1954

Relationship between size of school, expenditure, and quality of education in elementary schools

Wadhawa Singh Theophilus
Iowa State College

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RELATIONSHIP BETWEEN SIZE OF SCHOOL, EXPENDITURE, AND QUALITY OF EDUCATION IN ELEMENTARY SCHOOLS

by

Wadhawa Singh Theophilus

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of The Requirements for the Degree of DOCTOR OF PHILOSOPHY

Major Subjects: Vocational Education

Approved:

Signature was redacted for privacy.

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Signature was redacted for privacy.

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1954
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I. INTRODUCTION

School expenditures in the United States have been constantly increasing. Except for the depression years of the 1930's, the school expenditures almost doubled in each decade from 1900 to the present time. The total expenditures for schools in 1900 were about 215 million dollars;¹ they increased to 2.3 billion dollars in 1930 and to 5.7 billion dollars in 1950. Such increases have been attributed to growth in pupil population, increased demand for educational services and the declining value of the dollar.

The number of pupils enrolled in schools increased from 15.5 million pupils in 1900 to 25.4 million in 1940. It was 23.9 million in 1948, but increased to 25.1 million in 1950 and to 25.7 million in 1951.² It has been on the increase since. The increase in pupil enrollment was accompanied by an increase in school expenditures until 1940. However, during the period of 1940-1948, while school expenditures almost doubled, the pupil enrollment declined over one and one half million. This is an indication that increase in expenditures was due to factors other than an increase in the number of pupils. The increase in expenditures per pupil in average daily attendance


from $20.21 in 1900 to $105.79 in 1940 and $259.00 in 1950 offered further support to this view.

The increased expenditures per pupil in average daily attendance were partially due to more educational services rendered by the schools. The schools provided many opportunities for obtaining new mechanical and social skills, emphasised science and technology, increased educational opportunities for many more pupils, offered programs of vocational education, guidance and general education, and provided educational facilities for very young children as well as adults. As the schools tried to meet these new demands for more services, school expenditure increased.

Another important factor which contributed to increased educational expenditures was the decreased value of the dollar. The value of the dollar decreased sharply after both World Wars. "From 1940 to 1947 the consumer price index rose 57 percent; the retail price index 79 percent."¹ Thus the phenomenal increase in school expenditure was largely due to the increase in educational services and less purchasing power of the dollar.

This increase in school expenditures was not accompanied by corresponding changes in the means of financing education. The local government could tax only one source of wealth, i.e., the real property. The important forms of wealth such as industrial productivity,  

stocks, bonds, and personal services were beyond its jurisdiction. Differences in the ratio of assessed values to true values and distribution of wealth among communities produced inequalities in educational services available to children as well as in the burden of educational support.

Most of the states utilized sources of revenue which were not within the taxing power of local schools to provide funds for a state-wide minimum educational program. All or part of the general sales tax, special sales tax, motor-vehicle tax, liquor tax, severance tax, business license tax and income tax were used by various states to provide revenue for school purposes. In 1900 the state sources provided 17.2 percent of the total school expenditure but in 1950 the share of state sources rose to 39.8 percent.

In Iowa the picture was not much different from that of the nation. In 1900, total general fund expenditures in the state amounted to a little more than seven and one half million dollars. In 1930 they reached a total of forty-eight million dollars, but declined to forty-two million dollars in 1940 on account of the depression. They more than doubled in the next decade, being one hundred and seven million dollars from general funds alone in 1950.¹

Unlike the nation, enrollment has not increased in Iowa during

¹Iowa Department of Public Instruction. Biennial Reports of the Iowa Department of Public Instruction, 1900-01, 1930-31, 1940-41, 1949-50. Des Moines, Iowa: Department of Public Instruction. 1901, 1931, 1941, 1950.
the past fifty years. It declined from 562,662 pupils in 1900 to 477,120 pupils in 1950. Iowa did share with the nation the consequences of inflation and resulting decrease in the purchasing power of the dollar. Similarly in Iowa, as in the nation, demands were made upon the schools to provide more and better educational services. The increase in school expenditures until 1950 in Iowa could not be due to increases in pupil enrollment. The increases in expenditures may have resulted from expansion of educational services, from the declining value of the dollar, or both. The picture has changed somewhat during the recent years. The Research Division of the Iowa State Education Association stated in 1953:

During the past several years there have been three factors at work in our school systems which tend to increase the cost of education. The first of these is increased price levels due to the inflationary trend in operation since the end of World War II. The second is the increased school enrollments brought about by the increased birth rates during the war period and thereafter. The third which is closely related to the second, is the increased requirement for new buildings.

The result of these three factors operating in Iowa has been to increase the total cost of education in this state from $105,000,000 in 1948-49 to $144,500,000 in 1951-52. The Department of Public Instruction estimates that the total cost of the schools in the state for the 1952-53 school year was in excess of $162,000,000, which is a considerable increase over the preceding year. These increases have been borne largely by the local property taxpayer because very little increase in state support of schools has been made during the last four years.

More and more school funds were needed to take care of the increased enrollment, the demands for more and better educational services, and the continuing inflationary condition. The need for increased revenue resulted in a steep rise in tax levies. The tax-conscious public usually has been reluctant to approve increased levies on real property, regardless of how urgent the need may have been. The local school districts could not finance the educational program without additional financial assistance from other sources.

The Iowa legislature has provided an increased amount of state aid for public schools. The total amount of state aid increased from about three million dollars in 1945 to almost 19 million dollars in 1953. But in spite of this increase, it was only 11.65 percent of the total cost of education of $162,607,000 in Iowa in 1953. This percentage was much below the national average of 39.7 percent in 1951. Pressing demands have been made upon the state legislature to appropriate larger sums of money from state funds for support of education. The pressure for more financial assistance from state sources was accompanied by demands for greater financial efficiency and more adequate educational programs than small, weak districts could provide.

Chase and Morphet¹ have summarized data to show that the 12 states in the United States having the most school districts, an

The present study, therefore, was undertaken to determine the relationships between the size of school and the cost of education. These are explored later.

With secondary education, there are two studies were found which explored these relationships.

Only two studies were found which explored these relationships.

It became important to indicate therefore whether it is better...

Local districts

with a smaller number of teachers better organized and larger

appear that states that have been ever to secure in those states

General have experienced the more recent movement of state aid, it seems

have taken from state sources. Since local school districts...

90 districts have from state sources, as shown by the data of only

It states having the lowest school districts, in average of only

of the cost of education from state sources of revenue, and the

average of 4966 school districts per state, provided 90.7 percent

-6-
children attended private schools or schools in select districts.

In some instances pupils from other districts, and a number of
the public school or schools of the same district, must
attend. But all children of a school district do not go
boundaries of the school district, i.e., the enumeration of the

total number of children of school age residing within the legal
size of a school district may be measured in terms of the

A. Measures of size of school and cost of education

- Size and quantity relationship of size, cost and quantity
- The size and quantity relationship of size and quantity
- Measures of size of school and cost of education

Size and quantity relationship was studied in this major section, namely,
noted. The discussion was devoted to the problem of the present study were
expanded or more pertinent to the problem of the present study were
- Some were attempted. However, some individual studies which were
noted, only some which are general contains

II. REVIEW OF CERTAIN RELATED LITERATURE

- A number of studies have been made to investigate the nature...
To avoid such complications, it has been found convenient to report the size of a school in terms of enrollment, separately for elementary and high schools. A still finer measure is the average daily attendance. In research studies average daily attendance has usually been used as a measure of the size of the school.

The total expenditure includes capital outlay and debt services which tend to show considerable variation from very high for a period of years to very low for another period of years. Current expenditure alone is considered a good index of the cost of education. Influence of total expenditure is not altogether ignored by considering current expenditure alone as current expenditure over a period of years has a close relationship with total expenditure.

Expenditure for transportation is generally eliminated from the current expenditure. This expenditure compensates for the factor of sparsity of population but does not directly contribute to production of better quality of education. Mort shared the argument and said,

Transportation expenditure, where it is resultant of sparsity of population, should be eliminated. There seems to be no reason to believe that transporting children to school, even though it costs money, is reflected in the educational program in the school as
compared with schools of similar size and support.\textsuperscript{1}

Grims\textsuperscript{2} did include expenditure for transportation in his study in which he tried to answer the question, "To what extent does cost level influence the educational offering and environment of elementary school children in small city districts, ...?"

