on sound accounting and mathematical practices. In addition to the author's own evaluation of the formulas, the formulas were submitted to a jury of experts in school financial accounting. The jury evaluated and validated the formulas on the basis of their criteria for sound accounting and mathematical practices and on their knowledge of Iowa's school accounting procedures. The evaluation, validation, and recommendations are included in Chapter III.

Definition of Terms

Controlled Budget

In Iowa, that portion of the General Fund of the school budget funded by property tax and state aid. The amount of this portion of the budget is determined by the state legislature and is a product of district cost per pupil and district enrollment (Iowa School, 1973).

Foundation Program

A program enacted by the Iowa legislature to guarantee that a minimum amount of money be spent on each child in Iowa public schools (Iowa School, 1973).

Market Basket

A predetermined group of school services that exist in all the districts in this study for the purpose of a consistent comparison.

Service Cost

The cost of delivering the market basket of services computed on a per pupil per year basis.

Service Cost Differentials

The difference in the service costs of delivering the same market basket of services to students in different school districts.

Service Cost Index

An index of service cost differentials computed so the average service cost is represented by 100.

Small/Rural Districts

A description of schools with enrollments of 600 or less, which represents approximately half of the districts in Iowa.

CHAPTER II

REVIEW OF LITERATURE

Many researchers in school finance have made studies of school district efficiency for a variety of reasons. Historically, it was hypothesized that increasing school size, through consolidation of districts, would automatically increase efficiencies because of economies of scale. Therefore, research was conducted to support consolidation efforts. More recently, researchers have conducted efficiency studies in an effort to determine the financial handicap inefficient schools operate under, and to determine what equalizing effect state aid could produce for inefficient school districts (assuming the inefficiencies resulted from uncontrollable reasons).

This chapter consists of five components. First, a review of actions and concerns of the 1986 Iowa Legislature that led to the creation of Economy Task Forces for each Iowa school district is included. Second, a sample of research is presented that relates school funding levels to student achievement. Third, recent cost efficiency studies reported in the literature are reviewed, including a discussion of the type of data that is judged to be most appropriate in such studies. Fourth, a review of current literature on the relationship between school quality and school size is included. Last, a summation of the current school finance plan for the State of Iowa is presented.

1986 Iowa Legislature

Activity relating to school district efficiency was frequently on the agenda of the 1986 Iowa Legislature. Governor Terry Branstad set the tone for the 1986 legislative session on December 3, 1985, when he released to the public his plan for restructuring and downsizing state government in Iowa. Included in that plan were several proposals having a financial impact on Iowa's public schools. The major provisions which related to education were (IASB Network, 1985):

1. Freeze all local property tax levies at the 1985-86 level. Also, no new discretionary taxes could be levied.

2. Freeze state aid to Iowa school districts ignoring the allowable growth that had been established in September 1985 and also ignoring the 102% guaranteed growth.

3. Cut Area Education Agency budgets by $300,000.

4. Eliminate the foreign language, mathematics, and science improvement programs.

Iowa politicians quickly responded to Governor Branstad's plan. Fearing that the quality of public education in Iowa would be threatened, Senate majority leader C. W. Hutchins predicted that the Iowa legislature would operate under a dark cloud in 1986 (Norman, 1986). In referring to Iowa's claim to be the top state in the nation in educational excellence, Senator Hutchins further said, "We can't live on our past accomplishments much longer. We're going to have to put our money where our mouth is" (Norman, p. 1a). House Speaker Don Avenson agreed with Senator Hutchins' position when he said, "It's foolish to talk about excellence in education at the same time you are talking about a tax freeze" (Norman, p. 1a).

Governor Branstad held to his economizing plan in the face of criticism and even went further in his Condition of the State speech. In delivering this speech on January 15, 1986, the Governor asked lawmakers for incentives for local schools to reorganize into larger, more efficient districts (Witosky, 1986a).

As the 1986 Legislature (71st General Assembly) debated the Governor's proposals, a positive reaction seemed to emerge (Witosky, 1986b). Iowa lawmakers warned school officials they needed to economize their schools before lawmakers did it for them. Senate majority leader Calvin Hultman said, "No one wants forced school reorganization and I oppose it, but it is time school officials begin to look at ways to make their operations more efficient" (Witosky, p. 2a).

By March 3, 1986, much debate had taken place on the Governor's plan. At that time, the House Education Committee introduced its own plan related to school finance. The House Education Committee's plan included the following provisions (IASB Network, 1986a).

1. School districts with an unencumbered cash balance of over 10% of the certified budget would be required to apply the excess to the next school year's budget and to reduce the next year's property tax increase by the same amount.

2. Unencumbered cash balances in excess of 25% of the certified budget would not be allowed after July 1, 1988.

While the House Education Committee's plan did not survive full House debate, the House did pass a school efficiency bill on March 25, 1986. House File 2462, known as the School Efficiency Bill, related to educational cost efficiencies, including the reduction of administrative costs of public school districts. Specifically, the bill required school districts to reduce administrative costs by 0.5% a year if administrative costs exceeded 8% (House File 2462, 1986). The bill, following Governor Branstad's earlier suggestion, also offered tax incentives to school districts which reorganized or shared programs.

On April 2, 1986, representatives from four organizations (the Iowa School Board Association, the Iowa State Education Association, the Iowa Association of School Administrators, and the Educational Administrators of Iowa) joined together to discuss the need for adequate funding of education with Governor Branstad. The Governor continued, however, to support his plan to freeze school spending and to oppose any tax increases (IASB Action Line, 1986a).

House File 2462 eventually was approved by both the House and the Senate and signed by the Governor. Major changes, however, had occurred along the way (IASB Network, 1986b).

First, the final version of the bill included a provision requiring each school district in Iowa to establish an Economy Task Force (IASB Network, 1986b). The Economy Task Forces were directed to provide input to the Iowa Department of Education concerning needed efforts to increase the efficiency of local school districts. Second, the bill also set 5% as a target amount for executive administration. Districts exceeding that amount were required to reduce their executive administration expenditures by 0.5% per year for four years or until they reached the 5% level. While the 5%

level was lower than the original 8% level, it applied only to executive administration rather than all levels of administration. Third, the bill reduced property taxes for five years for any districts that reorganized; and fourth, the bill allowed for a district to increase its expenditures by approximately $37,500 if it shared an administrator with a neighboring district.

The 1986 Legislature concluded their work on May 2, 1986. While House File 2462 had a significant impact on school districts, the legislative session failed to include a notable proposal (IASB Action Line, 1986b). Governor Branstad's proposal to freeze state aid and property taxes for schools was not supported by the legislature, however, the legislature also failed to approve any tax increases for education.

House File 2484, approved late in the session, included a provision to increase the foundation level of the state's school finance plan from 80% to 81.5% in 1987-88 and to increase the foundation level in succeeding years by 0.5% until the foundation level reached 85% (IASB Action Line, 1986b). The result of this action was a $22.5 million property tax relief in the first year but no increased funds for education. The Iowa Association of School Boards expressed great disappointment in that action calling it a "missed opportunity" for education (IASB Action Line).

Funding and Achievement

Beginning with the work of Cubberly in 1911, studies dealing with the various effects of input and output relations were referred to as cost-quality studies (Dunnell, 1971). Such studies placed their emphasis on the financial (input) side of the ledger. The results of early research, including the work of Cubberly, usually were in agreement (Dunnell). Cubberly found a positive relationship between cost and quality. There was not, however, much early agreement or discussion of quality, although quality was often used synonymously with number or size of school programs (Dunnell). In other words, early researchers found that " . . . more money does more things" (Dunnell, p. 1).

Mort, in studies initiated during the 1940s and early 50s, generally agreed that a positive correlation existed between expenditure level and educational quality (Dunnell, 1971). Mort stated that "expenditure level is at one and the same time one of the most powerful predictors of quality and one of the simplest measures to obtain" (Mort & Cornell, 1938, p. 87).

The study which probably stimulated the most research, comment, and controversy in recent years was that published by Coleman in 1966 (Jencks, 1972). Jencks, in reporting on the Coleman study, observed that Coleman used a sample of 645,000 students from 3,500 schools throughout the United States. The measure of quality used by Coleman was students' performance on a standardized test, rather than approximating quality by using other data. This was a departure from earlier research. Coleman found that beyond some minimum per pupil expenditure level, higher expenditures did not produce higher student achievement (McDermott & Klein, 1974).

Many researchers, including Billings and Legler (1975), have raised questions regarding the methodology and data base of Coleman's research. In particular, Coleman used data from a national sample. Billings and Legler suggested that per pupil spending may have appeared to be unimportant simply because of data problems associated with a national sample, such as noncomparable salary, teacher quality variations, and cultural variations among the states. Also criticized was the use of national, state, and school district averages rather than individual test scores (Dawson, 1978).

While the cost-quality debate has obviously continued for many years, Jencks (1972) summarized the feelings of many educators when he stated:

> We have no way of proving that the quality of teachers' and students' lives is affected by the resources available to their school. We do know, however, that both teachers and students feel there is a connection. Virtually everyone prefers small classes, new buildings in which the paint is not peeling off the walls, plenty of books in the school library, and teachers who are paid enough so they do not have to take a second job. We cannot say which of these expenditures does the most to improve the quality of people's lives and which does the least. We do, however, assume that well-financed schools are better for their students than poorly financed schools. (p. 24)

Cost Efficiency Studies

In recent years, a number of studies have appeared which concern the operation of local school systems. Common purposes of these studies include providing a meaningful framework within which the efficiency of school operations can be assessed, and analyzing the question of the existence and estimation of optimal school size. Such studies have grown in importance as rapidly rising school expenditures have caused policymakers to seek ways to offset this trend. The hypothesis that larger schools could offer greater efficiency has frequently led to the conclusion that one solution to rising expenditures is to change the size of schools and school districts (Fox, 1981).

<u>Data Collection and Analysis</u>

Fox (1981) expressed concern about the approach researchers have taken in school efficiency studies. Specifically, he was concerned with data limitations which frequently require researchers to examine school level costs using aggregate expenditures and pupils. Another problem identified by Fox was the difficulty researchers have in developing good surrogates for inputs and outputs of educational production.

Educational output is comprised of quantity and quality of services. Fox (1981) pointed out, however, that there is no general agreement on what constitutes a unit of either quantity or quality of education. Although Levin (1974) and others have used cognitive learning, inculcation of attitudes and values, and reproduction of the social relations of production as educational outcomes, the commonly used output measures have been school enrollment or average daily attendance (Fox). Student number is a poor surrogate for output to the extent that the number of students does not provide information on the quality of education. Most questions related to size are concerned, however, with the potential cost savings associated with educating different numbers of students. Thus, Fox concluded, student number, or enrollment, can serve as an adequate output measure in a cost efficiency study.

Although it appeared that meaningful analysis of educational outcomes using student numbers as the output measurement required that quality be held constant, Fox (1981) found this was rarely done. While achievement test scores were generally used to measure quality (Kiesling, 1976), the ability to perform well on standardized tests was only one of many educational quality aspects. Levin (1974) concluded, "It is obvious that statistical estimates among existing schools that consider only the achievement score outcomes of students will not give us accurate estimates of the quality of educational production" (p. 21).

An alternative, promoted by Hirsch (1960), was to use inputs as surrogates for output quality. Hirsch considered the input approach to be advantageous because it avoided not only some of the output measurement problems, but also the multidimensional nature of output quality.

Fox (1981) agreed that inputs can serve as a successful surrogate for output quality. Fox contended that ideally inputs should include student inputs, such as native intelligence and effort and school inputs, such as labor and capital. A study by White and Tweeten (1973) maintained that the student's home environment should also be considered as an input in cost efficiency studies. Unfortunately, Fox found reliable data were frequently unavailable on most facets of the quality of student inputs, causing researchers to omit them.

Capital expenditures were also often excluded in measurements of input. Omission of capital was defended because data were difficult to obtain and because major capital expenditures occur too infrequently to adequately measure actual yearly capital costs, and data on depreciation of building value are frequently unavailable (Fox, 1981). Fox, therefore, after analyzing more than 30 studies which attempted to measure school efficiency, concluded it is most advantageous to use current instructional expenditures to determine variances in input cost. Because of these arguments concerning the omission of capital expenditures, Fox further concluded, capital costs should not be included in estimates of current instructional expenditures.

Results of Size Economies Research

Cohn (1968) studied a sample of 377 Iowa high schools to provide information on the input costs and the outputs of the Iowa public school system. Cohn measured school output (Y) by using the function:

$$Y = T(12) - T(10)$$

where

T(10) = average composite score on the Iowa Test of Educational Development (ITED) for the tenth grade in a given school.

T(12) = average composite score on the ITED for the twelfth grade in a given school.

These test measurements were taken by Cohn (1968) for the same classes two years apart. Although the students in the classes were not identical (due to in- and out-migration), the population was quite consistent.

Cohn (1968) measured input costs using an average cost function that included teacher salaries, building values, bonded indebtedness, class size, and units of instruction offered. Cohn found that when school quality was measured by Y, output as related to scale was not statistically different from zero. Cohn warned, however, " . . . this is not to exclude the possibility that an alternate measure of quality will have a coefficient which is statistically different from zero" (p. 432). He further stated that, " . . . the use of the ITED scores as proxies for school quality has not been very successful" (p. 434).

When analyzing input costs, however, Cohn (1968) found the existence of significant economies of scale for Iowa high schools. In other words, a larger school was likely to be able to spend a smaller amount of resources per student for the same quality of education. Optimal size was found to be about 1500 pupils. Cohn also found that the total function, as a relation of school size to efficiency, more closely reflected a hyperbola, rather than a parabola. A hyperbolic relationship suggests that school efficiency continually improves as school size increases, but at a decreasing rate. A parabolic relationship would indicate that schools either larger or smaller than the optimum size would be less efficient than schools at the optimum size. Thus Cohn concluded, "There may be no basis for specifying an upper limit to optimal school size within the range of our Iowa data" (p. 434).

Hind (1977) conducted his school efficiency study using a sample of rural rather than urban schools. Hind separated administrative, instructional, and maintenance costs. He found maintenance costs displayed a continuing economy throughout the sample as school size increased. Administrative and instructional costs, however, displayed a U-shaped or parabolic average cost curve with a minimum at approximately 600 pupils.

Johnson (1972), in a study of West Virginia Public High Schools, also found a U-shaped average cost curve with a minimum at 1,426 pupils. Johnson used average current per pupil expenditures for his study as did Katzman (1971) in a study of urban schools. Katzman also found a U-shaped average cost curve with a minimum between 1,400 and 1,800 pupils.

Debertin (1976) studied the economies of size in public schools using data from North Dakota and Indiana. Debertin used only instructional cost for input and found economies of size in North Dakota over the full range of enrollments, but failed to find significant economies of size in Indiana.

Richer and Tyner (1972) analyzed the value of consolidating schools in counties in north and west Florida based on educational efficiency criteria. They developed their data using all in-school costs except transportation and capital improvements. They found a hyperbolic relationship to exist. That is, as school size increased, efficiency also improved but at a decreasing rate.

Butler (1985) analyzed economies of scale in New York schools using an estimation of cost differentials. He computed cost differentials using a cost function given as:

$$C = C(Y,P)$$

where C was schooling costs, Y was a vector of schooling outputs, and

P was a vector of input prices. Butler's cost function assumed that schools were homogenous with respect to quality.

Butler (1985) concluded from his analysis that " . . . there is a sense in which small school districts operate with greater efficiency than otherwise similar larger districts" (p. 377). Butler thus hypothesized that there existed not one U-shaped cost curve with a single optimal level of scale, but rather two distinct cost functions. Butler thus claimed his results questioned the "bigger is better" view engendered by the one-cost-function postulate.

Based on results from a study conducted on 1,347 schools nationwide with an enrollment between 200 and 40,000 students, McLaughlin (1980) found several factors that caused per-pupil cost to vary. Most notable, he found costs were most affected by pupil-teacher ratio and by curricula offerings.