Another way to measure cost of education is to eliminate expenditure for tuition for children to other schools. Powell\textsuperscript{3} studied the relationship between current school expenses and educational outcomes in one-teacher schools. He took the current expenditure of the school as a measure of expenditure and designed his study accordingly. He did not count the cost of transportation and payment to other districts for tuition as part of the current expenditure. Since all the districts had almost the same cost-of-living status, no correction for cost-of-living was necessary.

Other measures of cost of education include corrections for various factors known to exercise disproportionate influence among


\textsuperscript{3}Powell, Orrin E. Educational Returns at Varying Expenditure Levels: A Basis for Relating Expenditure to Outcomes in Education. New York: Bureau of Publications, Teachers College, Columbia University. 1933.
several schools. Such factors include cost-of-living, sparsity of population, high school–elementary cost differential and regional differences. Grima in his above-mentioned study, used current expenditure per pupil in average daily attendance. He included transportation expenditure. Choice of size range eliminated the small school sparsity factor. The use of elementary schools only avoided the high school–elementary cost differential. The cost-of-living differential was omitted but the error was greatly reduced by omitting Cook County (Illinois) schools.

In his study, The Cost-Quality Relationship on the Growing Edge, Woollatt took account of various corrections such as transportation, sparsity, payments to other districts for tuition, high school–elementary cost differential, cost-of-living differential and the regional differences because the schools used in the study came from two states.

The pupil unit might be a classroom, a weighted classroom, a weighted pupil, a pupil in average daily attendance or a pupil enrolled, depending upon the purpose of the study. The expenditure per pupil in average daily attendance is considered to be the best index of cost-of-education. This measure has been widely used in studies when cost of education is a factor of the investigation.

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and is used as the cost measure in this study.

B. Measure of Quality of Education

Quality of education has defied definite and precise definition and measurement. Investigators have differed in their definitions and measures of quality. For example, Peck¹ defined the quality of education as the number of units of educational opportunity or number of subject offerings. He measured quality of education by the breadth of subject offerings.

Other authors, in order to avoid confusion and criticism, have used a variety of words and phrases descriptive of the quality of education. The literature dealing with quality of education is full of such phrases as "educational opportunity", "favorable school characteristics", "desirable or recommended practices", "educational efficiency", "outcomes in education", "special public school services", and "adaptability of public schools". Adaptability has been defined as "the capacity of a state school system to respond to changing demands on public education by casting off obsolete functions and methods and taking on new ones."² It has


been assumed as a good index of quality of education by many educators. Powell\(^1\) used the results of achievement tests as an index of quality of education and termed it "outcomes in education". Most other authors have used what Mort\(^2\) calls the normative approach -- what the schools do with children to affect their individual strength and happiness as well as the national welfare. They measured quality of education by the character of program being offered children -- what was taught and how it was taught.

Consensus of expert opinion is that quality of education is a complex of achievement, character of program -- both what is taught and how it is taught, administrative and structural setting, adaptability, and contribution to improvement of the level of adult living. It is a dynamic concept. Any list of items used today will prove too narrow in the light of insights of five years hence.

A number of instruments have been devised and used to measure quality of education. They include various types of check lists, rating scales, guides for self-appraisal and measures of adaptability. A few important ones may be briefly mentioned here.

\(^1\)Powell. \textit{op. cit.}

\(^2\)Mort. \"Cost-Quality Relationship in Education\". p. 11.
1. **Achievement tests**

Tests of achievement appear to be a good measure of quality of education. Their superiority rests on the argument that they attempt to measure achievement itself rather than the conditions which are assumed to produce educational results. Little objection could be raised to defining quality in terms of achievement test scores if all of the important objectives of education could be evaluated by such tests. Some types of achievement such as personality growth, social adjustment and character cannot be directly and objectively measured.

The achievement tests at the present stage of development do not test for use, application, and permanence. They are too narrow in scope. Mort cautioned against too much reliance on achievement tests.

Accordingly, achievement testing as it has developed at the present stage is both too narrow and too shallow to measure other than the differences in the lower expenditure levels of education.¹

Powell used achievement tests in reading, spelling, language usage, health knowledge, history and civics, geography, elementary science, arithmetic, and "happiness". At the low level of expenditure, he found major differences favoring the

higher expenditure group in all the tests.

2. New Jersey school survey commission's check list

In 1930, Mort and Hilleboe\textsuperscript{1} constructed "A Rating Scale for Elementary School Organization". The New Jersey School Survey Commission\textsuperscript{2} adapted an extensive check list from this scale and used it in survey of schools in New Jersey in 1932-33. The elementary check list had 6 major divisions, 53 subdivisions, and numerous sub-items. The high school list was still more lengthy and extensive.

3. Ferrell's efficiency index

Ferrell studied the relationship between current expenditure per pupil and efficiency, which he measured by the following five-item index:

1. Percent average daily attendance is of the census.

2. Holding power measured by the average of the sum of (a) percent eighth grade enrollment is of first grade enrollment and (b) percent high school enrollment is of the total public school enrollment.

\textsuperscript{1}Mort, Paul R. and Hilleboe, Guy L. \textit{A Rating Scale for Elementary School Organisation}. New York: Bureau of Publications, Teachers College, Columbia University. 1930.

3. Percent of teachers employed who have a given amount of preparation.

4. Percent of teachers employed who have had three or more years of teaching experience.

5. Percent the number of teachers is of the number of pupils.

6. Percent the number of days in the elementary school term is of 200 days.\(^1\)

4. Mort-Cornell Guide\(^2\)

This instrument was developed in the middle 1930's for use in adaptability studies. It sought to take account of all phases of the school program as it was then understood. It was used to note the presence of what were considered to be good practices. It was first used in an extensive study of Pennsylvania and reported in *American Schools in Transition*.\(^3\) It was used in many other studies, but in 1942 when it was applied to the Metropolitan School Study Council school systems, the field workers reported 900 notes dealing with practices that struck them as good but which they felt were not reflected in this guide. Another guide\(^4\)

\(^1\)Mort. "Cost-Quality Relationship in Education". p. 31.


\(^3\)Mort and Cornell. *American Schools in Transition*.

of 1091 items was developed by Mort, Burke and Fisk. This revised guide was used in the educational Conference Board Study of New York State in 1942-43.\(^1\) Vincent\(^2\) combined the 15 divisions of this guide into 12, with 32 sub-classifications and used the new instrument for his study. In 1947, McLure\(^3\) selected 153 of the 183 items in the Mort-Cornell Guide, and rated a number of Mississippi schools in his study on a scale of none, little, some, much, and very much.

5. **Evaluative Criteria\(^4\)**

The Committee of Cooperative Study of Secondary School Standards developed a very detailed instrument to evaluate a school system with a high degree of objectivity and validity. Each of the ten major divisions in Evaluative Criteria is divided into a number of sub-divisions and each sub-division contains a large number of additional items. Instructions for use and statement of guiding principles are given at the beginning.

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of each division. Each characteristic or statement is to be separately marked and at the end of each sub-area evaluation is made on the basis of verification and personal observation and judgment. The evaluation process is so thorough and complete that a manual\textsuperscript{1} of 139 pages was published to accompany the 1940 edition.

6. \textit{A Time-Scale}\textsuperscript{2}

The Mort-Pierce Time-Scale is a measure of long time adaptability, which shows whether or not a community may be expected to adjust readily to new forces and new knowledge. It attempts to find out at what stage of the diffusion of a given adaptation a community introduced it. In contains 22 adaptations of educational inventions and practices, considered desirable by authorities. Assumption is made that the earlier a community adopts a new practice, the more adaptable it is. The score is based upon the date of introduction of each adaptation, the earlier the date, the higher the score. Method of scoring and standard scores based on schools of the Metropolitan School Study Council are included in the booklet.


7. **How Good Is Your School?**

The Department of Public Instruction of Iowa designed a pamphlet to serve as a guide for lay people in evaluating the effectiveness of the local school. It contains seven major divisions in the areas of curriculum, guidance, instructional material, the school plant, instructional staff, school administration and community relations. Each division has 3 to 13 questions that contain two to eight sub-questions each. Each question may be scaled as above average, average, and below average.

8. **Rating on the ten imperative needs of youth**

Ransom\(^1\) developed a check list to evaluate the program or quality of a school in terms of meeting the ten imperative needs of youth. The check list was validated by the expert judgment of 100 educators. Fifteen to twenty-three characteristics were grouped under each need. Blank space was provided for additional characteristics. A six-point scale \((1, 2, 3, 4, 5, 6)\) meaning did not apply, very inferior, inferior, average, superior, and very superior respectively) was used to give a numerical value to each

\(^1\) State of Iowa, Department of Public Instruction, Division of Administration and Finance. *How Good Is Your School?* Des Moines: The State of Iowa. 1948.

characteristic.

The schools could be re-scored on the same characteristics, regrouped under the six major divisions; i.e., curriculum, community relations, pupil relationships, study of pupils, evaluation of activities, and guidance.

9. Community School Criteria Check List

Cushman\(^1\) developed a community school criteria check list to measure the degree to which a school approached the community school ideal. Christensen\(^2\) used the original check list of 150 items for his study but Underwood\(^3\) who sought to determine the reliability and validity of the check list, shortened it to 100 items by means of item analysis. Theophilus\(^4\) used the 100-item check list to evaluate certain schools in Iowa.


10. The Growing Edge

Many of the instruments developed to measure quality of education proved satisfactory in evaluating the scope of the program but did not do well in determining its character. They measured breadth but not the depth. How to teach was considered as important as what to teach. The measuring instrument should reflect not only variety and scope of the program but also permanence and application of learning. Mort, Vincent, and Newell started on this lead and worked on the assumption that whatever was taught realistically through real life situations or their nearest approximation was likely to be applied more in the solution of problems of daily life and also to last longer. In The Growing Edge an attempt was made to get at the depth of the program and also at the way knowledge and skills were taught the children. The specific practices included in the instrument were organized around four major areas, namely, (1) the teaching of the basic skills, (2) the teaching of the areas of knowledge, (3) discovery and development of special aptitudes of individuals through tests and tryout, (4) development of gross behavior patterns like citizenship, character and thinking.

Mort's evaluation of some of the instruments is given in

Table 1

The 1951 Ten-Item Check List

Application of Ten Tests to the Various Instruments Utilized in the Studies Reviewed in Section I

<table>
<thead>
<tr>
<th>Tests of instruments</th>
<th>Growing Edge (22)</th>
<th>Mort-Burke-Fisk (17)</th>
<th>Mort-Cornell (20)</th>
<th>New Jersey 1932-33</th>
<th>Grimm (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Skills, Brodened Scope</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>2. Skills, Realism</td>
<td>A</td>
<td>B+</td>
<td>B+</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>4. Knowledge, Useful</td>
<td>B</td>
<td>B-</td>
<td>B-</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>5. Knowledge, Realism</td>
<td>A</td>
<td>B</td>
<td>C+</td>
<td>C-</td>
<td>D</td>
</tr>
<tr>
<td>6. Aptitudes, Discovery</td>
<td>B+</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>7. Aptitudes, Development</td>
<td>B+</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>8. Behavior Habits</td>
<td>B+</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9. Mental and Physical Health</td>
<td>X</td>
<td>B-</td>
<td>B-</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>10. Use of Citizen Resources</td>
<td>X</td>
<td>C</td>
<td>C</td>
<td>D</td>
<td>X</td>
</tr>
</tbody>
</table>

1 Source: Mort. "Cost-Quality Relationship in Education". p. 16.
Six plans were suggested for using this guide. Any one of these methods be followed according to the convenience and aptitude of the worker.

The study of elementary education in the elementary schools of the South is based on the assumption that the cooperative study of elementary schools led to the selection of superior and more efficient methods of education. This statement is supported by the other instruments. This statement of the

Table 1.
priateness of local conditions. Its plan of organization contained five major sections:

A. Viewpoint (Values, outcomes, and how these are inter-related)

B. Functions (goals, tasks and opportunities of the elementary school)

C. Program (knowledge of children to be taught, scope, organization, the teaching-learning process)

D. Resources (plant, permanent facilities, materials, staff)

E. Planning (community planning, pupil-parent-teacher planning, faculty planning, pupil planning)

Evaluating the Elementary School consisted of more than 300 pages. It could be advantageously used for self-appraisal of a school system but it was considered too lengthy to be used in the present study.

Mort\textsuperscript{1} classified the various instruments into four major levels or categories.

(a) The Achievement Tests

They are too narrow and limited in scope at the present level of development. They do not test for use and permanence. Their scope may be extended in the future by testing into more fields of knowledge. There is no direct relationship of the

\textsuperscript{1}Mort. "Cost-Quality Relationship in Education". pp. 56-60.
He concluded that a composite evaluation method be used in

the research as well as depth of the program.

Some of the evaluation instruments attempted to get at the

(a) Characteristics of the Program

- Expenditures

pursuing; the all of which bear a direct relationship with
special classes, supplies, books, transportation for class,
which are involved with these deeded with teachers, materials.
They pose a special problem for cost-benefit analysis.

(b) Administrative and Personnel Costs

- To exceed expenditures

of the things on the school that are generally directed toward
about only. They do a good job of measuring the scope of the program

(c) Check Lists

measure by these tests to the object of expenditure.
a reasonably sharp instrument that will reflect
the differences in schools in scope and quality.¹

On the basis of this recommendation, four instruments were
used to measure quality in this study; i.e., The Growing Edge,
The Mort-Pierce Time-Scale, The Community School Criteria Check
List, and Iowa Basic Skills Tests.

C. Relationship between Size and Quality

The studies of relationship between size of school and qual-
ity of education are in general agreement that a positive rela-
tionship exists between the two. As the size of a school increases,
its educational program generally improves.

The National Commission on School District Reorganisation
found the educational program of smaller schools very inadequate:

They cost much more per pupil than larger schools
but they have too few teachers to make possible a well-
balanced program. The boy who wants to farm, the girl
headed toward office work, and the boy preparing for
medicine all have the same program. There is little
or no music or art education, physical education, or
guidance. Vocational education is either lacking or
offered in one or two fields at most ....

Few of these little schools do a good job even of
teaching the three R's. There are no supervisors or
guidance workers to whom teachers can refer problem
cases. The equipment is meager. Macksift labora-

¹Mort, "Cost-Quality Relationship in Education". p. 59.
tories and shops offer small stimulation to either
gifted or slow pupils.¹

Dawson² reported that the minimum size of satisfactory at-
tendance area of an elementary school must be an elementary
enrollment of 240 pupils. The smaller schools were less effec-
tive in reaching educational objectives in grade organization,
curriculum, pupil-teacher ratios, age-grade and grade-progress
status of pupils, achievement of pupils, training and experi-
ence of teachers, and length of school terms.

Thorpe³ studied the extent of desirable practices provided
in different types of school organization. His check list con-
sisted of 819 items pertaining to good educational practices.
He concluded that the elementary school children from larger
schools were distinctly favored over those from smaller schools
of less than 150 pupils. Mort and Cornell in their study of
adaptability in schools of Pennsylvania, found that size of
school affected its adaptability. The larger schools were the

¹National Commission on School District Reorganization. A
Key to Better Education. Washington: National Education Asso-

²Dawson, Howard A. Satisfactory Local School Units.
Field Study No. 7. Nashville, Tennessee: Division of Surveys
and Field Studies, George Peabody College for Teachers. 1934.

³Thorpe, Norman F. Extent of Desirable Practices Provided
Under Different Types of School Organization Now Prevalent in
Nebraska. Unpublished Ph.D. Thesis. Lincoln, Nebraska: Univer-
sity of Nebraska Library. 1950.
most likely first introducers of improved procedures and programs. They concluded that:

1. Larger communities score significantly higher on the general measure of adaptability.

2. The larger districts have higher tax rates for non-educational purposes, better trained teachers, a higher combined index of community life, better administrative services and leadership, and more ideas from the outside reported by teachers.

3. There is no necessary identity between the "urbanness" factor and the size factor as studied. The implications are that large districts, regardless of urbanness, favor adaptability.¹

Chisholm and Cushman² reviewed the research and professional recommendations concerning the relationship of programs of school finance to the reorganisation of local schools. Their conclusions in regard to the relationship of size and quality of education were:

1. As the size of the school becomes larger, up to a certain limit, the quality of its educational program generally becomes more satisfactory


and the per capita cost of its education program generally declines.

2. The per capita cost of education and the quality of the educational program are generally considered unsatisfactory in elementary school attendance units having fewer than 175 to 200 pupils.

3. School district reorganization generally may be expected to result in: the same educational program at a lower cost; (or) an improved education program at the same cost.

D. Relationship between Size and Cost

Educators and administrators have carried on studies of the relationship between size and cost of education. The conclusions of Chisholm and Cushman, quoted in the last section provided evidence to the fact that per capita cost of education is unsatisfactory for elementary attendance units of less than 175 to 200 pupils; that the larger schools cost less per capita than the smaller ones; and that the larger schools can provide a better educational program at the same cost or the same program at a lower cost than the smaller schools.