Based on his data, McLaughlin (1980) found pupil-teacher ratios to have the greatest effect on costs, " . . . as salaries represent about two-thirds of educational costs" (p. 63). He also found the curricula offered can greatly influence per-pupil costs as some course offerings require more faculty members and smaller pupil-teacher ratios than other offerings. McLaughlin thus concluded that funding schools on the basis of enrollment oversimplifies a complex issue.

Coleman and LaRocque (1984) conducted a major study in British Columbia using data for three years (1972, 1977, and 1982) to allow analysis of trends. They conducted their study to examine a government policy proposal that attempted to reduce school district costs by the consolidation of districts. They were concerned that the government policy may not be effective. They stated:

> For rural districts, often the focus of consolidation proposals, one very thorough review of research, by Sher and Tompkins, concludes the traditional claim that consolidating rural schools and districts will, ipso facto, save money, appears to have no empirical or logical basis. It is simply incorrect to assert that consolidation is synonymous with economy. (p. 24)

In conducting their study, Coleman and LaRocque (1984) sought relationships between five variables they believed to affect expenditure levels. The variables included school district size, administrative costs, pupil/teacher ratios, teacher salaries, and mean school size within the district.

Data on each of these variables were collected for 1972, 1977, and 1982 budget years. The data were used to examine:

> . . . the current merits of the traditional views regarding the link between district size and operating costs, and to identify the major factors, other than district size, that have been consistently associated with operating costs over the decade, and hence which should be the focus of attention. (Coleman & LaRocque, 1984, p. 28)

Coleman and LaRocque (1984) analyzed the relationship between each variable and operating cost when the effects of the other variables were partialed out. They made the following observations:

1. The partial correlations between district size and operating cost were nonsignificant. "Thus the argument in favor of eliminating small districts in order to increase efficiency by reducing operating cost . . . appear to be based on a spurious relationship" (Coleman & LaRocque, 1984, p. 29).

2. The partial correlations between administrative costs and operating costs were significant.

3. The partial correlations between pupil-teacher ratio and operating costs were not significant.

4. The partial correlations between costs due to teacher salaries and operating costs were strongly and significantly positive. "Since teacher salaries represent a major portion of overall costs, clearly this is the single most important variable contributing to operating costs" (Coleman & LaRocque, 1984, p. 29).

5. The partial correlations between average school size and operating costs were not significant.

Coleman and LaRocque (1984) concluded that the relationship between school district size and per pupil operating costs was spurious, and that the actual causes of the relatively high operating costs encountered by small districts were a consequence of school remoteness and related low pupil-teacher ratios and transportation. Thus, they stated, "The effect of consolidating small districts with larger ones would simply be to spread the high cost over a larger population, and hence conceal them" (p. 32). As a result, Coleman and LaRocque suggested that consolidation of districts as a cost control device be abandoned.

Because of the above conclusion, Coleman and LaRocque (1984) argued that policymakers consider small school size in rural areas to be an unalterable variable. Therefore, school size becomes an important consideration, not in cost control, but in equitable funding of school districts. The British Columbia school finance formula does include (since August, 1983) a "dispersion index" which provides 0.2% more money for pupils in rural districts. Coleman and

LaRocque found, however, that since operating costs in rural schools were approximately 23% above the provincial mean, " . . . the additional 'dispersion index' grant was correct in principle, but inadequate in practice" (p. 34).

Based on their research, Coleman and LaRocque (1984) offered the following conclusions to policymakers:

1. School district consolidations to increase school size will not result in economies of scale and reduced per pupil costs.

2. Attempts to control district per pupil costs should focus on teacher salaries and pupil/teacher ratios.

3. Small school districts are faced with an unalterable variable, small and remote schools, which has a dramatic impact on operating cost. Thus, the current school finance system will effectively create a two-tiered schooling system with small districts providing very minimal services compared to larger districts.

Monk (1982) also proposed an index be created to make possible a more equitable treatment of small/rural school districts. Monk criticized existing school finance formulas that provide all schools with essentially the same support per pupil (such as Iowa) because they discriminate against small/rural districts. Monk argued that if a state is interested in equalizing fiscal capacity of school districts, it has the responsibility for offsetting the adverse impact a small scale of operation can have on a small district. Such intervention, Monk proposed, could involve the use of a cost index based on service cost differentials. This is especially appropriate when a district is inefficient (i.e., small) because of uncontrollable reasons (e.g., geography, sparsity of population, etc.)

Monk (1982) found that financial analysts often fail to recognize that schools vary in terms of the mix of services they offer. This caused him to state, " . . . it is essential to control for variation in the service mix before estimates of costs are made" (p.2).

Sher (1977) pointed out that the consolidation of small schools does not necessarily result in economy of scale. Sher claimed recurring costs associated with consolidation can seriously detract from gains in efficiency that larger scale may promise (transportation, for example). In the absence of consolidation, however, these "necessarily" small schools will continue to face the higher costs associated with small scale.

Monk (1982) recommended that the state can and should offset the cost of small scale by constructing a service cost index for the purpose of adjusting the flow of state aid to provide equality of financial opportunity. This cost index, Monk proposed, should be constructed using a fixed bundle (market basket) of services.

Chambers (1985) also argued that states need to recognize that changes in financing small/rural enrollment schools must be made if equal educational opportunity for students is to be achieved. Chambers found that if costs per student in small and large districts are equal ($3,000), there results a discrepancy of approximately $24,000 per classroom because of differences in pupil/teacher ratios. Chambers, therefore, proposed that small schools should receive increased state support up to a 25% increase in cost per student. Thus, if cost per pupil is $3,000 in a large district, it would be $3,750 ($3,000 x 1.25) for a small district. Chambers was aware that critics would charge that such a system is too costly. He estimated, however, that in Iowa only 10% of the students are educated in small/rural districts. A 25% increase in cost per student for 10% of the students in the state results in a 2.5% increase in total state funding for education.

Chambers (1985) asked, "Is a 2.5% increase in a statewide school finance plan too great?" (p. 7). "No," he answered, "not if we desire to enhance equal opportunity for students" (p. 7). Chambers advocated that equal funding results in unequal opportunity. He proposed, therefore, that Iowa increase its support for education and that this increase be funded by additional state dollars (rather than local property tax dollars) as determined by a cost index of service costs created for this purpose.

School Quality--School Size

The average size of secondary schools in the United States has almost tripled in the past 50 years (Sher & Tompkin, 1977), and the average size of elementary schools has also increased considerably (Guthrie, 1979). The current decline in school enrollment, in many areas of the country, and the prevalence of school closures and reorganizations as an economic and political issue, have generated a resurgence of interest in the relationship between school size and school effectiveness (Boyd, 1982). The fact that declining enrollment in the public schools continues to be a major problem noted by school administrators, indicates that school closure and district reorganization decisions will continue as an important issue, and with that concern will follow the debate on how school size is related to effectiveness and quality (Duea, 1982). It is well that this debate takes place, for without it, the driving force behind school organization changes may be the decisions of the accountants (Sher, 1983).

Various kinds of criteria have been used to determine what differences exist in the characteristics of larger and smaller schools. In an early study, Conant (1959) evaluated 103 high schools. His report of that study, The American High School Today, received a considerable amount of publicity (Clements, 1970).

Conant (1959) considered the number of course offerings, if a school ability grouped in the required courses, and the existence of special provisions for slow readers to be useful criteria (among other criteria) in the measurement of school quality. Clements (1970) was critical of Conant's criteria, however, and stated,

> Summing up the Conant standards, we can see that a quick survey of a number of American high schools was made by a team headed by a brilliant scholar, but one who has little direct experience with American high schools. The standards (Conant's) for a 'good' school were arbitrarily chosen, with little empirical evidence to support them. The appraisals of schools were cursory rather than thorough. Important predictive variables such as pupil-teacher ratio were ignored. The ray of hope for enlightenment concerning ideal high school size as indicated by the Conant studies has faded to a mirage. They have little to offer. (p. 1)

Besides the Conant report, Clements (1970) found numerous studies which examined the curriculum, and in each case, the curriculum of larger schools tended to be broader. If one used breadth of curricular offerings as the criterion for quality, Clements concluded that large high schools have a distinct advantage. If one used the low cost of instruction (efficiency) as the measure of a quality school, however, Clements found that medium schools seem to have the advantage. If one measured the quality of a school by including in the criteria participation in the activities program, Clements found the evidence strongly favored small high schools. Clements cited a study by Wicker to support his last contention. Wicker (1969) found students in small high schools participated in several times as many activities as students in large schools and had significantly (at the .001 level) more positions of responsibility and leadership. Choosing appropriate criteria for evaluating a high school program continues to be a difficult and varying process.

Woods (1984) used mathematics achievement as a measure of school quality in his study of the effectiveness of various size schools. In his analysis he divided the schools in Alberta, Canada into three groups--small, medium, and large enrollment. Scores on standardized mathematics achievement tests were used to measure the effectiveness of each school's program. Scores were adjusted for student abilities. On the basis of the results of his study Woods concluded, " . . . there is no consistent effect on student achievement attributable to school size" (p. 86). Woods' study failed to find statistical significance at any grade level.

Lindsay (1982) explored the effect of high school size on student learning. Lindsay gave the following explanation of his research, " . . . though an increase in organizational size leads to greater specialization (of teachers), it is not clear that specialization leads to more student learning" (p. 64).

Honetschlager (1979) conducted a study of 432 Minnesota School Districts to compare school district size and quality. Honetschlager's measure of quality was the number of full-time equivalent (FTE) staff per hundred students. This number he labeled Service Capability. Honetschlager defended his use of FTE per hundred as a measure of instructional service by stating " . . . education is a labor-intensive industry; without staff, a school district would be unable to deliver educational services" (p. 7).

Analysis of Honetschlager's data revealed a strong negative relationship between school district enrollment size and service capability for the aggregate instructional service area. The differences in service capability between small districts and larger districts was statistically significant.

According to a national study of secondary schools, Gottfredson (1986) found large schools to be more disorderly than small schools. She also found, however, that when administrative variables are added, the effects of size could be substantially reduced. Gottfredson noted that good administration could counter the negative effects of large size.

A study of Connecticut school districts found little difference in academic achievement between the state's large and small school systems ("Large, Small," 1986). The study was prepared for the Connecticut Association of School Administrators and defined small districts to be those with an enrollment of 2,500 students or fewer.

While the larger schools tended to offer more advanced courses, according to the study this fact appeared to have made little difference in the comparative college entrance examination scores of the students.

Researchers at the University of Oregon concluded that, "The optimum school size is the one that supports the kind of education the community wants" ("School Size," 1981, p. 2). These researchers surveyed empirical evidence on school size and found most of it unreliable. They found some research which supported the argument that larger schools are more effective, but much of the evidence could not withstand their critical examination. For example, they noted that several studies found a positive relationship between larger size and student achievement. When later studies, however, controlled for students' intelligence, the relationship disappeared ("School Size"). Researchers also found little relationship between school size and subsequent pupil success or failure, at least not when adjustments were made for differences in mental ability (Hess, 1978).

Researchers in Alberta, Canada, when doing a comparative analysis between the province's small and larger schools, also debated the conclusiveness of recent research on school size and quality. They stated:

> Published findings from other jurisdictions indicate that in most cases pupils in small schools do not seem to have poorer achievement than pupils in large schools, although in a few specific cases student achievements have been higher in both small and large schools. ("Small School," 1984, p. 3)

The school size/school quality debate has not been resolved. Questions will continue to arise regarding the impact of school size on the quality of education. James and Leven's (1970) summary on this issue over a decade ago still appears to be accurate. They said, "Thus, all of the studies that have tried to relate school or school district size to education outcomes have found no relationship . . . between student enrollments and the level of education outcome" (p. 287).

Iowa's Current School Finance Plan

Iowa's current school finance plan was implemented in 1971. Prior to that, Iowa school finance was characterized by a proportionate sharing plan. From 1967 to 1971, under the proportionate sharing plan, school spending in Iowa jumped 60% and property taxes rose approximately 30% (Department of Public Instruction, 1971). The public cry from the rapidly increasing taxes and school expenditures caused the Iowa legislature to again concern itself with school funding (Senate Journal, 1972).

In response to this new round of concern, a Governor's Educational Advisory Committee was appointed in 1969 for a two-year study of the educational needs in Iowa, and how such needs could be financed (Iowa School Foundation, 1973). One section of the Advisory Committee's report dealt with the State's role in financing education and provided support for the legislative and executive action taken by the state in establishing an Iowa foundation plan for financing education. The committee's report included the following principles for guiding Iowa's educational responsibility to its citizens (Iowa School Foundation, 1973):

1. The State should insure that all students have equal access to a quality education.

2. The State should provide for equity in financing education.

3. The State should insist upon efficient operation of local school districts.

4. The State should allow for local flexibility.

A Foundation Plan was also recommended by the Governor's Educational Advisory Committee and included the following provisions: (a) a local property tax of 20 mills collected in all districts and maintained locally, (b) a State general fund allocation, (c) a State equalization aid up to 80% of the State average per pupil cost of general fund expenditures, (d) a State contingency fund to help local districts meet special problems, and (e) an additional local property tax levy to meet the balance of general fund expenditures above the foundation and to include capital improvements (Iowa School Foundation, 1973).

A legislatively organized Tax Study Committee, along with school administrators and state financial specialists, concurred with the Governor's Educational Advisory Committee that an overall foundation plan for distributing state aid was necessary (Iowa School Foundation, 1973). The legislature responded to the Tax Study Committee's report by recognizing the necessity to conceive a new school finance plan and to arrest the rapid spiral of increasing property taxes. To accomplish this, the legislature enacted House

File 121 in March 1971 (Senate Calendar, 1971). House File 121 declared that property taxes were to be frozen at the 1970-71 rate, except in extraordinary circumstances and with permission from the School Budget Review Committee. In addition, House File 121 provided for a $45 per pupil increase in state aid for the 1971-72 Committee. In effect, the legislature used House File 121 to buy time to formulate a new school finance program under which property taxes could be arrested, and the state could assume a greater burden of school finance. The legislature passed House File 654 late in the 1971 session which created the Iowa School Foundation Plan to be implemented for the 1972-73 school year (Iowa School Foundation, 1973). The following seven provisions summarize House File 654 and describe the Iowa School Foundation Plan (Iowa School Foundation):

1. A basic property tax of 20 mills which would be kept locally.

2. State aid which would insure each school district up to 70% of the state cost per pupil for the first year. The foundation percentage would then increase at 1% per year up to a maximum of 80%. The average state cost per pupil was set at $920 for the 1971-72 school year.

3. Each school district received at least $200 per pupil in state aid unless this caused more than a 10% reduction in local millage rates. This limit was maintained for three years and was based upon a 10% reduction of the Base Year's rate.

4. A state allowable growth rate was computed. For the first time, local public school district costs were tied to the growth of

the state's economy. For three years the limit was approximately 5%; thereafter, the growth of the state was the limit. For the first year of the Foundation, the growth of the state was limited to $46 per pupil, then $48 for 1973-74, and $51 for 1974-75. After the third year, the allowable growth for the school district budgets depended entirely on the computed state allowable growth rate. The allowable growth was the percentage increase of the second and third years of the most recent three years for which accurate figures were available for the total adjusted state general fund revenues and adjusted state assessed valuation, all divided by four, then converted to dollars per pupil.

5. An additional local property tax was levied to cover the balance of the budget providing the millage rate did not exceed the 1970-71 general fund millage. The School Budget Review Committee was authorized to review schools where growth problems seemed to exist, and provide additional state aid where necessary.

6. Local School Boards would continue to operate the local educational program. Local boards could request, in unusual circumstances, supplemental state aid which would be available if approved by the Budget Review Committee. The boards also had the system of exceeding limitations of the state maximum allowable district costs, by calling for a local school district referendum in which the local voters could approve an additional income surtax.

7. A Guaranteed State Aid fund to aid school districts in which the Foundation formula did not meet the district's actual or maximum cost, whichever was less.

Four features of this Foundation Plan should be noted (Iowa School Foundation, 1973):

1. It provided for both property tax and income tax equalization, and gradually reduced the percentage of support for school costs borne by property tax from a state average of 60% to less than 50%.

2. It eliminated open funding of school budgets from property tax.

3. It attempted, through a 10-year evolutionary process, to achieve the state goal of assuring any school district a specific financing level of up to 80% of the state average educational cost per pupil.

4. It provided for local option, through an income surtax referendum, if the community wished to exceed the average school district budget limit.

In the years that followed, the legislature frequently considered various provisions of the Foundation Plan. Changes were made to correct inequalities found in the plan, and to increase ease in administration at all levels.

In 1973 the following changes were made by the legislature for the 1973-74 school year (Truesdell, 1975):

1. Removed miscellaneous income from the controlled budget.

2. Allowed districts, in an effort to cushion declining enrollment, to base enrollment on either the second Friday of September of the budget year, or the second Friday of January of the base year, whichever was larger.

3. Allowed low cost per pupil districts to use a growth rate that was 125% of the state growth rate, if district cost per pupil was lower than state cost per pupil, to bring it up only to state cost per pupil.

4. Provided for the School Budget Review Committee to alleviate local school budget problems of an exceptional nature.

In 1974, the legislature made the following changes in the Foundation program for the 1974-75 school year (Code of Iowa, 1973):

1. Further cushioned the effects of declining enrollment. Schools were allowed to count one-half the difference between the January 1974 and January 1973 enrollments. This delayed the effect of declining enrollment by one and one-half year. Schools could still use the September 1974 enrollment if it was larger.

2. Raised the growth factor from 5% to 8%.

3. Provided for the 1975-76 school year by allowing a school to add to its actual enrollment an additional amount equal to 50% of the decrease in enrollment to the extent the decrease was no more than 5% of the base year's enrollment, and 25% of the decrease to the extent that the decrease exceeded 5% of the base year's enrollment.

A significant change made by the 1975 Legislature was to drop taxable valuation of property from the growth factor. The Consumer Price Index was then added to the formula to help compute the allowable growth factor (Truesdell, 1979). The formula was then based on the growth in state revenues and the Consumer Price Index. In 1975 further changes were made. The most notable addition to the Foundation program was the concept of weighted pupils. In 1976 the

Iowa Foundation Program allowed extra funds for children with learning difficulties on the assumption that smaller classes and more individualized help was needed (Truesdell, 1978). The allowable growth rate was also increased to 10.7% for increased IPERS and for state aid to cover Driver's Education.

In 1979 the Legislature further promoted the concept of school district efficiency by adding a weighting plan for students taught in a shared program or by a teacher employed mutually by two districts (Sheffield, 1982). Such students were counted as 1.1 students for that part of the school day that they met the above requirements.

As stated previously, the growth factor originally was based in 1972-73 on (a) property assessment growth and (b) growth in state revenue receipts. In 1975 property assessment growth was dropped in favor of the Consumer Price Index. Beginning with the 1980-81 school year the growth in state revenue receipts was dropped and the growth factor depended solely on the Consumer Price Index (Truesdell, 1979). Before the 1980-81 school year had even begun, however, the legislature made another change in the computation of allowable growth. For the 1981-82 school year the Gross National Product deflator (GNP deflator) would be used ("Ray Signs," 1980). At a time when rapid inflation along with a looming recession was threatening, the GNP deflator had a great advantage because " . . . it was substantially lower, at least currently, than the CPI" ("Ray Signs," 1980, p. 19). To make sure the state could afford school aid, the new law also said that if the GNP deflator index was higher than the growth in state revenue, the inflation index part of the formula could be forgotten entirely.

Rapidly declining enrollment continued to have a dramatic impact on many school budgets in the 1980s. The legislature, therefore, guaranteed schools 100% of their past years' budget for the 1983-84 school year, and 102% of their budget for the 1984-85 through 1986-87 school years (Iowa School, 1985). As enrollment continued to decline in the latter half of the 1980s, and the Iowa agriculture and industrial economy sagged, the 1986 Iowa Legislature (as reviewed earlier in this chapter) again searched for ways to economize public education and improve the foundation formula (Iowa School).

Summary

This chapter reviewed the concerns of the 1986 Iowa Legislature with regard to the efficiency of public school districts in the state. This concern began with Governor Branstad's proposal to downsize state government and ended with legislation which, among other things, created an Economy Task Force for each Iowa school district.

This chapter also presented a review of research concerning school funding levels and achievement. While early researchers, such as Cubberly and Mort, found a positive correlation between cost and quality (Dunnell, 1971), a significant study by Coleman did not (Jencks, 1972). Although researchers debated the appropriate method to use when measuring educational output, most researchers who conducted cost efficiency studies found either a parabolic or hyperbolic relationship existed between school district efficiency and enrollment.

The review of literature also contained a study of the relationship between school quality and school size. Clements (1970) summarized this literature by concluding that the criteria used to measure quality will determine whether small, medium, or large school districts offer the highest quality instruction.

A historical review of Iowa's current school financial plan was also included in this chapter. This review began with school finance problems in the late 1960s, and presented the changes and concerns that led to the plan which was implemented for the 1986-87 school year.

CHAPTER III

METHODS AND PROCEDURES

As reported in Chapter II, school efficiency was a popular topic during the 1986 legislative session. The Iowa Department of Education is also concerned about school efficiency and the measurement of school efficiency. According to Leland Tack, Chief, Department of Education's Data Analysis and Statistical Section, how to accurately measure the relative efficiencies of schools that serve a wide variety of geographic areas and enrollments is a difficult task.

This study attempted to address that task by creating a Service Cost Index (SCI) for measuring the relative efficiency of delivering a fixed market basket of services for each school district in a randomly selected sample. A jury of experts was selected by the author's dissertation committee to evaluate the formulas (Appendices A-F) that were used to compute the SCI. The jury members selected represented experience and expertise in school administration, school finance, accounting, school law, and school legislation. The jurors and their areas of expertise are listed in Appendix G. Each juror received a cover letter (Appendix H), a copy of the SCI model (Appendix I), and a jury questionnaire (Appendix J). The first section of this chapter reports the results of the jury's evaluation and their recommendations. The second section reports the procedures which were followed for the development and application of the SCI.

Jury Analysis

The jury's overall evaluation gave the Service Cost Index model strong support as indicated by their questionnaire responses and recommendations below. Although the jury members asked insightful questions and offered challenging recommendations, their overall high acceptance of the SCI model suggested the model possessed content validity. The jury also offered suggestions on how the model might be used in district/agency program evaluation.

Results of Question 1

Question 1: In your opinion, how adequately does the total service cost formula sum the per pupil costs of delivering the market basket of services used in this study?

1	X 2	3	4	5
QUITE ADEQUATELY				QUITE INADEQUATELY

Question 1 received a mean rating of 1.9 on the 5-point scale, as indicated by the "X" on the above scale, where 1 was a high rating indicating support for the question's formula or procedure, and 5 was a low rating indicating disagreement or dissatisfaction with the formula or procedure. Numerous jurors gave this question a 1 rating, although one juror gave a 4 rating, stating preference for a different mix of courses for the market basket. No juror found fault with the total service cost being represented by the sum of the four components, although two jurors asked if maintenance expenditures were included in support costs. Maintenance costs were included in support costs.

Results of Question 2

Question 2: In your opinion, how adequately does the factor 5/22 adjust the total sum of the 22 courses so it reflects the cost of 5 of the 22 courses?

1	X	2	3	4	5
QUITE ADEQUATELY					QUITE INADEQUATELY

Question 2 received a mean rating of 1.6 on the 5-point scale. The jury provided almost no additional comments for this question. The juror giving a 4 rating, however, indicated a desire to see each student's course load included in an average for each district rather than to use a predetermined course load of five. This concern had received consideration by the author, but was rejected due to the desire to measure a constant market basket of services across all districts rather than trying to compare different services in different districts. No other concerns were expressed regarding the ratio 5/22.

Results of Question 3

Question 3: Given that P represents the percentage teacher salaries are of total instructional cost as determined by the Secretaries Annual Report, how adequately does the factor 100/P adjust the sum to reflect total instructional cost rather than just the total cost of salaries?

1	2 X	3	4	5
QUITE ADEQUATELY				QUITE INADEQUATELY

Question 3 received a mean rating of 2.1. Five of the seven jury members gave a high rating to this question, but two jurors gave a 4 rating, both expressing the same concern. Although neither of the two who had given the low rating were concerned with the ratio 100/P, they did comment that the courses in the market basket would have a high P (High percentage of costs for salaries) because they are courses requiring little equipment. Vocational courses and industrial arts courses, which are not included in the market basket, would have a larger share of their costs spent on equipment and less on salaries. This would result in a lower P. They suggested, therefore, that the results of this study would be representative of the market basket courses and not the total curriculum.

Results of Question 4

Question 4: In your opinion, how adequately does that portion of the formula that multiplies FTE by average salary and then divides the total by course enrollment reflect an approximate per pupil cost of providing instructional services for that course?

1	2 X	3	4	5
QUITE ADEQUATELY				QUITE INADEQUATELY

Question 4 also received a mean rating of 2.1. Again, five jurors rated this question 1 or 2, but two jurors rated it 4. The two jurors who gave the low rating were not concerned with the formula, but rather were concerned that a district which recently hired young teachers would look more efficient than a district that had a number of teachers ready to retire. No suggestions, however, were offered to improve on the use of average teacher salary.

Results of Question 5

Question 5: How adequately, in your opinion, does the ratio described above approximate the ratio of administrative time spent administrating the market basket courses to total administrative time?

1 X 2 3 4 5
QUITE ADEQUATELY — QUITE INADEQUATELY

Question 5 received a mean rating of 1.7. In spite of this high mean rating, there were juror questions or comments. One question asked if the formula adjusted for schools that teach more non-market basket courses than others. (The formula does make that adjustment.) Another juror pointed out that the accuracy of this portion of the formula depended on the accuracy with which schools coded costs to administration on the Secretary's Annual Report. No jurors expressed concern with the method the formula used to distribute administrative time over the market basket courses. One juror did suggest that using student enrollments in the market basket courses would be equally as accurate as using the FTE of teachers teaching market basket courses.

Results of Question 6

Question 6: How adequately is the assumption that support costs are shared equally across all programs represented by the support cost formula?

1 X	2	3	4	5
QUITE ADEQUATELY				QUITE INADEQUATELY

Question 6 received a mean rating of 1.3, the highest rating of the seven questions asked. The only issue the jurors raised on this question was to ask what services are included in support costs. It was apparent the definition of support costs included with the SCI model mailed to the jury was not clear. As indicated by the high average rating and the lack of additional comments, however, the jury was supportive of the procedure to distribute support cost across all programs equally.

Results of Question 7

Question 7: How adequately is the assumption that transportation costs are shared equally across all programs represented by the transportation cost formula?

1	X 2	3	4	5
QUITE ADEQUATELY				QUITE INADEQUATELY

Question 7 received a mean rating of 1.9 from the seven jurors. Although the jurors agreed the formula accurately represented transportation costs, their comments expressed concern with this component.

The central issue of their comments was the relevancy of including transportation in the SCI. The jurors felt that the high cost of transportation in some districts was due to geographic factors and/or sparsity of population. They sensed an element of unfairness in a district being found to be relatively inefficient because of transportation, a factor the district cannot control. And while the jury made an excellent point, it is the case that all SCI components may have local circumstances that make changes difficult if not impossible. Transportation, in that regard, is not unlike the other components. Transportation is included in the SCI because it is a part of any school district's expenditures. The transportation component is especially useful when the SCI is correlated with school enrollment as the transportation component can be analyzed separately from the other components (see Chapter IV). Consequently, the impact of the transportation component on the SCI can be determined for each district in the sample. One juror recognized this factor and commented that when this impact is known, perhaps information will finally exist to cause the cost of transportation to be removed from a school's controlled budget.

The questionnaire asked the jurors to respond to six open-ended questions. Some jurors took advantage of that opportunity. While many of their comments related strictly to the first seven questions and have been included in the discussion of those questions, several additional comments will be reviewed in the following paragraphs.

One juror planned to use the formula on his local district. The juror was more interested in using the formula with his district each year than in using it with other districts. Using the formula over time will allow year to year efficiencies to be compared. This, the juror felt, would be especially important as his district faces severe declining enrollment in the future.

Another juror was critical of the SCI because he thought it to be too narrow. He felt limiting the study to the secondary program and then to only 22 selected courses would not provide as much information as could be found with a broader market basket. In contrast, another juror was critical because the study was too broad. He felt it would be more useful to develop a separate SCI for each course, rather than to average 22 courses.

It was also noted that the State of Iowa is focusing on school district efficiency in 1986. Jurors suggested that the SCI may provide useful information as school districts across the state look at the efficiency of their operation. One juror warned that conclusions of this study need to be carefully drafted so they are not misrepresented. His fear was that the market basket does not represent the entire curriculum; therefore, conclusions should not be generalized to the entire curriculum

A concluding comment from a juror summarized many comments by stating that cost accounting in the public sector needs refinement. "This research project," he stated, "does just that."

Procedures

The Service Cost Index described in this study was based upon the computation of the cost of delivering a fixed market basket of services to a typical student in each of 44 randomly selected Iowa High Schools (9-12). The market basket of services was defined as the Minimum Curriculum Requirements and Standards for Approved Schools as outlined in the Code of Iowa, Chapter 257.25 with two exceptions. First, driver's education was excluded as it was often offered only during the summer months and/or has its cost covered in part by charges to the students. Second, health education was excluded as this requirement is often met by including health education units in physical education, family living, or other courses, rather than offering a full semester course on health education.

To compute the cost of delivering these services, four factors (contributions) were considered. First, since the typical student enrolls in five courses in a given semester, the instructional cost of the 22 required courses in the market basket were computed and multiplied by a factor of 5/22. This fraction gave instructional cost the proper weight in relation to the other three factors described below. In addition, a factor of 100/P was used because the costs used in the computation for instructional costs account for approximately P percentage of the total costs.

Second, the administrative costs associated with this market basket of services were computed by determining the ratio of the market basket to the total curriculum and multiplying that ratio by total administrative costs. The appropriate ratio was determined by dividing the full-time equivalency (FTE) of the faculty teaching the market basket services by the FTE of the total faculty.

Third, the contribution of support cost was computed. Support costs included central debt, central insurance, and operation and maintenance expenditures which were divided by student enrollment.

Fourth, the cost of providing transportation services was computed by multiplying a district's per pupil transportation costs by the ratio of students transported to total enrollment. This ratio, like the previous ratios, was used to ensure that the various factors of the total service cost were properly weighted as to their proportion of educational costs.

The sum of these four factors was the total Service Cost for a typical student of the market basket of services previously identified. This amount represented the cost of instructing, administering, supporting, and transporting for a specific market basket of services for a typical student in each district in the study.

Sample

A stratified random sample of 44 districts was selected from Iowa's 429 school districts (Dunn, 1985). The districts were ranked by enrollment from highest enrollment to lowest. After the districts were listed in rank order, each district was assigned a number from 1 (district with the highest enrollment) to 429 (district with the lowest enrollment). The districts were then separated into four categories of equal size with the first 107 districts placed in Category I, the next 107 districts placed in Category II, and next 107 districts placed in Category III, and the remaining 108 districts placed in Category IV. Eleven districts were then selected at random from each of the categories. The 44 districts selected represent approximately 10% of the districts in Iowa.

The random selection was accomplished by using a five digit random number table found in the 1963 Edition of the CRC Standard Mathematical Tables. The table of random numbers was entered by starting with the 4th column and the 20th row and continuing down the column with every other entry thereafter. The first three digits of the five digit number were used. If a number selected fell between 1 and 429 inclusive, it was selected and the district with the corresponding rank was placed in its appropriate category (Category 1: Rank 1 to 107, Category II: Rank 108 to 214, Category III: Rank 215 to 321, Category IV: Rank 322 to 429). If a district was selected by this method a second time, it was discarded the second time selected. When 11 districts were selected for a category, no others were added to that category. This process continued until 11 districts were selected for each category.