Dawson\(^2\) in his study, "The Organisation and Financing of Rural Schools", indicated that the cost per pupil in the ele-

\(^1\)Ibid. p. 103.

mentary schools tends to decrease rapidly up to an enrollment of 100 pupils and to a lesser extent up to 200 pupils.

Mort and others, in the National Survey of School Finance, found that the per pupil cost in elementary schools of less than 40 pupils was 38 percent higher than that of the schools of more than 200 pupils.

Regarding the relationship of size and per pupil cost the National Commission on School District Reorganization had the following to say:

Size of the school and the cost of education are directly related. In general, the smaller the school the higher the cost per pupil, and the smaller the administrative unit the smaller the schools maintained.2

E. Relationship between Cost and Quality

The cost-quality relationship has been subject of many research studies during the last two or three decades. As indicated earlier quality has been defined and measured in different ways by more than a dozen different instruments.


In the earlier studies, quality was evaluated in terms of the administrative and structural setting including such factors as teachers' salaries, special classes, supplies, books, etc. Criticism has been voiced that all these factors were direct objects of expenditure and the measure of quality "loaded" with them, presumably indicated a higher degree of cost-quality relationship than that which might actually exist. To avoid such logical criticism, leads were taken to measure quality by educational practices not charged as directly related to expenditure.

Powell\(^1\) measured quality with achievement tests in various subjects. He found major differences favoring the higher expenditure group. His results differed from those of the Illinois\(^2\) study, which showed that the skill subject achievement average scores rose from the low level schools to the middle level ones, but no farther.

In the middle thirties, the emphasis shifted to measuring quality in terms of recommended and desirable educational practices and procedures. In the school finance survey of New

\(^1\)Powell. *Educational Returns at Varying Expenditure Levels: A Basis for Relating Expenditure to Outcomes in Education.*

\(^2\)Grimm. *Our Children's Opportunities in Relation to School Costs.*
Jersey\(^1\), check lists of more than a thousand items each -- both cost and non-cost items -- were used to evaluate the program of elementary and secondary schools. The cost items showed a relationship to levels of expenditure in 87 percent of the cases both for elementary and secondary schools. But surprisingly enough, the non-cost items showed such relationship in 70 percent of the items in the case of elementary schools and 77 percent in the case of high schools. Mort concluded that

1. School districts which spend more tend to buy more of the sorts of things which are at the time considered good by educators in general.

2. Schools which spend more get a higher quality from administrators, supervisors, and classroom services, ... even when no relationship is apparent between the patterns of behavior and the amount of money spent.\(^2\)

Vincent\(^3\) found similar phenomena in his study. His field workers observed 165 noteworthy adaptations -- unusual and outstanding practices to meet specific and local needs, in middle and high expenditure schools as against only 13 in the low expenditure ones. About half of these adaptations required no extra equipment, supplies, or teachers and consequently did

\(^1\)New Jersey. *Reconstruction of the System of Public School Support in the State of New Jersey*.


\(^3\)Vincent. *Emerging Patterns of Public School Practice*. 
not in and of themselves cost any more to have than not to have.

Morl's conclusion on this particular point was that

In general, it may be said that whether or not the items selected for the description of a good school can be definitely earmarked as cost items, they will be found pretty generally more often in high expenditure schools than in the low. In other words, in the higher expenditure schools the educational operation is a more favorable one, whether it is measured in terms of the adequacy of offering or in terms of the kind of behavior associated with learning.¹

Morl summarised more than thirty research studies on cost-quality relationship for the National Conference of Professors of Educational Administration. He summarised his conclusions:

Studies of the relationship in acceptably organized districts suggest that schools that spend more contribute more to the lifelong personal happiness of their charges and to the social and economic strength of Americans as a people ....

The above conclusions may be stated in greater detail as follows:

1. The presumptive relationship appears to hold through all levels of expenditure as yet-experienced in public education ....

2. There is presumptive evidence that even the highest expenditure public schools do not begin to approach the point, if there is one, where the relationship drops off, and no school is so poorly supported as to be lacking in important values.

3. The presumptive relationship is an accelerating one. Those who spend more appear generally to contribute more per dollar to individuals and to our national life

than those who spend less.

4. As expenditure levels go up, the expenditure generally takes upon itself more of the characteristics of a productive investment for the nation. ¹

F. Interrelationship of Size, Cost and Quality

Some authors who measured quality in terms of special services, teacher salaries, breadth of educational opportunity or desirable educational practices, have considered the interrelationship of size, cost and quality. Conclusions of some of the more important studies only may be summarized here.

Burke studied the interrelationship of special services, pupil-teacher ratio, and size of school district. He reported that

1. Where the ratio exceeds 25 the lowest number of services is found, six on the average. Between 22 and 25 the median number provided is nine, .... The highest average number of services is provided where the ratios range from 18 to 22. Below 18 the number of services decreases, reaching 8 where the ratio is under 16. This is the effect of small size, which means low ratios and meager offerings.

2. Elementary schools with less than 100 pupils have the same median expenditure level as those with 100-299 pupils. Yet, the median number of special services provided in the first group is only three, while in the second group it is eight. The median expenditure level for the group 200-299 is higher than for the group 300-399, but the median number of services provided in the first is only 9 as compared with eleven in the second.

¹Ibid. pp. 9-10.
The relationship between the state of the school and the teacher's preparation for their particular work.

The poorest teachers who had little preparation for their particular work.

Preparation, poor readiness for literacy and numeracy, a low level of teacher education with small enrolment and stagnation in the other cost per school was the attainment area as well. They concluded that the matters involved proportion in the schools in Kentucky. The school districts.

Health and classroom student enrolment, cost and the classroom.
great significance for a comparative study. He sought to answer the following questions: 1. What was the effect of the size of secondary schools upon the breadth of educational opportunity? 2. What was the effect of the size of secondary school upon the cost per pupil? 3. When breadth of opportunity was considered, what was the relative cost per pupil in schools of various sizes? 4. What were the absolute and desirable minimum sizes necessary for secondary schools to provide adequate educational opportunity at a reasonable cost? On the basis of this study, he concluded:

1. The breadth of educational opportunity provided in the secondary schools is directly related to the size of the schools. As the size of the school increases, the scope of educational opportunity becomes broader.

2. The size of secondary schools has a negative effect upon the cost per pupil. As the school increases in size, the cost per pupil decreases.

3. The size of secondary schools has a much more pronounced effect upon the actual cost, in terms of units of educational opportunity, than is revealed by cost per pupil.

4. The minimum size necessary for six-year secondary schools to provide an adequate breadth of educational opportunity at a reasonable cost is 500 pupils. In the schools having three- or four-year programs, the minimum size should not be less than 450 in membership....

5. Unless the schools are of adequate size to provide substantially equivalent educational opportunity for an equal expenditure per pupil, a comprehensive minimum foundation program for administering state support does not provide equal educational opportunities.¹

¹Ibid. pp. 175-76.
In 1952, Peck\(^1\) made a study "to determine the relative influence of both size of school and cost of education in determining quality of education in the school districts of Iowa which maintain high schools." He sought to answer the following specific questions:

1. What is the relationship (a) between size and quality, (b) between cost and quality, and (c) between size and cost?

2. What is the relative influence of both size and cost upon quality?\(^2\)

He concluded:

1. The size of school had a positive relationship to the quality of educational opportunity. As the size of the school increased, the average number of units of educational opportunity also increased.

2. There was an inverse relationship between size of school and cost per pupil; as the size of the school increased, the per pupil costs declined.

3. As the size of the school increased, the average cost per pupil per unit of educational opportunity decreased.

4. Although size of school and cost per pupil were both reliable predictors of quality of education, the former was 7 times as important as the latter.\(^3\)

He further stated that:

---

\(^1\)Peck. op. cit.

\(^2\)Ibid. p. 112.

\(^3\)Ibid. pp. 113-15.
The general conclusion is that size of school was a more important determinant of the quality of education in the 831 Iowa high schools than was educational cost. While this conclusion might imply that, in terms of state policy, the state might spend considerably more effort in reorganising its school districts, such an implication should not be drawn until a similar study of these relationships among elementary schools has been made. ¹

The present study has been undertaken to investigate such relationships, i.e., to determine the relationships between size, cost and quality of education in the elementary schools of Iowa.

¹Ibid. p. 115.
III. PROCEDURES OF THE INVESTIGATION

This study was designed to determine the relationship between both cost of education and size of school, and quality of education in elementary schools in Iowa.