Selection of the Market Basket

Most educational cost studies look at the total cost of operating a school district in relation to enrollment but neglect the fact that different schools offer different services (Monk, 1982). To compare the relative efficiency with which schools deliver educational services, this study defined a specific market basket of services and determined the cost of delivering this market basket of services in each of the 44 schools in the sample.

The market basket included all the courses required for the minimum program in grades nine through twelve by the Code of Iowa, Chapter 257.25, 6a-6j, 7. The market basket, dictated by this requirement, included four units of English-language arts, one unit of fine arts, two units of foreign language, five units of mathematics, one unit of occupational education, one unit of physical education, four units of science, and four units of social studies.

The market basket did not include units in driver's education or health education for reasons previously stated on pages 49 and 50.

Computation of Service Cost

Instructional Component

To measure the cost of instructional services, average teacher salaries were used. Teachers' salaries represent a large proportion of instructional costs; therefore, differences in salaries serve as an excellent approximation of differences in the cost of instructional services. To determine the cost of a unit of educational service, the number of full-time equivalency teachers delivering that service was multiplied by the average teacher salary. The total was then divided by the enrollment in that course to determine a per pupil cost. Because teachers' salaries represent a large majority, but not the total cost of instruction, the per pupil cost computed above was multiplied by 100 and divided by the percentage of instruction represented by teachers' salaries. (For example: If the product of FTE and Average Salary was $54,000 and it was found that teachers' salaries represent 90% of instructional cost, then one would multiply $54,000 by 100 and divide by 90 to determine that the total cost of instruction was $60,000.) This yielded a number that represented the cost to the school of delivering that service to one student for one year. The following formula represented this process for English I:

Cost of English I Per Student =

$$\frac{(100/85)*(\text{English I FTE} * \text{Ave. Salary})}{(\text{English I Enrollment})}$$

The full formula for the Instructional Component (see Appendix A) computes the sum of the 22 units of service in the market basket previously described. Summation notation was used to shorten the presentation of the formula. The typical student, however, does not take 22 courses per semester; consequently, the sum of the 22 courses was multiplied by 5/22 to determine the cost of providing instructional services to a student enrolled in five classes per semester.

Administrative Component

To determine the administrative time devoted to administering the market basket of services, the FTE of teachers teaching market basket courses was compared to total faculty FTE. The computation of this component required that total administrative cost be multiplied by the ratio of the teacher FTE needed to teach the market basket courses to the school district FTE. This product gave the total cost to administer the market basket if one assumed administrative costs were distributed evenly over the total school program. This product was then divided by total school enrollment to determine the per pupil administrative cost of the market basket services. The formula for this component is shown in Appendix B.

Support Component

Three services were included to determine the support costs component: one, central debt; two, central insurance; and three, operation and maintenance expenditures. These costs were also assumed to be distributed equally over all school programs. Consequently, to determine the support cost component the sum of central debt, central insurance, and operation and maintenance expenditures was divided by total district enrollment to determine a per pupil cost for support services. The formula used for this component of total service cost is shown in Appendix C.

Transportation Component

In computing the cost of delivering the service of transportation, the formula (shown in Appendix D) determined the average cost per student. Each school district in Iowa already reports to the Iowa Department of Education its per pupil cost of transportation. This average, however, is based only on the number of students transported. To measure the average cost per student in the district, the formula multiplied the amount reported to the Department of Education by the ratio of the number transported to total enrollment. Using this ratio, the transportation component was kept in the proper proportion to the other components.

Total Service Cost

As stated earlier, the sum of the instructional component, the administrative component, the support component, and the transportation component represented the total cost of delivering the market basket of services. Appendix E displays the formula used for this computation.

Service Cost Index

Using the first formula in Appendix F, the sum of the Service Costs of all 44 districts was computed. The average Service Cost was then found by dividing the total by 44 as shown in the second formula in Appendix F. Finally, each school's Service Cost was divided by the average Service Cost and multiplied by 100 to determine the Service Cost Index (SCI) of the district as shown in the third formula in Appendix F. The difference between 100 and a district's SCI measured the percentage a district was above or below average in its ability to deliver the market basket of services efficiently.

The data needed to develop the SCI are shown in Appendix K for two Iowa school districts. Also shown is the source of the data. The formulas used in the computation of the SCI, which are presented in Appendices A through E, were converted for the Apple IIe computer and the spreadsheet portion of the AppleWorks software. The results of applying these formulas to two Iowa school districts are shown in Appendix L.

Analysis of Data

The Pearson product-moment correlation coefficient (r) was used to test the relationship between enrollment and the SCI, and between enrollment and each of the four SCI components. Also, Pearson's coefficient was used to test the relationship between the SCI and average teacher salary, and between the SCI and pupil/teacher ratio. Significance of the resulting Pearson correlations was tested at the .01 level.

The relationship between school district enrollment and the SCI (Hypothesis 7) was further tested to validate the results found using Pearson's correlation coefficient. First, the method of linear regression was used to obtain the equation of a regression line that would fit the data. Second, a regression line was obtained for each of the four enrollment categories. The slope of these four regression lines led to further testing of the data using the method of curvilinear regression. The method of curvilinear regression developed a second power polynomial regression between enrollment and the SCI.

CHAPTER IV

RESULTS

This study was designed to construct a Service Cost Index (SCI) for a sample of Iowa School Districts. The SCI was developed to measure the relative efficiency of school districts in their ability to deliver a fixed market basket of services to their students. The relationship between the SCI and school district enrollment was examined, as well as the relationship between components of the SCI and enrollment. In the first section of this chapter a description of the total sample is presented. The second section includes the seven hypotheses which were tested and the resultant data. The final section summarizes the results of the study.

Sample

The 44 school districts that were selected for this study represented approximately 10% of the 429 school districts in the State of Iowa. The 44 school districts selected and their rank are presented in Appendix M.

Iowa's 429 school districts were separated into four enrollment categories with 11 districts selected from each category. Category I was the largest enrollment category representing the largest 107 districts in Iowa, Category II was second largest, and so on. Districts selected for this study from Category I school districts ranged in enrollment from 1,068 students to 5,056 students. The median enrollment was 1,957. This was a range of almost 4,000 students, a larger range than the other categories. Category II school districts selected for this study ranged in enrollment from

799 students to 563 students. Category II school districts selected had a range of 236. The median of the 11 Category II school districts selected was 693 students. School districts selected for Category III ranged in enrollment from 523 to 380. Category III school districts had a median enrollment of 421 students and a range of 143 students. Category IV school districts selected for this study represented the lowest enrollment category. These school districts ranged in enrollment from 345 to 180, a range of 165. Median enrollment was 249.

Analysis of Data

Seven specific hypotheses were statistically tested. Results relative to each hypothesis are presented in this section.

Hypothesis 1

Research hypothesis, H(1): There is a significant negative correlation between school district enrollment and the instructional cost component of the SCI.

Statistical hypothesis, H(0): There is no significant correlation between school district enrollment and the instructional cost component of the SCI.

The data for this hypothesis included school district enrollment and the instructional cost component of the SCI. School district enrollment and the instructional cost component for each school in the sample are presented in Table 1. The average instructional cost component for the four categories ranged from 1,157 to 1,740 with Categories I and II (1,157 and 1,430, respectively) being below the

Table 1

The Rank, Enrollment, and Instructional Cost Component for 44 Sample Schools

Rank	Category I Enrollment	Inst.	Rank	Category II Enrollment	Inst.
14	5,056	1,313	139	799	1,181
19	4,466	904	142	754	1,589
23	3,179	1,131	145	737	1,896
31	2,588	1,401	153	724	1,261
38	2,099	1,084	160	696	1,095
40	1,957	1,275	162	693	1,471
78	1,381	1,227	164	692	1,652
90	1,181	1,119	188	631	1,860
97	1,105	1,150	199	601	1,065
99	1,097	1,026	207	575	1,463
101	1,068	1,092	213	563	1,197
Average		1,157			1,430
	Category III			Category IV	
233	523	1,295	325	345	2,294
253	482	1,296	329	326	1,254
255	476	2,130	337	314	1,195
277	434	1,474	364	284	1,722
278	432	1,175	377	273	1,952
282	421	1,245	383	249	1,427
290	395	1,855	384	246	1,274
299	391	1,324	386	245	1,697
301	381	1,397	389	228	2,339
307	381	1,880	394	224	1,992
309	380	2,194	413	180	2,001
Average		1,578			1,740

Average of 44 School Districts: 1,476

44 district average of 1,476, and Categories III and IV (1,578 and 1,740, respectively) being over the 44 district average.

Table 2 presents the results of testing this hypothesis using Pearson's product-moment correlation coefficient. The Pearson correlation coefficient, $r = -.407$, was found to be significant ($p < .01$), thus demonstrating a significant negative relationship between enrollment and the instructional cost component. Because of the high value of r, the statistical hypothesis H(0) was rejected.

Hypothesis 2

Research hypothesis, H(2): There is a significant negative correlation between school district enrollment and the administrative cost component of the SCI.

Table 2

Relationship Between District Enrollment and Instructional Cost Component

H(1): Hypothesis 1; H(0): $r = 0$ (Null Hypothesis)

Pearson's Coefficient = -.407

Number of Pairs (N) = 44

Degrees of Freedom = 42

Critical Value of r at .01 Confidence Level = -.358
for one-tailed test

Therefore: H(0) is rejected.

Statistical Hypothesis, H(0): There is no significant correlation between school district enrollment and the administrative cost component of the SCI.

The administrative cost component, computed with the formula in Appendix B, was used to test this hypothesis. Results of computing the administrative cost component are shown in Table 3. The average administrative cost component increased with each category as enrollment decreased. Administrative cost component averages were 50 in Category I, 56 in Category II, 66 in Category III, and 80 in Category IV, with total group average being 63. The administrative cost component ranged from a low of 29 in Category I school districts to 113 in Category IV districts.

Testing hypothesis 2 using Pearson's correlation coefficient resulted in $r = -.407$ ($p < .01$). This r value is too large to occur by chance more than one time in 100, thus the statistical hypothesis H(0) was rejected. This information is presented in Table 4.

Hypothesis 3

Research hypothesis, H(3): There is a significant negative correlation between school district enrollment and the support cost component of the SCI.

Statistical hypothesis, H(0): There is no significant correlation between school district enrollment and the support cost component of the SCI.

The support cost component, computed with the formula in Appendix C, and school district enrollment were used to test this

Table 3

The Rank, Enrollment, and Administrative Cost Component for 44 Sample Schools

Rank	Category I Enrollment	Admin.	Rank	Category II Enrollment	Admin.
14	5,056	50	139	799	57
19	4,466	39	142	754	39
23	3,179	47	145	737	60
31	2,588	29	153	724	34
38	2,099	51	160	696	41
40	1,957	70	162	693	75
78	1,381	55	164	692	51
90	1,181	51	188	631	63
97	1,105	47	199	601	79
99	1,097	47	207	575	61
101	1,068	59	213	563	54
Average		50			56
	Category III			Category IV	
233	523	55	325	345	76
253	482	67	329	326	113
255	476	73	337	314	79
277	434	49	364	284	84
278	432	74	377	273	30
282	421	64	383	249	82
290	395	58	384	246	97
299	391	53	386	245	52
301	381	63	389	228	94
307	381	103	394	224	63
309	380	70	413	180	112
Average		66			80

Average of 44 School Districts: 63

Table 4

Relationship Between District Enrollment and Administrative Cost Component

H(2): Hypothesis 2;	H(0): r = 0 (Null Hypothesis)
Pearson's Coefficient = -.426	
Number of Pairs (N) = 44	
Degrees of Freedom = 42	
Critical Value of r at .01 Confidence Level = -.358 for one-tailed test	
Therefore: H(0) is rejected.	

hypothesis and is presented in Table 5. Results of the analysis are presented in Table 6.

The statistical hypothesis H(0) was not rejected at the .01 confidence level. Pearson's correlation coefficient $r = .065$ ($p > .01$), indicated almost no correlation between school enrollment and the support cost component. Each enrollment category had a district with support cost near the minimum for the sample schools (241) as well as a district near the maximum for the sample schools (650). Both the highest and the lowest support component cost were from Category IV. The smallest enrollment category had the highest average support cost component of 401, whereas the second highest average was from Category I with a support cost component of 361. Categories II and III had costs of 349 and 339, respectively.

Table 5

The Rank, Enrollment, and Support Cost Component for 44 Sample Schools

Rank	Category I Enrollment	Support	Rank	Category II Enrollment	Support
14	5,056	438	139	799	378
19	4,466	487	142	754	352
23	3,179	424	145	737	284
31	2,588	329	153	724	331
38	2,099	274	160	696	325
40	1,957	363	162	693	463
78	1,381	362	164	692	372
90	1,181	262	188	631	324
97	1,105	386	199	601	345
99	1,097	298	207	575	298
101	1,068	355	213	563	371
Average		361			349
	Category III			Category IV	
233	523	405	325	345	339
253	482	312	329	326	289
255	476	320	337	314	451
277	434	319	364	284	508
278	432	257	377	273	241
282	421	319	383	249	400
290	395	449	384	246	365
299	391	352	386	245	320
301	381	333	389	228	650
307	381	326	394	224	392
309	380	341	413	180	462
Average		339			401
Average of 44 School Districts: 363					

Table 6

Relationship Between District Enrollment and the Support Cost Component

H(3): Hypothesis 3;	H(0): *r* = 0 (Null Hypothesis)
Pearson's Coefficient = .065	
Number of Pairs (N) = 44	
Degrees of Freedom = 42	
Critical Value of *r* .01 Confidence Level = -.358 for one-tailed test	
Therefore: H(0) is not rejected.	

Hypothesis 4

Research hypothesis, H(4): There is a significant negative correlation between school district enrollment and the transportation cost component of the SCI.

Statistical hypothesis, H(0): There is no significant correlation between school district enrollment and the transportation cost component of the SCI.

The formula in Appendix D was used to compute the transportation cost component for each of the 44 school districts. The transportation cost component and school district enrollment were used to test this hypothesis. The transportation cost component represented the average cost per student enrolled, not the average cost per student transported. Transportation cost component and enrollment data are presented in Table 7. The average transportation cost component for Categories I through IV were 119, 196, 180, and 229, respectively. Although these averages did not follow the pattern established with the instructional and administrative cost components, the *r* value found when testing this data was -.380. Consequently, the statistical hypothesis was rejected. Results are presented in Table 8.

Hypothesis 5

Research hypothesis, H(5): There is a significant positive correlation between the SCI and average teacher salary.

Statistical hypothesis, H(0): There is no significant correlation between the SCI and average teacher salary.

Data for testing Hypothesis 5 are shown in Table 9, while Table 10 displays the results of testing the hypothesis using Pearson's coefficient. Although it was hypothesized that higher teacher salaries would result in a higher SCI, given the *r* value of -.412, the statistical hypothesis could not be rejected. If the hypothesis had predicted a negative relationship to have existed between the SCI and average teacher salary, the data would have supported the hypothesis.

Average salary by enrollment category was found to decrease as the SCI increased. The highest average was found in Category I with a salary of $21,581. Category II salaries averaged $19,357, with Category III and IV school districts averaging $18,229 and $17,193, respectively.

Table 7

The Rank, Enrollment, and Transportation Cost Component for 44 Sample Schools

Rank	Category I Enrollment	Trans.	Rank	Category II Enrollment	Trans.
14	5,056	74	139	799	295
19	4,466	40	142	754	176
23	3,179	169	145	737	184
31	2,588	100	153	724	187
38	2,099	130	160	696	103
40	1,957	127	162	693	268
78	1,381	208	164	692	233
90	1,181	82	188	631	228
97	1,105	133	199	601	228
99	1,097	159	207	575	130
101	1,068	92	213	563	125
Average		119			196
	Category III			Category IV	
233	523	170	325	345	190
253	482	88	329	326	125
255	476	194	337	314	338
277	434	182	364	284	246
278	432	112	377	273	130
282	421	170	383	249	149
290	395	191	384	246	421
299	391	95	386	245	239
301	381	263	389	228	266
307	381	334	394	224	227
309	380	179	413	180	178
Average		180			228

Average of 44 School Districts: 181

Table 8

Relationship Between District Enrollment and Transportation Cost Component

H(4): Hypothesis 4;	H(0): *r* = 0 (Null Hypothesis)
Pearson's Coefficient = -.380	
Number of Pairs (N) = 44	
Degrees of Freedom = 42	
Critical Value of *r* at .01 Confidence Level = -.358 for one-tailed test	
Therefore: H(0) is rejected.	

Hypothesis 6

Research hypothesis, H(6): There is a significant negative correlation between pupil/teacher ratio and the SCI.

Statistical hypothesis, H(0): There is no significant correlation between pupil/teacher ratio and the SCI.

The pupil/teacher ratio and the SCI for each district in the sample are shown in Table 11. The average pupil/teacher ratio for each category ranged from a high of 17.2 in Category I to a low of 11.1 in Category IV. Category II school districts had a pupil/teacher ratio of 15.7, which declined to 13.8 in the Category III districts. Average for the total sample was 14.5.

The results of testing Hypothesis 6 using Pearson's correlation coefficient are shown in Table 12. With a calculated *r* value = -.582, the statistical hypothesis was rejected ($p < .01$).

Table 9

The Rank, Average Salary, and Service Cost Index (SCI) for 44 Sample Schools

	Category I			Category II	
Rank	Avr. Sal.	SCI	Rank	Avr. Sal.	SCI
14	24,631	90	139	19,390	92
19	25,125	71	142	20,462	104
23	23,977	85	145	21,674	117
31	22,294	89	153	19,685	87
38	20,265	74	160	20,349	75
40	21,148	88	162	20,595	110
78	19,429	89	164	15,597	111
90	19,641	73	188	17,412	119
97	21,183	83	199	18,551	83
99	20,758	74	207	18,834	94
101	18,944	77	213	20,385	84
Average	21,581	81		19,357	98
	Category III			Category IV	
233	17,083	93	325	16,329	139
253	17,244	85	329	19,225	86
255	19,334	131	337	16,665	99
277	17,813	97	364	18,509	123
278	18,314	78	377	18,037	113
282	17,188	86	383	15,887	99
290	18,570	123	383	16,031	104
299	19,141	88	386	15,895	111
301	18,130	99	389	17,693	161
307	19,571	127	394	16,027	129
309	18,137	129	413	18,823	132
Average	18,229	104		17,193	118

Average Salary of 44 School Districts: $19,090

Average SCI of 44 School Districts: 100

Table 10

Relationship Between the SCI and Average Teacher Salary

H(5): Hypothesis 5; H(0): $\underline{r} = 0$ (Null Hypothesis)

Pearson's Coefficient = -.412

Number of Pairs (N) = 44

Degrees of Freedom = 42

Critical Value of $\underline{r}$ at .01 Confidence Level = .358 for one-tailed test

Therefore: H(0) is not rejected.

Hypothesis 7

Research hypothesis, H(7): There is a significant negative correlation between school district enrollment and the Service Cost Index (SCI).

Statistical hypothesis, H(0): There is no significant correlation between school district enrollment and the SCI.

The SCI of each school district along with its rank and enrollment were used to test this hypothesis and are presented in Table 13. Results of the analysis are presented in Table 14.

An inspection of Table 13 reveals the school districts in Category I ranged in enrollment from 5,056 to 1,068 and had an SCI that ranged from a low of 71 (29% below average) to a high of 90 (10% below average). All school districts in Category I were below the sample average. School districts in Category II had enrollment range of 799 to 563 and a range in their SCI from 75 to 119.

Table 11

The Rank, Pupil/Teacher Ratio, and Service Cost Index (SCI) for 44 Sample Schools

	Category I			Category II	
Rank	Pup./Teach	SCI	Rank	Pup./Teach	SCI
14	18.8	90	139	15.1	92
19	19.7	71	142	16.4	104
23	18.7	85	145	16.2	117
31	17.7	89	153	14.3	87
38	17.1	74	160	16.7	75
40	16.1	88	162	15.8	110
78	15.3	89	164	13.5	111
90	17.3	73	188	13.7	119
97	18.4	83	199	18.0	83
99	13.1	74	207	16.2	94
101	17.2	77	213	16.8	84
Average	17.2	81		15.7	98
	Category III			Category IV	
233	11.8	93	325	11.9	139
253	17.0	85	329	12.0	86
255	14.5	131	337	12.6	99
277	14.8	97	364	10.9	123
278	12.0	78	377	11.6	113
282	12.1	86	383	11.1	99
290	13.2	123	384	10.8	104
299	14.1	88	386	10.5	111
301	13.3	99	389	9.8	161
307	14.7	127	394	9.7	129
309	14.0	129	413	11.3	132
Average	13.8	104		11.1	118

Average Pupil/Teacher Ratio of 44 School Districts: 14.5

Average SCI of 44 School Districts: 100

Category III school districts ranged in enrollment from 523 to 380 and showed a SCI which ranged from 78 to 131. The highest SCI was found in a Category IV school district where the SCI ranged from 161 to 86. Enrollments in Category IV ranged from 345 to 180. The mean SCI for each of the four categories increased as average enrollment of the categories decreased. The category means ranged from a low of 81 in Category I to a high of 118 in Category IV. Category III and IV means were 98 and 104, respectively.

Table 12

Relationship Between Pupil/Teacher Ratio and the Service Cost Index (SCI)

H(6): Hypothesis 6; H(0): *r* = 0 (Null Hypothesis)

Pearson's Coefficient = -.582

Number of Pairs (N) = 44

Degrees of Freedom = 42

Critical Value of *r* at .01 Confidence Level = -.358
for one-tailed test

Therefore: H(0) is rejected.

As presented in Table 14, the value of *r* (*r* = -.423) suggested a strong, but negative relationship existed between enrollment and the SCI. Because the probability of *r* occurring by chance alone was less than the selected .01 level of significance, the statistical hypothesis H(0) was rejected.

Table 13

The Rank, Enrollment, and Service Cost Index for 44 Sample Schools

Rank	Category I Enrollment	SCI	Rank	Category II Enrollment	SCI
14	5,056	90	139	799	92
19	4,466	71	142	754	104
23	3,179	85	145	737	117
31	2,588	89	153	724	87
38	2,099	74	160	696	75
40	1,957	88	162	693	110
78	1,381	89	164	692	111
90	1,181	73	188	631	119
97	1,105	83	199	601	83
99	1,097	74	207	575	94
101	1,068	77	213	563	84
Average		81			98
	Category III			Category IV	
233	523	93	325	345	139
253	482	85	329	326	86
255	476	131	337	314	99
277	434	97	364	284	123
278	432	78	377	273	113
282	421	86	383	249	99
290	395	123	384	246	104
299	391	88	386	245	111
301	381	99	389	228	161
307	381	127	394	224	129
309	380	129	413	180	132
Average		104			118
Average of 44 School Districts:		100			

Table 14

Relationship Between District Enrollment and Service Cost Index (SCI)

H(7): Hypothesis 7; H(0): $r = 0$ (Null Hypothesis)

Pearson's Coefficient = -.423

Number of Pairs (N) = 44

Degrees of Freedom = 42

Critical Value of r at .01 Confidence Level = -.358
for one-tailed test

Therefore: H(0) is rejected.

In order to further examine the relationship between enrollment and the cost of delivering the market basket of services defined in this study, the method of least squares was used to fit a regression line to the data. The data used to locate the regression line were enrollment and the total service cost for each district. Data are presented in Table 15. The same data and the resulting regression line are shown in Figure 1. An analysis of variance table accompanying this data is shown in Table 16. The slope of the regression line was -.174 with a Y-intercept of 2238.134. The resulting F-test yielded an F value of 9.049, which indicated significant results at the .01 confidence level. A Beta Coefficient Table and a Confidence Intervals Table are also shown in Table 16.

An examination of Figure 1 led to an attempt to fit a regression line to enrollment and total service cost data for each of the four enrollment categories. While 11 pairs of data proved too small to

Table 15

The Rank, Enrollment, and Total Service Cost for 44 Sample Schools

Rank	Category I Enrollment	S. Cost	Rank	Category II Enrollment	S. Cost
14	5,056	1,875	139	799	1,912
19	4,466	1,470	142	754	2,156
23	3,179	1,772	145	737	2,423
31	2,588	1,860	153	724	1,814
38	2,099	1,539	160	696	1,565
40	1,957	1,835	162	693	2,278
78	1,381	1,852	164	692	2,309
90	1,181	1,513	188	631	2,475
97	1,105	1,716	199	601	1,717
99	1,097	1,529	207	575	1,953
101	1,068	1,597	213	563	1,746
Average		1,687			2,031
	Category III			Category IV	
233	523	1,926	325	345	2,900
253	482	1,764	329	326	1,782
255	476	2,716	337	314	2,064
277	434	2,024	364	284	2,560
278	432	1,618	377	273	2,354
282	421	1,798	383	249	2,058
290	395	2,553	384	246	2,159
299	391	1,823	386	245	2,309
301	381	2,056	389	228	3,349
307	381	2,644	394	224	2,673
309	380	2,685	413	180	2,754
Average		2,146			2,451
Average of 44 School Districts: 2,079					

find significant results at the .01 level, the slopes of the four regression lines fitted to each enrollment category suggested that a linear regression line, though indicating significance, may not have been the most accurate line possible. The four regression lines for the four enrollment categories are displayed in Figures 2 through 5.

Categories I and II showed a regression line with a positive slope, while Categories III and IV showed a negative slope. This difference in the sign of the slope between the regression lines of Categories I and II compared with Categories III and IV suggested that a second degree polynomial regression equation, which describes a regression curve with a single bend, would better fit the data than the linear regression line shown in Figure 1.

Consequently, the data were tested using the method of curvilinear regression analysis. The data plotted on a graph and the resulting polynomial curve are shown in Figure 6. The polynomial equation:

$$Y = 2{,}489.143 - .691\ X + 1.1449E\text{-}4\ X^2$$

was found significant at the .01 level as a result of an F value of 9.561. Table 17 presents the results of the polynomial regression including the Beta Coefficient Table and the Confidence Intervals and Partial F Table. Comparing Tables 16 and 17 indicated that the R-squared value of the simple regression was .177, while the R-squared value of the polynomial regression was .318. It was therefore concluded that the polynomial regression curve presented a better fit for the data than did the simple regression line.

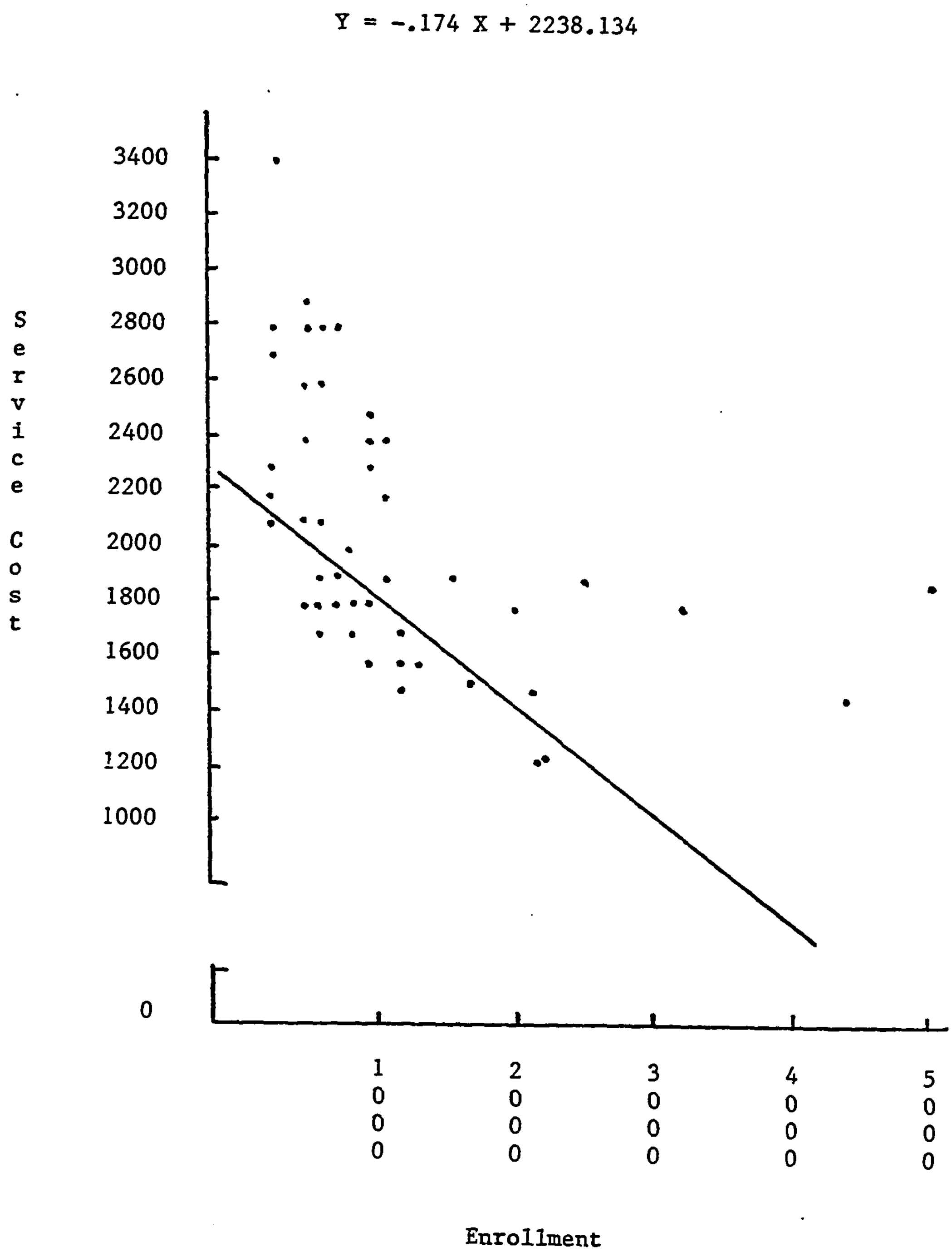


Figure 1. Simple regression (Enrollment).