A. Delimitation of the Study

Iowa had 4,652 legal school districts of various sizes and performing a variety of educational functions in 1949-50. Some school districts maintained both elementary and high schools, some elementary schools only, some one-room rural schools, and some no school at all. Such districts might have no children of school age or might send all the pupils to a neighboring district as tuition pupils. It was neither possible nor desirable to include all the elementary schools in Iowa, because the conditions found in one-room rural schools were in no way comparable to those of elementary schools in large cities. The investigation was limited to the school districts maintaining 12 grades with an enrollment of 200 or more in the elementary school. The districts having more than one elementary school attendance unit, or school building, were also excluded.

Some of the reasons for such a selection may be briefly enumerated as follows: (a) Continuation of one-room schools was
assumed to be contrary to the principles of democracy and equal educational opportunity for all children. The existence of such schools could only be tolerated as a necessary evil on the grounds of sparsity of population, natural barriers or other good reasons.

(b) The results of various studies and the opinions of experts indicated that an elementary school, in order to be effective in its program without being too expensive, should have at least one teacher per grade for grades kindergarten to 6, and with 25 to 30 pupils per teacher an enrollment of 175 to 210 pupils. (c) The Fifty-fifth General Assembly of the State of Iowa partially recognized the importance of size of school and enacted

Section 3. Minimum standards. No new school district shall be planned by a county board of education nor shall any proposal for creation or enlargement of any school district be approved by a county board of education or submitted to electors unless there reside within the proposed limits of such district at least three hundred persons of school age who were enrolled in public schools in the preceding school year."

An enrollment of 300 pupils is approximately 23 per grade or a total of 207 in grades kindergarten to eight inclusive. (d) The school districts of large towns and cities, having more than one elementary school building could not be categorized with the districts having only one elementary school, as they had one administrative unit but two or more attendance units. Separate attendance

units might have widely divergent per pupil costs. (a) The
cost of providing a good program of education in small schools
was so enormous that the very small schools could not afford to
develop a good program. The evidence of how much it would cost
to provide a good program in a very small school could not be
obtained in schools of Iowa. So, the schools, smaller than 200
elementary enrollment were excluded.

A list of 255 school districts maintaining twelve grades
of instruction and having an enrollment of 200 or more in the
elementary school but not more than one elementary attendance
unit, was developed from the Iowa Educational Directory¹, 1952-
53.

It was assumed that a fifty percent sample would be repre-
sentative of all the schools in this category. The 255 schools
were alphabetically arranged and consecutive numbers from one to
255 were assigned. By the flip of a coin, it was decided to in-
clude the schools with an even serial number. Thus, 127 selected
schools were used for this study.

B. Definition of Terms

The following definitions of terms were adopted for the

¹The State of Iowa. Iowa Educational Directory, School Year
purposes of this study.

1. Size of the school was the average daily attendance in kindergarten and grades one to eight inclusive, both resident and non-resident.

2. Cost of education was the average cost per elementary pupil (including both resident and tuition pupils) in average daily attendance. Transportation costs were excluded. The same definition of per pupil cost that was adopted by the Fifty-fifth General Assembly of Iowa for determining non-resident tuition payments was used in this study. This cost included "expenditures from the general fund or general control, instruction, auxiliary agencies except transportation costs, coordinate activities, operation of plant, maintenance of plant, fixed charges including insurance on buildings and contents, capital, interest paid for debt service from the general fund, interest paid for debt service and retirement of bonds from the school house fund."¹

3. The pupil achievement was the score obtained by the pupils of grades four, six and eight, of the schools studied, on Iowa Basic Skills Tests of Reading, Vocabulary, Work-study, Language, and Arithmetic. The scores of the three grades on these five skills were added together and divided by 15 to obtain an

average score. To simplify computation each score was multiplied by 10, and 587 (the lowest score) subtracted from each score.

4. The community school score was the total number of affirmative answers to certain parts of the Community School Criteria Check List containing 100 items. The Sections II B and III which deal with the program of the secondary school and community services were excluded, leaving a total of 55 items.

5. The adaptability score was the score obtained by a school on the elementary form contained in The Growing Edge: An Instrument for Measuring the Adaptability of School Systems. The teachers of grades 2, 4, 6, and 8 were asked to check the practices which they followed in their daily classroom teaching. The total number of practices checked by the teachers of a school were added and divided by the number of teachers reporting.

6. The Time-Scale score was the score obtained by a school on the twenty-two adaptations contained in A Time-Scale. This instrument was published in 1947, so the table for scoring did not contain score points after 1946. The practices which were reported to have been introduced later than 1946 or for which no particular year was mentioned were given the score point of 1946.

7. Quality of education was defined as a composite of the pupil achievement, the community school score, the adaptability
score, and the Time-Scale score. The composite scores were changed to standard scores, with a mean of 100 and standard deviation of 30, and were called standard scores of quality.

C. Sources of Data

The data used in this study were secured from a number of sources.

The figures for average daily attendance and cost per elementary pupil in average daily attendance were secured from the official records of the Iowa Department of Public Instruction, Des Moines, Iowa. These records were completed from the approved official reports submitted by the county superintendents of schools to the Department of Public Instruction.

Mert recommended the use of measures from all levels to obtain a composite evaluation of quality of education. A number of available instruments designed to evaluate school systems were examined. With the exception of Evaluating the Elementary School, all of them were found to be designed to evaluate high schools also. Most of them were developed for the purpose of self-appraisal and self-improvement of school systems. The teachers and administrators could use them for self-evaluation

with great advantage. They were very detailed and exhaustive. In fact, most of them, including *Evaluating the Elementary School*, were found to be too lengthy for use in a study of such scope as the present one. *The Growing Edge* contained a separate form of 64 items for evaluating an elementary school. It was also rated by Mort as the most superior to evaluate both breadth and depth of the educational program. *A Time-Scale* was designed to measure how early a community adopted recommended practices. The reliability of both the instruments was tested by their authors. It was stated that

The reliability of the instrument [*A Time-Scale*] obtained by the split-halves correlation technique is .84. Application of the instrument to a group of communities in the top fifth of expenditure in the United States revealed a range of scores from 44 to 126, with a mean of 78. The same instrument applied to a group selected as typical of 138 schools in the State of West Virginia revealed a range of scores from 34 to 86.¹

Test of reliability [of *The Growing Edge*] made by the split-halves technique yielded a coefficient of reliability of .88 for the High School Form and .89 for the Elementary School Form ....

The intercorrelation of the Elementary School Form with another measure of adaptability, *A Time-Scale*, is .51.²

*A Time-Scale* and *The Growing Edge* have been used in a number of studies. For the above-mentioned reasons it was decided to use


these two instruments.

The community school scores were already available for 103 schools included in the sample of schools selected for this study. The results of the Iowa Basic Skill Tests of Reading, Vocabulary, Work-Study, Language, and Arithmetic could be obtained from the State University of Iowa, Iowa City, Iowa. These considerations helped to decide the use of a composite score from The Growing Edge, A Time-Scale, The Community School Criteria Check List, and the Achievement Tests, as the measure of quality of education.

The pupil achievement scores were secured from the official records, in the office of the Director, Basic Skills Testing Program, State University of Iowa, Iowa City, Iowa.

The community school scores were obtained by rescoring the replies sent in by the superintendents of various schools for the studies made by Christensen¹ and Theophilus.² Copies of the check list were sent to the 24 schools, which had not replied to Christensen or Theophilus.

The copies of A Time-Scale and The Growing Edge along with score sheets were sent to all the 127 schools included in the study, through the Department of Public Instruction, Des Moines,

¹Christensen. op. cit.
²Theophilus. op. cit.
Iowa. The returns received were scored and formed the source for the adaptability score and the Time-Scale score.

Although the forms were sent to the 127 school in early November, 1953, they were slow in being returned. In spite of follow-up letters only about 80 were received by the third week of January, 1954. Another 20 were received by the end of the first week of February. The test of significance between the means and variability of the first 80 and the last 20 showed that there was no significant difference between the scores of quality of those received early and those received late. It was an indication that the score of quality of schools which did not return the questionnaires would be similar. This study includes, therefore, the 100 schools whose returns were in hand on February 8, 1954.
IV. SIZE OF SCHOOL, COST PER PUPIL, AND QUALITY OF EDUCATION

A. Cost per Pupil and Size of School

In order to determine if relationship existed between the size of school and cost per pupil, the coefficient of correlation was computed. Cost per pupil was rounded to the nearest dollar and the average daily attendance to the nearest whole number. The coefficient of correlation was -.2903, which is significant at the one percent level. It showed that an inverse relationship existed between cost per pupil and size of school, i.e., the larger the school, the lower the cost per pupil for the 100 schools used in the study.