Table 16

Simple Regression (Enrollment)

Simple Regression   X: Enrollment   Y: Service Cost

DF: 43, R: .421, R-Squared: .177, Adj. R-squared: .158,
Std. Error: 402.95

Analysis of Variance Table

Source	DF	Sum Squares	Mean Square	F-test
Regression	1	1,469,209	1,469,209	9.049
Residual	42	6,819,487	162,368	p=.0044
Total	43	8,288,696		

Beta Coefficient Table

Intercept: 2,238.134,   Slope: -.174

Std. Err.: .058,   Std. Value: -.421,   T-value: 3.008

Probability: .0044

Confidence Intervals Table

	Mean (X.Y)	Slope
95% Lower	1,956	-.291
95% Upper	2,201	-.057
90% Lower	1,976	-.271
90% Upper	2,181	-.077

Both simple regression analysis and curvilinear regression analysis thus served to further validate the rejection of experimental Hypothesis 7. While the polynomial regression line provided the best fit, both the polynomial regression line and the simple regression line proved to be accurate descriptions of the data at the .01 level.

$$Y = .0207\,X + 1638.25$$

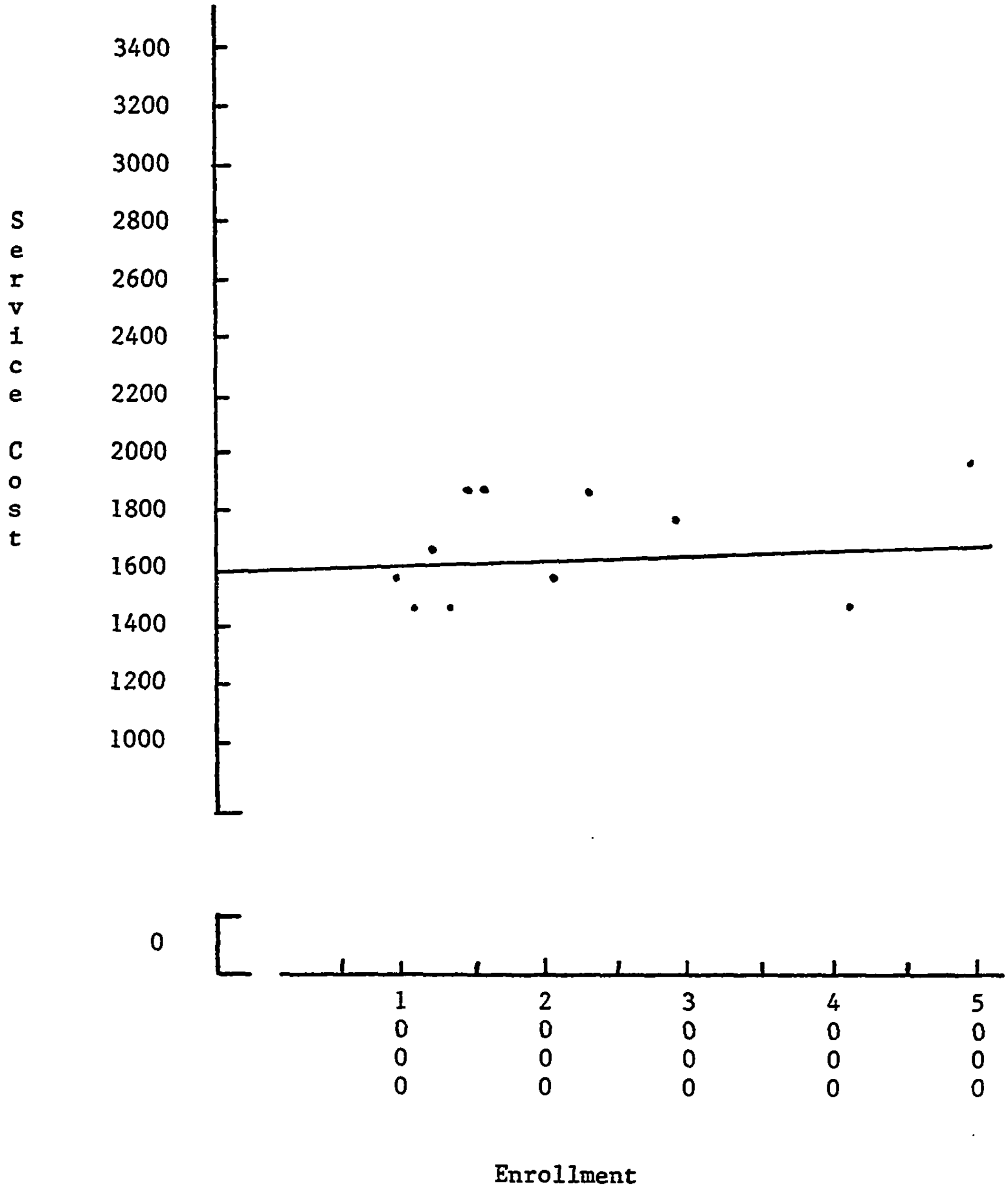


Figure 2. Simple regression (Category I).

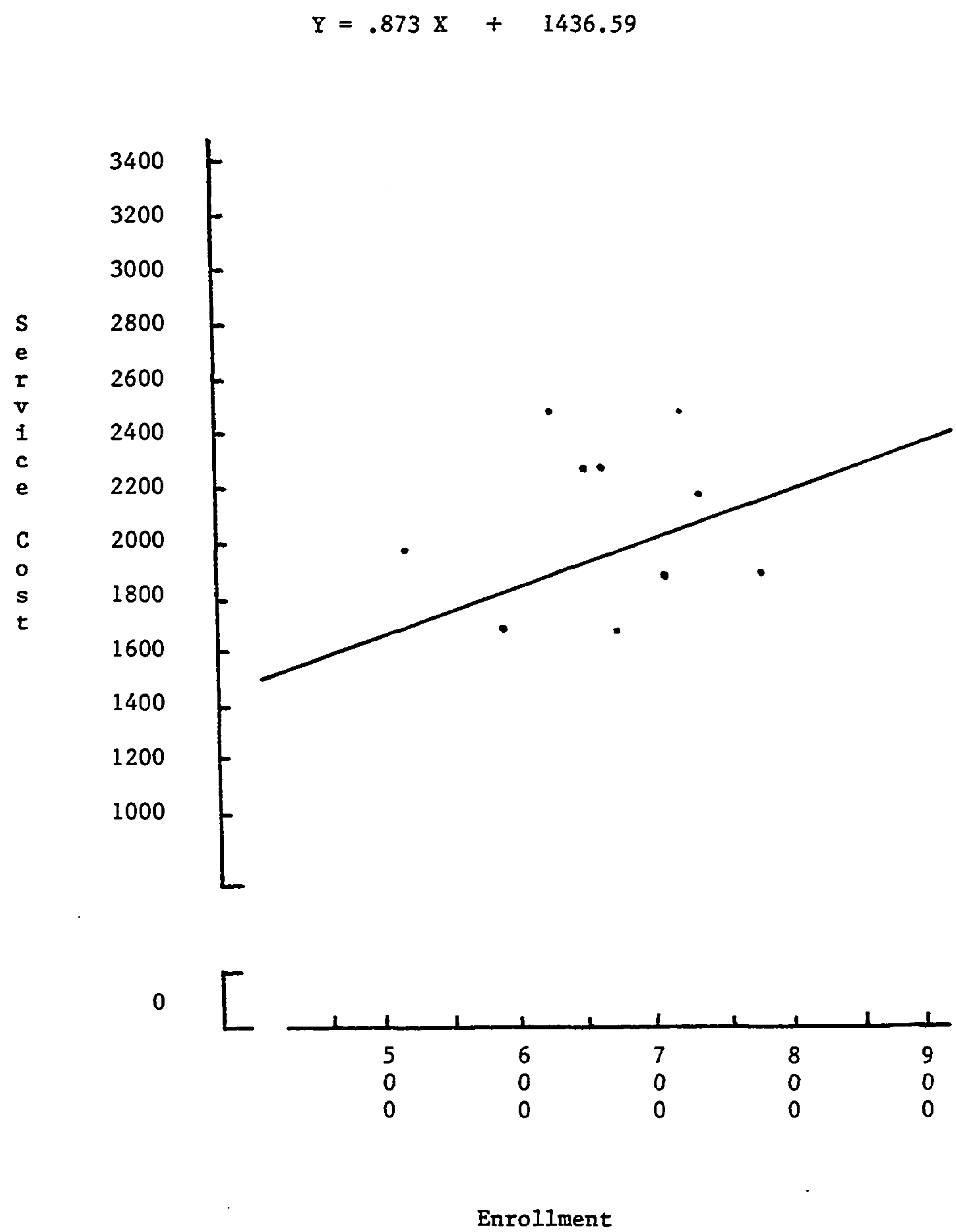
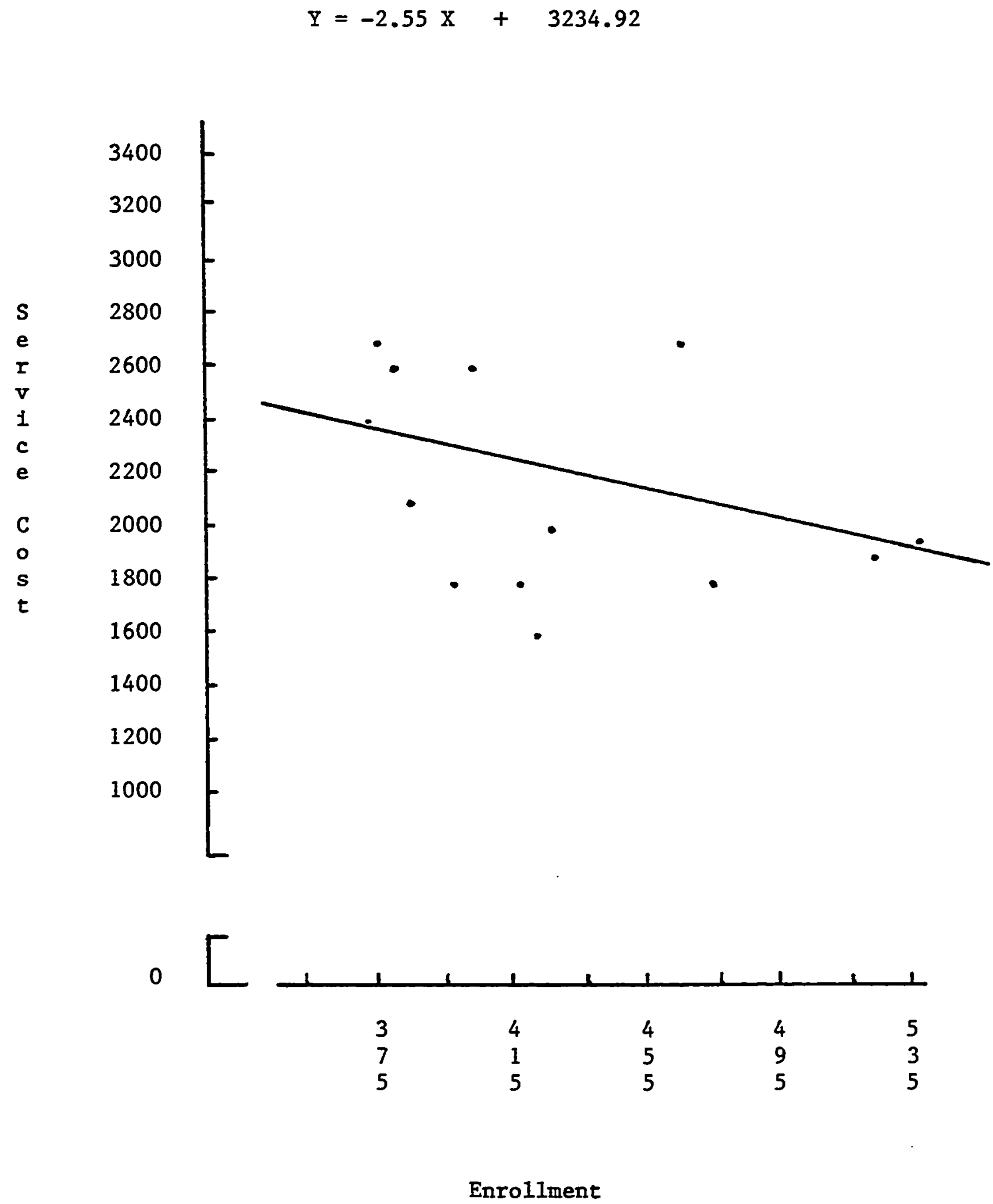


Figure 3. Simple regression (Category II).



<u>Figure 4</u>. Simple regression (Category III).

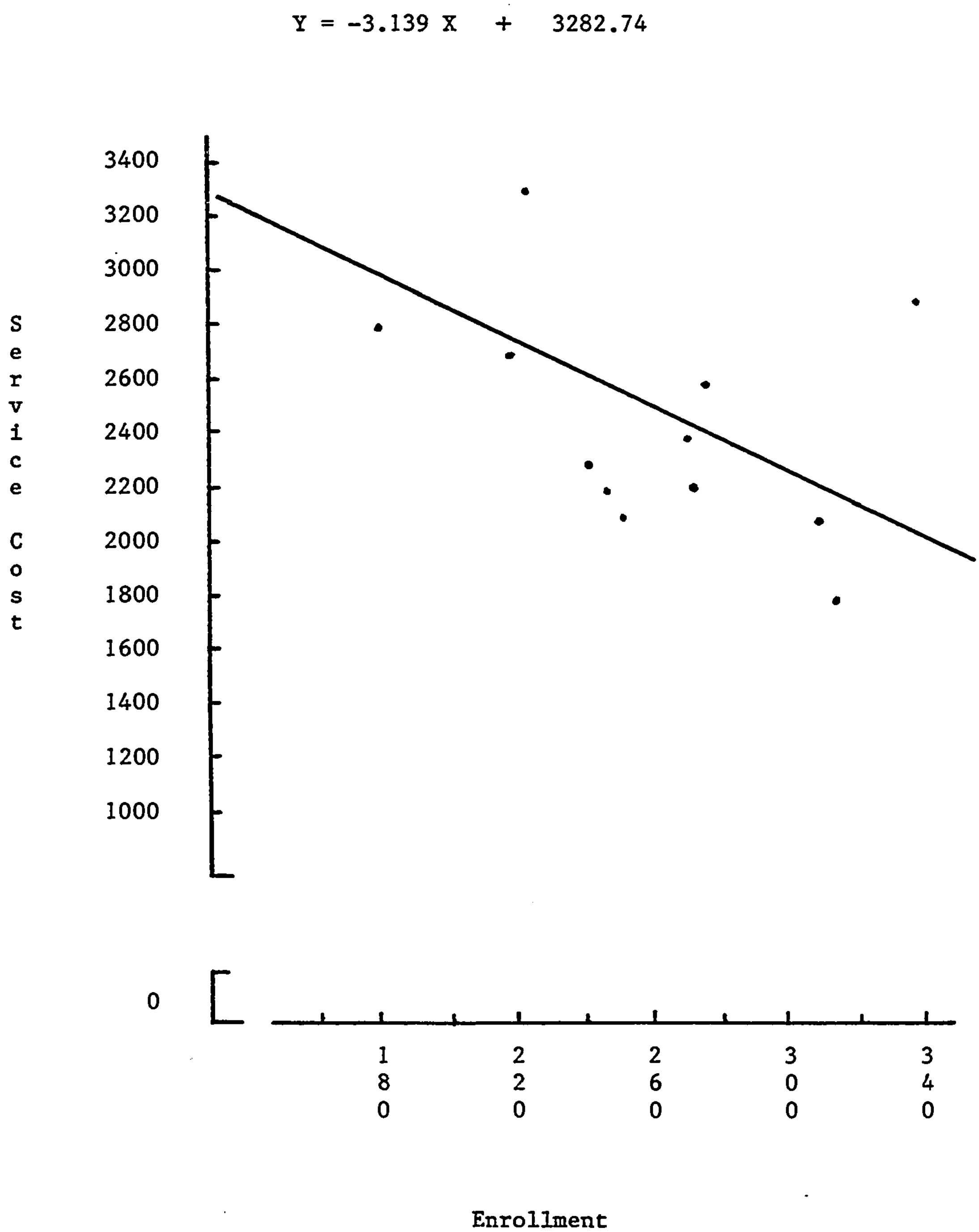


Figure 5. Simple regression (Category IV).

Summary of Results

A Service Cost Index (SCI) was computed for each of the 44 schools in the sample. Comparison of the SCI with school district enrollment revealed a significant negative correlation. Three of the four components of the SCI, when compared with enrollment, also revealed significant negative correlations. The significant negative correlations were found between instructional cost and enrollment, administrative cost and enrollment, and transportation cost and enrollment. Comparing support cost and enrollment resulted in an almost zero correlation coefficient.

While it was predicted that average teacher salary and the SCI would show a positive correlation, the data were not able to support the prediction. In fact, a highly negative correlation coefficient resulted from the comparison of those factors. Pupil/teacher ratio and the SCI showed the strongest negative correlation coefficient (-.582) of any of the factors compared.

To further examine the relationship between service cost and enrollment, the method of least squares was used to fit a regression line to the data. The line $Y = 2{,}238.134 - .174\ X$ produced a significant fit at the .01 level. Computing regression lines for each enrollment category resulted in Categories I and II having a positive slope and Categories III and IV having a negative slope. Therefore, the data were again tested using the method of curvilinear regression analysis. The polynomial equation $Y = 2{,}489.143 - .691\ X + 1.449\text{E-}4\ X^2$ was found to present a better fit to the data than the linear equation.

$$Y = 2489.143 - .691\,X + 1.1449E{-}4\,X^2$$

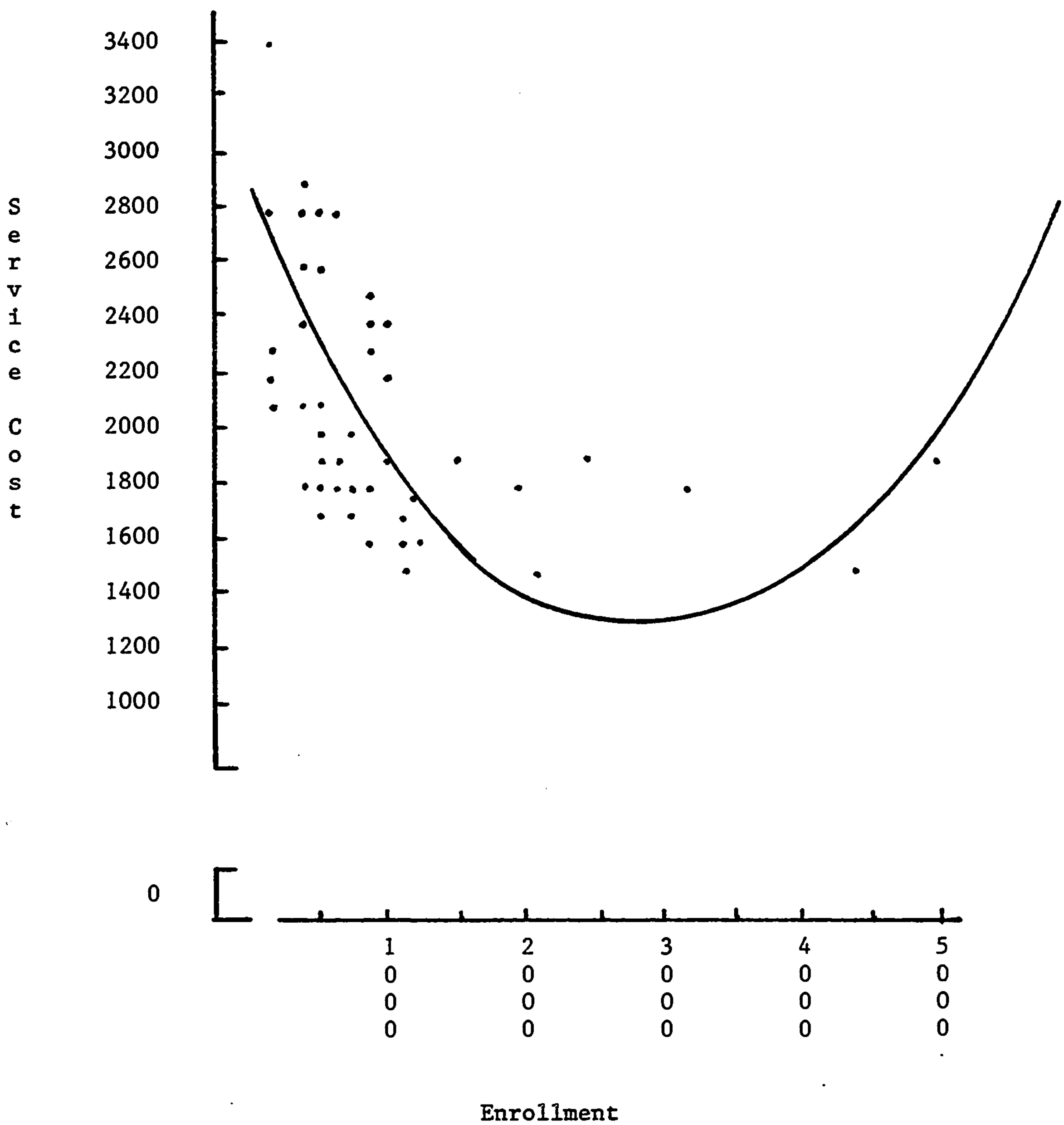


Figure 6. Polynomial regression (Enrollment).

Table 17

Polynomial Regression (Enrollment)

Polynomial Regression X: Enrollment Y: Service Cost

DF: 43, R: .564, R-Squared: .318, Adj. R-squared: .285
Std. Error: 371.304

Analysis of Variance Table

Source	DF	Sum Squares	Mean Square	F-test
Regression	2	2,636,176	1,318,088	9.561
Residual	41	5,652,520	137,866	*p*=.0004
Total	43	8,288,696		

Beta Coefficient Table

Intercept: 2,489.143, Slope: -.174

X: -.691

Std. Err.: .186, Std. Value: -1.673, T-value: 3.724

Probability: .0006

X^2: 1.1449E-4

Std. Err.: .00004, Std. Value: 1.307, T-value: 2.909

Probability: .0058

Confidence Intervals Table

	X	X^2
95% Lower	- 1.066	3.5010E-5
95% Upper	- .316	1.9398E-4
90% Lower	- 1.004	4.8260E-5
90% Upper	- .379	1.8073E-4
Partial F	13.87	8.464

Chapter V

CONCLUSIONS AND RECOMMENDATIONS

The primary purpose of this study was to construct a Service Cost Index (SCI) for a sample of Iowa School Districts based on service cost differentials and to apply the index to examine the cost of educational services. The SCI was based upon the computation of the cost of delivering a fixed market basket of services to a typical student in each of 44 randomly selected Iowa High Schools. The market basket of services was defined to be the Minimum Curriculum Requirements and Standards for Approved Schools as outlined in the Code of Iowa.

To compute the cost of delivering these services, instructional, administrative, support, and transportation cost components were considered. The four components were summed to determine the total service cost. The SCI was found by dividing the total service cost for each district by the average district service cost and multiplying by 100. The difference between 100 and a district's SCI measured the percentage a district was above or below average in its ability to deliver the market basket services efficiently.

Hypotheses

Seven null hypotheses were statistically tested and are listed below:

1. There is no significant correlation between school district enrollment and the instructional cost component of the SCI.

2. There is no significant correlation between school district enrollment and the administrative cost component of the SCI.

3. There is no significant correlation between school district enrollment and the support cost component of the SCI.

4. There is no significant correlation between school district enrollment and the transportation cost component of the SCI.

5. There is no significant correlation between average teacher salary and the SCI.

6. There is no significant correlation between pupil/teacher ratio and the SCI.

7. There is no significant correlation between school district enrollment and the SCI.

Discussion

The Service Cost Index (SCI) developed in this study measured the cost of delivering those educational services included in the state's minimum standards to a typical high school student in each of the sample schools. Thus, study conclusions presented in this chapter are limited to analysis of those services as measured by the SCI. If a school district delivers those services more efficiently than other districts, then it would follow logically that more dollars would be available for other educational opportunities than would be available in less efficient school districts. A school district delivering the market basket services efficiently would not necessarily, however, be a school district also capable of delivering non-market basket services equally as efficiently. Nevertheless, the ability to deliver the minimum standards efficiently will have a direct effect on a school district's ability to have the funds available to offer a comprehensive and varied curriculum. The conclusions of this study address the findings concerning the SCI and the components of the SCI as they are related to school district enrollment and efficiency.

Instructional Component

Analysis of instructional cost data using Pearson's product moment correlation coefficient (r) suggested a statistically significant negative relationship between school district size and the cost of providing instruction in the market basket courses. Of the four enrollment categories defined in this study, it was consistently the case that the larger the enrollment of a category, the smaller the cost of providing instruction. The 11 largest school districts in the study averaged an instructional cost component of $583 per pupil less than the average of the smallest 11 districts. None of the other components exhibited as large a difference between enrollment categories. The main factor causing this difference was pupil/teacher ratio. The other factor contributing to instructional cost, average teacher salary, had the opposite effect. Analysis of the data revealed that the largest districts had the highest average salaries. In spite of those high salaries in the larger schools, their relatively high pupil/teacher ratios contributed to the lowest instructional cost. This study is not advocating large class sizes, but rather, as an examination of the class enrollment data indicates, schools with high instructional cost need to eliminate classes with small enrollments if they wish to lower their instructional cost.

Administrative Component

Administrative cost, as computed for this study, was limited to that portion of administrative expenditures devoted to administering the market basket services. The Pearson's correlation coefficient (r) value of -.426 suggested a strong negative relation between administrative cost and enrollment. The analysis of the data revealed, however, only a $30 spread between the average administrative cost component of the large enrollment and small enrollment categories. Thus, the data suggested that low enrollment districts could improve their overall efficiency more by increasing instructional efficiencies rather than administrative efficiencies.

Support Component

Analysis of the data revealed no relationship between support cost and enrollment (r = .065). While size economies appeared to exist for instructional and administrative costs, no such conclusion could be made for support cost. Support costs ranged from a low of $241 per pupil to a high of $650 per pupil. These extremes occurred in districts whose enrollment differed by only 45 pupils. The data did not suggest, therefore, that support cost could be lowered by increasing enrollment.

Transportation Component

Again, as was the case for instructional and administrative components, Category I, the largest enrollment districts had the smallest average transportation cost ($119 per pupil) while Category IV, the smallest enrollment districts, had the highest average transportation cost ($228 per pupil).

As the literature review cautioned, however, care must be taken in making conclusions from this data. Small enrollment districts tend to exist in sparsely populated areas, while large enrollment districts are located in more densely populated areas. Concluding that economies of scale exist in transportation would be spurious. Merging two or more small districts into a larger district would probably not decrease, and might possibly increase, the per pupil cost of transportation. It is important to note, however, there was a significant negative relationship between school size and transportation cost. As small school districts, on the average, spend more for transportation than larger school districts, less dollars are available to them for a comprehensive and varied curriculum. All else being equal, high cost transportation districts cannot offer their students the same opportunities as lower cost districts because of the extra dollars they must devote to transportation. This fact suggests that including transportation costs in the controlled budget of a school district causes a handicap for high transportation cost districts.

Service Cost Index

Analysis of the Service Cost Index (SCI) and enrollment data using Pearson's correlation coefficient revealed an *r* value of -.423. The analysis suggested a strong negative relationship existed between the SCI and enrollment. This study thus found, as the literature review indicated, that a considerable economy of scale existed in Iowa school districts' abilities to deliver the services of the market basket defined for this study.

Further analysis developed a regression line with the equation $Y = 2{,}238.134 - .174\ X$ to describe the relationship between service costs and enrollment. The development of a regression line for each of the four enrollment categories suggested a polynomial curve of the second order would provide a more accurate data fit. A curvilinear regression analysis developed a parabola with the equation $Y = 2{,}489.143 - .691\ X + 1.1449\text{E-}4\ X^2$. The parabola described by this equation revealed service costs for the market basket of this study decreased as enrollment increased until a minimum was reached at approximately 3,000 students (see Figure 6, p. 85).

Other researchers have found results similar to those found in this study. As reviewed in Chapter Two, Cohn (1968) in a study of 377 Iowa School Districts found optimal size to be about 1,500 pupils. Hind (1977), Johnson (1972), and Katzman (1971) also found parabolic cost functions with minimum per pupil costs ranging from 600 to 1,800 pupils. Each researcher, however, used different criteria to measure input costs, which in turn affected the minimum value of their parabola.

Iowa's current school finance laws, which calculate a controlled budget for each district based upon enrollment and nearly equal per pupil spending, severely limit opportunities in some school districts. While enrollment Categories I, II, and III all have average SCIs near or below the state average, the school districts in Category IV averaged 18% above average. Although this study did not analyze a district's ability to deliver services other than those selected for the market basket, the study does suggest that those districts spending 18% above the average to deliver the services in the market basket (minimum standards) will have less funds available for other educational opportunities in their curriculum compared to other more efficient districts.

Conclusions

This study was designed to construct a Service Cost Index (SCI) for a sample of Iowa school districts based on service cost differentials and to apply the index to examine the cost of educational services. Additionally, this study examined the cost of four components of the SCI. Based on data collected from 44 randomly selected school districts, the following conclusions were drawn:

1. School district enrollment and the instructional cost of market basket services exhibited a significant negative correlation as measured by Pearson's product-moment correlation coefficient (r).

2. School district enrollment and the administrative cost of the market basket services exhibited a significant negative correlation as measured by Pearson's product-moment correlation coefficient (r).

3. No significant correlation existed between school district enrollment and support costs.

4. School district enrollment and transportation costs exhibited a significant negative correlation as measured by Pearson's product-moment correlation coefficient (r).

5. Average teacher salary and the SCI showed a significant negative relationship.

6. Pupil/teacher ratio and the SCI exhibited a significant negative correlation as measured by Pearson's product-moment correlation coefficient (r).

7. School district enrollment displayed a significant negative correlation with the SCI as measured by Pearson's product-moment correlation coefficient (r).

8. The Polymonial equation $Y = 2,489.143 - .691 X - 1.1449E-4 X^2$ provided a significant fit to service cost and enrollment data.

Recommendations

This study developed a Service Cost Index (SCI) to measure the relative efficiency of randomly selected Iowa School Districts to offer a selected market basket of educational services to their students. Based on this study, the following recommendations are made regarding school district funding:

1. Iowa school districts must make every effort to provide services as efficiently as possible by concentrating on the reduction of instructional cost. This can be accomplished by increasing low pupil/teacher ratios. While low enrollment districts and low pupil/teacher ratios may be necessary or even desirable in some cases, the State of Iowa should continue to assist Iowa schools, through research and inservice, to improve pupil/teacher ratios that are too low.

2. The State of Iowa must recognize that (a) small school districts are inherently inefficient and (b) that all small schools cannot be eliminated. This study recommends neither continuation nor

elimination of all small schoools. Rather, the recommendation is that Iowa should develop funding laws recognizing these facts and thus provide for an increase of funds to inefficient districts.

The 108 schools in Category IV of this study educate approximately 5.5% (26,758) of Iowa's 489,000 students (Dunn, 1985). Multiplying that percentage by the 18% those schools were above average in their SCI equals the amount the state average cost per pupil would have to be increased to provide more equitable funding for Category IV school districts. This product is .0098, or slightly less than a 1% increase. If the State of Iowa wishes to provide equal educational opportunities for all students in the state, regardless of the district in which the students reside, then an approximate 1% increase may be an acceptable price to pay to help reach that goal. The alternative solution of eliminating small, inefficient schools may well prove to be far less acceptable to the people of Iowa. To do nothing continues the present inequities in educational opportunities due to the inherent inefficiencies existing in some Iowa districts.

3. The State of Iowa should develop an SCI that includes not only the services included in this study but also educational services provided in all grades to all students. On the basis of such a comprehensive index, funding for schools could be better accomplished. Precedent exists for such activity. The State of Iowa already provides extra funding for unique needs including special education programs, drop-out prevention programs, shared programs, TAG programs, vocational programs, and asbestos removal. The State

of Iowa should also provide extra funding to compensate for inherent inefficiencies that exist in some school districts.

4. The State of Iowa should remove the cost of transportation from the controlled budget. Districts which must spend more than average for transportation must spend correspondingly less for other educational services. The children of those districts, therefore, have less resources available for their education than students in districts with lower transportation costs.

5. The State of Iowa should conduct research and disseminate information to help Iowa School Districts improve small pupil/teacher ratios. Examples include shared teachers, shared classes, development of telecommunication programs and utilization of area community colleges.

In addition to the above funding recommendations, the researcher recommends several additional studies be effected:

1. Development of a Service Cost Index for elementary services, junior high services, vocational services, and co-curricular services.