The next step was to find the curve which would best fit the data.

For a quadratic curve, the following equation was assumed:

\[ Y = a_1 z^2 + a_2 z + a_3 \]

where

\[ Y = \text{cost per pupil} \]

and \[ Z = \text{average daily attendance} \].
Solving the usual normal equations, the derived constants were:

\[ a_1 = 0.0013379379 \]
\[ a_2 = -0.9450913009 \]
\[ a_3 = 362.9510941 \]

Table 2

Analysis of Quadratic Regression of Cost per Pupil

and Average Daily Attendance

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2</td>
<td>14085.94</td>
<td>7042.97</td>
</tr>
<tr>
<td>Residuals</td>
<td>97</td>
<td>106306.82</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>120392.76</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{2,97} = 6.426 \quad R = .342 \]

The analysis of quadratic regression is presented in Table 2. The F-value was 6.426 with 2 and 97 degrees of freedom. It was significant beyond the one percent level. The multiple coefficient of correlation, R, was .342 which is also significant. Test of linearity was tried to see if there was any advantage in using
Table 3
Test of Linearity between Average Daily Attendance and Cost per Pupil

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadratic regression</td>
<td>2</td>
<td>14085.94</td>
<td></td>
</tr>
<tr>
<td>Linear regression</td>
<td>1</td>
<td>8781.55</td>
<td></td>
</tr>
<tr>
<td>Loss due to using linear regression</td>
<td>1</td>
<td>5304.39</td>
<td>5304.39</td>
</tr>
<tr>
<td>Quadratic residuals</td>
<td>97</td>
<td>106306.82</td>
<td>1095.95</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>120392.76</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{1,97} = 4.84 \]

...quadratic curve rather than the linear. The test of linearity is shown in Table 3.

The F-value for loss was 4.84 which is significant. So a significant loss would result if linear relationship was used instead of the quadratic.

The foregoing tests indicated that some type of curvilinear
Table 4
Values of Coefficients of Correlation between Cost per Pupil and Average Daily Attendance Using Various Curves

<table>
<thead>
<tr>
<th>Kind of curve</th>
<th>Value of coefficient of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>-.2903</td>
</tr>
<tr>
<td>Quadratic</td>
<td>.34205</td>
</tr>
<tr>
<td>Log Z</td>
<td>-.3157</td>
</tr>
<tr>
<td>100 $\sqrt[3]{Z}$</td>
<td>-.2876</td>
</tr>
<tr>
<td>$\frac{100,000}{Z}$</td>
<td>.3148</td>
</tr>
<tr>
<td>$\frac{10,000,000}{Z^2}$</td>
<td>.3270</td>
</tr>
</tbody>
</table>

relationships exist but does not indicate that a quadratic equation is necessarily the best indication of the relationship between the per pupil cost and size of school. Several types of curves were also tried, which can be represented by the following equations,

(a) $Y = \log Z$

(b) $Y = 100 \sqrt[3]{Z}$

(c) $Y = \frac{100,000}{Z}$
(d) \( Y = \frac{10,000,000}{Z^2} \)

where

\[ Y = \text{cost per pupil} \]
\[ Z = \text{average daily attendance} \]

The values of coefficients of correlation between cost per pupil and average daily attendance for each of the foregoing curves are shown in Table 4. All the values were significant beyond the one percent level.

The two curves having the highest values of coefficient of correlation, i.e., .342 and .327 were the quadratic and the reciprocal function, \( Y = \frac{10,000,000}{Z^2} \) respectively.

The reciprocal curve \( Y = \frac{10,000,000}{Z^2} \), where \( Y = \text{cost per pupil} \) and \( Z = \text{average daily attendance} \), was chosen although the data did not fit quite as well as they did in a quadratic curve. The quadratic curve showed that the cost per pupil decreased as the size of the school increased but for schools of average daily attendance of more than 353, it began to increase. This tendency for an increased cost per pupil beyond average daily attendance of 353, from a logical consideration, was indefensible if the quality of the program was held constant. A curve was desired in which no increase of per pupil cost was indicated.
within the limits of average daily attendance for which interpretations were desired. The reciprocal curve chosen showed that the cost per pupil decreased as the size of school increased but tended to level off at approximately $190 per pupil as the size of the school increased.

It seemed desirable to test if a significant difference would result from using the reciprocal curve rather than the quadratic. The formula used was

$$F = \frac{R_1^2 - R_2^2 [N-m-1]}{1 - R_1^2}$$

on substitution and solution

$$F = \frac{[ (.34205)^2 - (.32700)^2 ] [100-2-1]}{1 - (.34205)^2}$$

$$= .9767126425$$

$$= .8830027975$$

$$= 1.11.$$ 

The $F$-value of 1.11 with 2 and 97 degrees of freedom is not significant. So no significant loss would result from using the reciprocal curve instead of the quadratic.

These considerations lead to the choice of the reciprocal curve, $Y = \frac{10,000,000}{X^2}$ where

$$Y = \text{cost per pupil}$$
The cost in a school of average daily attendance of 180 pupils was 

\[ \text{cost per pupil} = \frac{164594 + 185,1793}{180} = \]

The correlation was expressed by the equation

The relationship between the cost per pupil and average daily attendance was described by the equation

\[ \text{cost per pupil} = \frac{180,1793}{164594} \]

The solution of usual normal equations gave the values of constants

\[ \frac{\text{average daily attendance}}{100000} = \alpha \]

\[ \text{cost per pupil} = I \]

where

\[ \alpha + \beta a = I \]

In this study, the following equation was assumed:

\[ \frac{z}{100000} = \text{average daily attendance} \]

-57-
The conclusions of this section may be summarized as,

1. There is an inverse relationship between cost per pupil and average daily attendance or in other words, as the size of a school increases, the cost per pupil decreases.

2. The relationship between the per pupil cost and average daily attendance is curvilinear.

B. Size of School and Quality of Education

1. Measure of quality

Four measures of quality; i.e., the Time-Scale score, the adaptability score, the community school score and the pupil achievement score were obtained as described in Chapter III.

The coefficients of correlation were computed between each possible combination of these scores. The correlations are presented in Table 5.

Only two coefficients of correlation were significant. Time-Scale scores had significant direct correlation both with adaptability scores and community school scores. It indicated that there were some common factors which tended to produce similar scores between the Time-Scale and the Community School Criteria Check List. Similarly there were some factors which tended to produce similar scores between the Time-Scale and The
Growing Edge.

None of the other coefficients of correlation was significant. It indicated that all the four measures of quality attempted to measure different aspects of quality of education independently of each other.

Table 5
Coefficients of Correlation between Four Measures of Quality of Education

<table>
<thead>
<tr>
<th></th>
<th>Adaptability score</th>
<th>Community school score</th>
<th>Pupil Achievement score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-Scale score</td>
<td>.2755 **</td>
<td>.3252 **</td>
<td>.0295</td>
</tr>
<tr>
<td>Adaptability score</td>
<td></td>
<td>.1704</td>
<td>- .0348</td>
</tr>
<tr>
<td>Community school score</td>
<td></td>
<td></td>
<td>- .0196</td>
</tr>
</tbody>
</table>

** Significant at the one percent level

For a first composite measure of quality, it was decided to weight all these measures equally in terms of their standard deviation. The means and standard deviations were computed for the scores on each of the four measures of quality. The mean, the standard deviation, and the factors, computed to weight the four
measures equally in terms of standard deviation, are shown in
Table 6. The Time-Scale score, the adaptability score, the com-
munity school score and the pupil achievement scores of each
school were multiplied by 11, 8, 8, and 2 respectively and added
together to give a composite single score to each school. For
example a school, whose four scores of Time-Scale, adaptability,

Table 6
Means and Standard Deviations of Quality Measures

<table>
<thead>
<tr>
<th>Measure of quality</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-Scale scores</td>
<td>13.73</td>
<td>5.26</td>
<td>11</td>
</tr>
<tr>
<td>Adaptability scores</td>
<td>24.83</td>
<td>7.11</td>
<td>8</td>
</tr>
<tr>
<td>Community school scores</td>
<td>35.95</td>
<td>6.90</td>
<td>8</td>
</tr>
<tr>
<td>Pupil achievement scores</td>
<td>72.13</td>
<td>29.09</td>
<td>2</td>
</tr>
</tbody>
</table>

community school and pupil achievement were 7, 14, 23, and 65
respectively, got a composite single score of \( (7)(11) + (14)(8) + (23)(8) + (65)(2) \) or 503. The mean and standard deviation of
these composite scores were computed and found to be 781.55 and
133.56 respectively. These composite scores were changed into
standard scores, with a mean score of 100 and standard deviation
30. The formula used was

\[
\text{Quality of education score} = 100 + \frac{30 (\text{composite score} - \text{mean})}{\text{standard deviation}}
\]

or on substitution of the mean score of 781.55 and the standard deviation of 133.56:

\[
\text{Quality of education score} = 100 + \frac{30 (\text{composite score} - 781.55)}{133.56}
\]

The school which had a composite score of 781.55 got a quality score of 100. The school which had a composite score of 503 got a quality score of 37 and the one which had 1009 got 151.

2. Average daily attendance and quality

In order to determine the relationship between size of school and quality of education, the coefficients of correlation between average daily attendance and the Time-Scale score, the adaptability score, the community school score and pupil achievement score were computed. Coefficient of correlation was also computed between the average daily attendance and the standard score of quality. The average daily attendance figures were changed to reciprocal scores by the formula.

\[
W = \frac{10,000,000}{(\text{average daily attendance})^2}
\]

These correlations are presented in Table 7.
Table 7
Coefficients of Correlation
\[
10,000,000 \times \frac{(\text{average daily attendance})^2}{W}
\]
and Various Measures of Quality of Education

<table>
<thead>
<tr>
<th>Measure of quality</th>
<th>Coefficient of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Time-Scale score</td>
<td>-0.3398 **</td>
</tr>
<tr>
<td>The adaptability score</td>
<td>0.1035</td>
</tr>
<tr>
<td>The community school score</td>
<td>-0.2125 *</td>
</tr>
<tr>
<td>The pupil achievement score</td>
<td>-0.1986 *</td>
</tr>
<tr>
<td>The standard score of quality</td>
<td>-0.3840 **</td>
</tr>
</tbody>
</table>

** Significant at the one percent level
* Significant at the five percent level

The negative coefficient of correlation between the reciprocal of average daily attendance and the Time-Scale score was highly significant. It indicated that as the size of the school increased, the quality as measured by the Time-Scale also increased. The coefficients of correlation between the reciprocal of average daily attendance and the community school score and pupil achievement score were also negative and significant. It showed that as the size of the school increased, the quality of education as measured by both the community school...
check list and the pupil achievement tests increased.

The non-significant coefficient of correlation between the W-score and the adaptability score indicated that there was not sufficient evidence found to show that the size of the school was related to the adaptability score.

It might be noted here that The Growing Edge was developed to measure adaptability of school systems on the basis of personal visitation by trained and qualified field workers. Because the method of personal visits to the 127 schools was impractical in a study of this scope, the alternative method of mailing the questionnaires was used. The very application of a different method of using the instrument might have affected its reliability and validity.

The highly significant negative coefficient of correlation of \(-.364\) between the standard scores of quality and W-scores, indicated that as the size of school increased, the quality also increased.

In order to find the difference between the standard scores of quality in smaller and larger schools included in this study, the following equation was assumed:

\[ Q_i = a_i W + C \]

where
\[ Q_1 = \text{standard score of quality} \]

\[ W = \frac{10,000,000}{(\text{average daily attendance})^2} \cdot \]

The values of the constants, found by solution of the usual normal equations, were:

\[ a_1 = -0.167229 \]

\[ c = 128.17. \]

The relationship between the standard score of quality and average daily attendance was represented by the equation

\[ Q_1 = -0.167229W + 128.17. \]

The standard score of quality of a school of average daily attendance of 180 pupils was 77 while that of a school of 480, was 121.

C. Quality and Cost per Pupil

In order to determine the relationship between cost per pupil and quality of education, coefficients of correlation between cost per pupil and the scores of A Time-Scale, the adaptability, the community school, and the pupil achievement as well as between cost per pupil and the standard score of education, were computed. The coefficients of correlation are
Table 8
Coefficients of Correlation between the Cost per Pupil and Various Measures of Quality of Education

<table>
<thead>
<tr>
<th>Measure of quality</th>
<th>Coefficient of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Time-Scale score</td>
<td>-.0765</td>
</tr>
<tr>
<td>The adaptability score</td>
<td>-.1761</td>
</tr>
<tr>
<td>The community school score</td>
<td>.1291</td>
</tr>
<tr>
<td>The pupil achievement score</td>
<td>.0618</td>
</tr>
<tr>
<td>The standard score of quality</td>
<td>-.0310</td>
</tr>
</tbody>
</table>

presented in Table 8. None of these coefficients of correlation was significant. It indicated that insufficient evidence has been found in this study to support the statement that relationship exists between the quality of education as measured in this study and the cost per pupil.

Peck\(^1\) reported a highly significant negative coefficient of correlation of -.333 between cost per pupil and number of units of educational opportunity in high schools of Iowa. He reported that as cost per pupil increased, the average number of units of educational opportunity decreased, in high schools

\(^1\)Peck, op. cit. p. 80.
of Iowa. He explained it by saying that

The findings are not necessarily inconsistent with the findings of other studies which have been known to show that educational opportunities increased as expenditures increased since these studies have not generally included small schools or schools that varied widely in size as does the present study.¹

D. Prediction of Quality

1. Equally-weighted criteria of quality

The preceding sections of this study have shown that significant relationship existed between (a) size of school and quality of education, (b) size of school and cost per pupil. Therefore, it was desirable to investigate the possibility of predicting quality of education from size of school and cost per pupil. The following equation was assumed:

\[ Q_1 = a_1 W + a_2 Y + G \]

where

\[ Q_1 = \text{quality of education} \]

\[ W = \frac{10,000,000}{\text{(average daily attendance)}^2} \]

\[ Y = \text{cost per pupil}. \]

¹Ibid. p. 81.
Table 9
Analysis of Multiple Regression of Quality of Education

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-variable regression</td>
<td>2</td>
<td>14199.25</td>
<td>7099.63</td>
</tr>
<tr>
<td>Residuals</td>
<td>97</td>
<td>75870.59</td>
<td>782.17</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>90069.84</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{2,97} = 9.08 \quad R = .397 \]

Solving the usual normal equations, the values of the constants were found to be:

\[ a_1 = -.182367245 \]
\[ a_2 = .091978131 \]
\[ G = 111.13. \]

On substitution of the values of the constants the equation of prediction became:

\[ Q_1 = -.182367W + .091978X + 111.13. \]

The analysis of regression predicting quality of education from
size of school and cost per pupil was computed and is presented in Table 9. The F-value, 9.08 with 2 and 97 degrees of freedom, was significant at the one percent level of confidence. The multiple correlation coefficient, R, was .397. Therefore, size of school and cost per pupil may be considered as significant predictors of quality of education. The foregoing prediction equation was used to predict quality of education for the range of schools used in this study, i.e., the schools having 180 to 480 pupils in average daily attendance in grades kindergarten to eight and with one attendance unit only. The quality of education scores were expressed in terms of standard scores, with a mean of 100 and a standard deviation of 30. The predicted scores of quality of education are presented in Table 10.

The lowest scores of quality of education are found among the schools having an average daily attendance of less than 200 elementary pupils. A school of average daily attendance of 200 and spending $200 per pupil has a quality score of only 84. It can increase its score to 100 by spending $375 per pupil or increasing its size to 240 and spending $225 per pupil.

A school of average daily attendance of more than 260 elementary pupils can achieve the average quality of education by spending $225 per pupil.