2. Development of criteria to measure the quality of education in relation to district enrollment and per pupil spending.

3. Development of a sparsity index and related studies of the fiscal effects of rural isolation.

4. Development of criteria to differentiate between necessarily small districts and those remaining small only by local choice.

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APPENDICES

APPENDIX A

Instructional Cost Component

INSTRUCTIONAL COSTS COMPONENT=

[(5/22) * (100/85] *

[[E (Eng i FTE * Ave Sal) / (Eng i Enrollment)] +

[E (For Lang. i FTE * Ave Sal) / (For Lang. i Enr.)] +

[E (Math i FTE * Ave Sal) / (Math i Enrollment)] +

[(Typing I FTE * Ave Sal) / (Typing I Enrollment)] +

[(Art I FTE * Ave Sal) / (Art I Enrollment)] +

[(P.E. FTE * Ave Sal) / (P.E. Enrollment)] +

[E (Science i FTE * Ave Sal) / (Science i Enr.)] +

[E (Soc. St. i FTE * Ave Sal) / (Soc. St. Enrollment)]]

APPENDIX B

Administrative Cost Component

ADMINISTRATIVE COSTS COMPONENT =

$$\frac{[(\text{Total Adm. Cost}) * (\text{Market Basket FTE} / \text{Total FTE})]}{(\text{Total Enrollment})}$$

APPENDIX C

Support Cost Component

SUPPORT COSTS COMPONENT =

(Total Support Costs) / (Total Enrollment)

APPENDIX D

Transportation Cost Component

TRANSPORTATION COST COMPONENT =

(Per pupil Transportation cost) *
[(Number transported) / (Total Enrollment)]

APPENDIX E

Service Cost

SERVICE COST i =

(Instructional component i + Administrative component i + Support component i + Transportation component i)

SERVICE COST i refers to the Service Cost of the i(th) District of the study.

APPENDIX F

Service Cost Index

(Formula 1, Total Service Costs)
Total Service Costs = E Service costs i

(Formula 2, Average Service Costs)
Average Service Costs = (Total Service Costs) / 30

(Formula 3, Service Cost Index)
SCI i = [(Service Cost i) / (Average Service Costs)] * 100

SCI i refers to the Service Cost Index of the i(th) District in the study.

APPENDIX G

Jury of Experts

Name	Position	Field of Expertise
Guy Ghan	Dept. of Education, Administration and Finance Division	School Finance, School Law
Wayne Beal	Iowa Association of School Boards, Assistant Director	School Finance, Legislation
Elaine Rasmusson	Superintendent Independence C.S.D.	School Administration School Finance
Robert Longmuir	Superintendent Hudson C.S.D.	School Administration School Finance
Donald Hanson	Superintendent Hartley C.S.D.	School Finance
Fred Wessendorf	Business Manager Cedar Falls C.S.D.	Business Management Accounting
Don Guinnane	Business Manager Cedar Rapids C.S.D.	Accounting School Finance

APPENDIX H

Jury Letter

May 23, 1986

Thank you for your willingness to participate on the jury to validate the appropriateness and feasibility of the enclosed Service Cost Index (SCI) model. You will be responding to questions concerning the four components of the model.

In recent years, much concern has been expressed about Iowa schools' ability to deliver adequate educational services to students. In Iowa, school funding laws provide nearly equal dollars to support the education of each child. If a school district is inefficient, for whatever reason, it would be less able to deliver the quality and quantity of services than would a more efficient district.

The first specific objective to be addressed in my study is to construct a service cost index (SCI) for a sample of Iowa schools based on service cost differentials. The second objective will be to use the SCI to analyze the impact a school's size has on its ability to deliver educational services efficiently.

The first objective will be accomplished by the following activities. One, I will select a sample of 44 school districts from the state of Iowa. Two, I will determine a "market basket" of educational services so all comparisons are made on the same basis. Three, I will compute the Service Cost (of the market basket) of each district. Four, I will use the Service Cost of each district to compute a service cost index (SCI). Fifth, I will determine the relationship between the SCI and school size, teacher salaries, instructional costs, administrative costs, support costs, and transportation costs.

The third activity will be accomplished by using the SCI model which is enclosed with this letter. It is this model that you are being asked to evaluate. Your evaluation will be accomplished with the seven question survey which is also enclosed. I am requesting that you review the SCI model and respond to the questions in the survey. In order for me to meet my deadlines, it would be most helpful if the completed questionnaire was returned to me by June 5, 1986.

Thank you for your help.

Sincerely,

Dean Meier

APPENDIX I

Service Cost Index (SCI) Model

Total Service Cost

The total cost of delivering the services which are contained in the "market basket" is the sum of the four components shown in the formula below. The computation of each component is determined by the formulas on the following pages. The market basket contains twenty-two courses which are required in the minimum standards as set by the DPI. The total cost of delivering a service to a student requires more than just the cost of instruction; it also includes the cost of administrating that service, the cost of support activities for that service, and the cost of transportation for that service. See page two for details on instructional costs, page three for details on administrative costs, and page four for details on support costs and transportation costs. Each of the four components determines a per pupil cost. Therefore, the sum of the four components represents the per pupil cost of delivering the market basket of services.

Total Service Cost = (IC) + (AC) + (SC) + (TC)

where:

IC = Instructional cost

AC = Administrative cost

SC = Support cost

TC = Transportation cost

Instructional Cost Component

Instructional cost for each course in the market basket is determined by multiplying the number of teachers teaching the course (full time equivalency) by the average salary of the teachers. Because teachers' salary represent a large majority, but not the total cost of instruction, the product of the above computation is first multiplied by 100 and then divided by P, where P represents the percentage salary cost is of total instructional cost. (For example: If the product of FTE and Average Salary was $54,000 and it was found that teacher salaries represent 90% of instructional cost, then one would multiply $54,000 by 100 and divide by 90 to determine that the total cost of instruction was $60,000.) The formula below then sums the instructional cost of the twenty-two courses. However, the typical student does not take twenty-two courses per semester, consequently the sum of the twenty-two courses is multiplied by 5/22 to determine the cost of providing instructional services to a student enrolled in five classes per semester.

Instructional cost =

[(5/22) * (100/P)] *

[[E (Eng i FTE * Ave Sal) / (Eng i Enrollment)] +

[E (For Lang. i FTE * Ave Sal) / (For Lang. i Enr.)] +

[E (Math i FTE * Ave Sal) / (Math i Enrollment)] +

[(Typing I FTE * Ave Sal) / (Typing I enrollment)] +

[(Art I FTE * Ave Sal) / (Art I Enrollment)] +

[(P.E. FTE * Ave Sal) / (P.E. Enrollment)] +

[E (Science i FTE * Ave Sal) / (Science i Enr.)] +

[E (Soc. St. i FTE * Ave Sal) / (Soc. St.

Enrollment)]]

where:

i = the ith course of the department
P = the percentage salary cost is of total instructional cost for a given district
Ave Sal = the average salary for a teacher in a given district
FTE = the full time equivalency of the teachers teaching a given course
E = Summation Notation (for i = 1 to n) where n represents number of courses in department

Administrative Cost Component

To compute the administrative cost associated with the fixed market basket of educational services used in this study, the total administrative cost of the district is multiplied by the ratio of the market basket FTE to the total FTE of the school district. This product represents the total cost of administration for the market basket services. This product is then divided by total enrollment to determine a per pupil cost of administration for the market basket services.

Administrative costs =

$$\frac{[(\text{Total Adm. Cost}) * (\text{Market Basket FTE} / \text{Total FTE})]}{(\text{Total Enrollment})}$$

where:

Market Basket FTE = the full time equivalency required to teach the market basket courses

Total FTE = the full time equivalency of all teachers

Support Cost Component

To compute the per pupil support cost, the total support costs for the district are divided by the total enrollment.

$$\text{Support cost} = \frac{(\text{Total Support Costs})}{(\text{Total Enrollment})}$$

Transportation Cost Component

To compute the per pupil cost of transportation, the total cost of transporting students to and from school (does not include activity program transportation costs) is divided by total enrollment. This quotient gives an average cost per pupil for all students, not an average for only those who ride buses.

$$\text{Transportation cost} = \frac{(\text{Total transportation cost})}{(\text{Total enrollment})}$$

APPENDIX J

Jury Questionnaire

Name ____________________

JURY QUESTIONNAIRE

As a jury member, you will be asked to respond to the following questions regarding the Service Cost Index Model. The questions are specific and require that you rate a given concept or feature of the model by placing a check (x) on a 1 -5 scale below each question. If you elect not to answer a specific question, you may check the line to the right of the scale. In addition, there is space below each question's scale for you to add your comments if you wish to amplify or qualify your response.

Part One: Reactions to the Total Service Cost Formula

The Total Service Cost Formula is an attempt to compute the sum of the four components. All program accounts included in the SAR are contained in one of the four components.

Q 1. In your opinion, how adequately does the total service cost formula (page one of the model) sum the per pupil costs of delivering the market basket of services used in this study.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Part Two: Reactions to the Instructional Cost Component

The instructional cost formula (page two of the model) attempts to find the total cost of delivering the educational services in the market basket of services used in this study. The educational market basket includes four courses of English; two courses of Foreign Language; five courses of Mathematics, four which must be sequential; one Typing course; one Art course; one P.E. course; four Science courses; and four Social Studies courses. Once the total cost is determined, two factors are used to adjust the total so that it reflects a per pupil cost. One, a factor of 5/22 is used to adjust the total cost of 22 courses so it instead represents a total cost of 5 courses. Second, because average teachers' salary is used to represent the cost of instruction and that cost is less than the total cost of instruction, a factor of 100/P is used to adjust the total to represent the full cost of instruction.

Q 2. In your opinion, how adequately does the factor "5/22" adjust the total sum of the twenty-two courses so it reflects the cost of five of the twenty-two courses.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Q 3. Given that "P" represents the percentage teacher salaries are of total instructional cost as determined by the Secretaries Annual Report, how adequately does the factor "100/P" adjust the sum to reflect total instructional cost rather than just the total cost of salaries.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Q 4. In your opinion, how adequately does that portion of the formula that multiplies FTE by average salary and then divides the total by course enrollment reflect an approximate per pupil cost of providing instructional services for that course.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Part Three: Reactions to the Administrative Cost Component

The Administrative Cost Component (page 3 of the model) attempts to determine the per pupil cost of administrating the market basket services. A per pupil cost is found by dividing total administrative costs by total enrollment. This quotient represents the per pupil cost of administrating the entire school program. To reduce this quotient so it represents only the cost of administrating the market basket of services, it is multiplied by the ratio that the FTE of teachers teaching market basket courses is to the FTE of the total faculty.

Q 5. How adequately, in your opinion, does the ratio described above approximate the ratio of administrative time spent administrating the market basket courses to total administrative time.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Part Four: Reactions to the Support Cost Component and the Transportation Component

Both the Support Cost Component and the Transportation Component (page 4 of the model) assume that support costs and transportation costs are shared equally across all programs. Therefore, to find a per pupil cost of these services, the total cost of the service is divided by total enrollment.

Q 6. How adequately is the assumption that support costs are shared equally across all programs represented by the support cost formula on page 3.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Q 7. How adequately is the assumption that transportation costs are shared equally across all programs represented by the transportation cost formula on page 3.

1	2	3	4	5	
quite adequately				quite inadequately	no response

Comments:

Part Four: Open Questions

The next questions are offered so that you can share your impressions, comments, concerns, and suggestions about the Service Cost Index Model. Please use the attached sheets of paper for writing your responses, indicating the question number for your response.

Q 8. What is your field(s) of expertise (e.g., school finance, taxation, educational administration, accounting, etc.)?

Q 9. What strikes you as the most promising features of the Service Cost Index Model?

Q 10. What do you consider to be the limitations of the Service Cost Index Model?

Q 11. What are your suggestions for overcoming these limitations?

Q 12. In your opinion, what uses can be made of these models?

Q 13. Do you have additional comments?

APPENDIX K

Computation of Service Cost

School	A	B	Source of Data
Average Salary	22,170	16,585	Scattergram
Periods Per Day	7	7	School Schedule
Number of Sections			
English I	2	1	School Schedule
English II	2	1	School Schedule
English III	2	1	School Schedule
English IV	3	1	School Schedule
Foreign Language I	1	1	School Schedule
Foreign Language II	1	1	School Schedule
General Math	1	1	School Schedule
Algebra I	2	1	School Schedule
Geometry	2	1	School Schedule
Algebra II	1	1	School Schedule
Senior Math	1	1	School Schedule
Typing I	1	1	School Schedule
Art I	2	1	School Schedule
P. E.	4	4	School Schedule
General Science	3	1	School Schedule
Biology	2	1	School Schedule
Chemistry	2	1	School Schedule
Physics	1	1	School Schedule
Social Studies I	3	1	School Schedule
Social Studies II	3	1	School Schedule
Social Studies III	2	1	School Schedule
Social Studies IV	2	1	School Schedule

Enrollment			
English I	35	24	BEDS
English II	35	25	BEDS
English III	38	19	BEDS
English IV	56	16	BEDS
Foreign Language I	24	6	BEDS
Foreign Language II	11	1	BEDS
General Math	13	9	BEDS
Algebra I	29	22	BEDS
Geometry	38	7	BEDS
Algebra II	28	12	BEDS
Senior Math	10	5	BEDS
Typing I	13	24	BEDS
Art I	39	7	BEDS
P.E.	249	95	BEDS
General Science	60	24	BEDS
Biology	41	26	BEDS
Chemistry	24	6	BEDS
Physics	13	6	BEDS
Social Studies I	73	24	BEDS
Social Studies II	73	22	BEDS
Social Studies III	53	19	BEDS
Social Studies IV	43	27	BEDS
Total Administrative Cost	205,722	106,585	DOE
Service Cost FTE	7.167	4.167	Computation
Total K-12 FTE	44.6	23.5	SAR
Total K-12 ENROLLMENT	668	315	SAR
Total Support Cost	191,985	76,169	DOE
Per Pupil Cost of Trans.	195.5	203.43	Grant Wood
No. of Students Transported	448	228	Grant Wood

APPENDIX L

Service Cost Contributions

Service Cost Contributions	A	B
English I	$211.14	$115.17
English II	$211.14	$110.57
English III	$194.47	$145.48
English IV	$197.95	$172.76
Foreign Language I	$153.96	$460.69
Foreign Language II	$335.91	$2,764.17
General Math	$284.23	$307.13
Algebra I	$254.83	$125.64
Geometry	$194.47	$394.88
Algebra II	$131.96	$230.35
Senior Math	$369.50	$552.83
Typing I	$284.23	$115.17
Art I	$189.49	$394.88
P.E.	$ 59.36	$116.39
General Science	$184.75	$115.17
Biology	$180.24	$106.31
Chemistry	$307.92	$460.69
Physics	$284.23	$460.69
Social Studies I	$151.85	$115.17
Social Studies II	$151.85	$125.64
Social Studies III	$139.43	$145.48
Social Studies IV	$171.86	$102.38
Instruction Cost Contribution, Adj.	$1,241.92	$2,042.16
Administration Cost Contribution	$49.49	$59.99
Support Cost Contribution	$287.40	$241.81
Transportation Cost Contribution	$131.11	$147.24
Total Service Cost	$1,709.92	$2,491.20

APPENDIX M

Sample of Forty-Four Schools

Category I

Rank	Enrollment
14	5,056
19	4,466
23	3,179
31	2,588
38	2,099
40	1,957
78	1,381
90	1,181
97	1,105
99	1,097
101	1,068

Category II

Rank	Enrollment
139	799
142	754
145	737
153	724
160	696
162	693
164	692
188	631
199	601
207	575
213	563

Category III

Rank	Enrollment
233	523
253	482
255	476
277	434
278	432
282	421
290	395
299	391
301	381
307	381
309	381

Category IV

Rank	Enrollment
325	345
329	326
337	314
364	284
377	273
383	249
384	246
386	245
389	228
394	224
413	180