A word of caution is necessary about applying the findings
Table 10

Standard Scores of Equally-Weighted Quality of Education, Predicted from Average Daily Attendance and Cost per Pupil

(Mean = 100, and Standard Deviation = 30)

<table>
<thead>
<tr>
<th>Elementary average daily attendance</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
<th>325</th>
<th>350</th>
<th>375</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>71</td>
<td>73</td>
<td>75</td>
<td>78</td>
<td>80</td>
<td>82</td>
<td>85</td>
<td>87</td>
<td>89</td>
<td>92</td>
</tr>
<tr>
<td>200</td>
<td>82</td>
<td>84</td>
<td>86</td>
<td>89</td>
<td>91</td>
<td>93</td>
<td>95</td>
<td>98</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td>220</td>
<td>89</td>
<td>92</td>
<td>94</td>
<td>96</td>
<td>99</td>
<td>101</td>
<td>103</td>
<td>106</td>
<td>108</td>
<td>110</td>
</tr>
<tr>
<td>240</td>
<td>96</td>
<td>98</td>
<td>100</td>
<td>103</td>
<td>105</td>
<td>107</td>
<td>109</td>
<td>112</td>
<td>114</td>
<td>116</td>
</tr>
<tr>
<td>260</td>
<td>100</td>
<td>103</td>
<td>105</td>
<td>107</td>
<td>109</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>119</td>
<td>121</td>
</tr>
<tr>
<td>280</td>
<td>104</td>
<td>106</td>
<td>108</td>
<td>111</td>
<td>113</td>
<td>115</td>
<td>118</td>
<td>120</td>
<td>122</td>
<td>125</td>
</tr>
<tr>
<td>300</td>
<td>107</td>
<td>109</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>118</td>
<td>121</td>
<td>123</td>
<td>125</td>
<td>128</td>
</tr>
<tr>
<td>320</td>
<td>109</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>119</td>
<td>121</td>
<td>123</td>
<td>125</td>
<td>127</td>
<td>130</td>
</tr>
<tr>
<td>340</td>
<td>111</td>
<td>114</td>
<td>116</td>
<td>118</td>
<td>121</td>
<td>123</td>
<td>125</td>
<td>127</td>
<td>130</td>
<td>132</td>
</tr>
<tr>
<td>360</td>
<td>113</td>
<td>115</td>
<td>118</td>
<td>120</td>
<td>122</td>
<td>125</td>
<td>127</td>
<td>129</td>
<td>132</td>
<td>134</td>
</tr>
<tr>
<td>380</td>
<td>115</td>
<td>117</td>
<td>119</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>131</td>
<td>133</td>
<td>135</td>
</tr>
<tr>
<td>400</td>
<td>116</td>
<td>118</td>
<td>120</td>
<td>123</td>
<td>125</td>
<td>127</td>
<td>130</td>
<td>132</td>
<td>134</td>
<td>136</td>
</tr>
<tr>
<td>420</td>
<td>117</td>
<td>119</td>
<td>121</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>131</td>
<td>133</td>
<td>135</td>
<td>138</td>
</tr>
<tr>
<td>440</td>
<td>118</td>
<td>120</td>
<td>122</td>
<td>125</td>
<td>127</td>
<td>129</td>
<td>132</td>
<td>134</td>
<td>136</td>
<td>138</td>
</tr>
<tr>
<td>460</td>
<td>119</td>
<td>121</td>
<td>123</td>
<td>126</td>
<td>129</td>
<td>130</td>
<td>132</td>
<td>135</td>
<td>137</td>
<td>139</td>
</tr>
<tr>
<td>480</td>
<td>119</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>129</td>
<td>131</td>
<td>133</td>
<td>135</td>
<td>138</td>
<td>140</td>
</tr>
</tbody>
</table>
Table 11

Analysis of Regression Eliminating Cost per Pupil

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-variable regression</td>
<td>2</td>
<td>14199.25</td>
<td></td>
</tr>
<tr>
<td>Size of school regression</td>
<td>1</td>
<td>13289.64</td>
<td></td>
</tr>
<tr>
<td>Loss due to elimination of cost per pupil</td>
<td>1</td>
<td>909.61</td>
<td>909.61</td>
</tr>
<tr>
<td>Residuals</td>
<td>97</td>
<td>75870.59</td>
<td>782.17</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>90069.84</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{1,97} = 1.63 \]

of this study to schools either larger or smaller than those included in this study. No evidence has been assembled here to justify such extrapolation. The F-value of 1.63 with 1 and 97 degrees of freedom was not significant. Therefore, a significant loss would not occur in prediction of quality of education by elimination of cost per pupil.

The test of loss due to elimination of average daily attendance is shown in Table 12. The F-value of 18.045 with 1 and 97
Table 12
Analysis of Regression Eliminating Average Daily Attendance

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-variable regression</td>
<td>2</td>
<td>14199.25</td>
<td></td>
</tr>
<tr>
<td>Cost per pupil regression</td>
<td>1</td>
<td>84.54</td>
<td></td>
</tr>
<tr>
<td>Loss due to elimination of average daily attendance</td>
<td>1</td>
<td>14114.71</td>
<td>14114.71</td>
</tr>
<tr>
<td>Residuals</td>
<td>97</td>
<td>73570.59</td>
<td>782.17</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>90069.84</td>
<td></td>
</tr>
</tbody>
</table>

\[
F_{1,97} = 18.045
\]

degrees of freedom was significant at the one percent level.
Therefore, a significant loss in predication of quality would result by elimination of size of school from the prediction scheme.
The contributions of the two prediction variables to the sum of squares for regression were:

For size of school: 14492.688

For cost per pupil: \(-293.436\).

This indicated that the contributions of the size of the school
and the cost per pupil to predict quality of education were in
the ratio of 49 : 1.

2. Regression-weighted criteria of quality

The preceding sections of this study have shown that a
significant relationship existed between size of school and cost
per pupil as well as between size of school and various measures
of quality of education except *The Growing Edge*.

It seemed desirable to give proportional weights to the var-
ious measures of quality based on the knowledge that the larger
the school, the better the quality. The correlation of the score
of adaptability as measured by *The Growing Edge* with size of school
was non-significant and negative. It was assumed that the method
of mailing the questionnaire might have affected the validity of
the instrument, as it was intended to be used by the field worker
on personal visits to evaluate the school systems. For the pur-
pose of this section the adaptability score on *The Growing Edge*
was discarded. The other three measures were given proportional
weights.

In order to determine the proportional weights, the following
equation was assumed:

\[ W = a_y Y + a_{11} X_{11} + a_{33} X_{33} + a_{44} X_{44} + c \]

where
\[
W = \frac{10,000,000}{(\text{average daily attendance})^2}
\]

\[Y = \text{cost per pupil}\]

\[X_1 = \text{Time-Scale score}\]

\[X_3 = \text{community check list score}\]

\[X_4 = \text{pupil achievement score.}\]

To simplify computation the deviation form was used, i.e.,

\[W = a_0 Y + a_1 X_1 + a_3 X_3 + a_4 X_4.\]

Solving the usual normal equations the values of the derived constants were:

\[a_0 = .6592062876\]

\[a_1 = -3.366354581\]

\[a_3 = -1.721115102\]

\[a_4 = -.0857003126.\]

So the proportion weights were found to be approximately

\[a_1 : a_3 : a_4 :: 40 : 20 : 1.\]

In order to get the proportionally weighted composite score of quality, the Time-Scale score, the community school score and the pupil achievement score of each school were multiplied by 40, 20,
and 1 respectively and added together. Thus a school whose Time-
Scale, community school, and pupil achievement scores were 7, 23,
and 65 respectively, got a new score of \((7)(40) + (23)(20) + 65\)
or, 805. Thus regression-weighted composite scores were computed
for each school. The mean and standard deviation of these scores
were found to be 1340.33 and 288.84 respectively.

These scores were changed to standard scores with a mean of
100 and standard deviation of 30. The formula used was:

\[
\text{Quality score} = 100 + \frac{30(\text{composite score} - \text{mean})}{\text{Standard deviation}}
\]

or

\[
\text{Quality score} = 100 + \frac{30(\text{composite score} - 1340.33)}{288.84}
\]

Thus a school whose composite score was 1340 got a standard score
of 100. The school which had a composite score of 805 got a stan-
dard score of 44 and the one which had 1720 got 139.

It was desirable to compare these scores of quality, obtained
by giving proportional weights to the three measures, with similar
scores obtained by giving equal weights in terms of standard de-
viation to the four measures. The coefficient of correlation was
computed between the two scores using the formula:

\[
r = \frac{Q_1 Q_2}{Q_1^2 Q_2^2}
\]
\[ 1224963626 = 2^x \]
\[ 67377794 = 1^x \]

The results found were

Sorati the usual normal equations, the values of the constants

\[
\text{average deviation} = 0.00041000
\]

\text{cost per pupil} = 1

\[
\text{quantity of education} = 2^x
\]

therefore

\[ 2^x + 1 \times + 1 = 2^x \]

The equation was assumed:

\[ \text{quantity from cost per pupil and state of school} \]

In order to predict the quantity of education necessary in

\[ \text{predicted in different ways} \]

\[ \text{correlation exists between the two standard scores of quantity} \]

\[ \text{the value of } x \text{ was found to be } 0.05 \text{. It showed that a high co-} \]

\[ \text{quantity score of quantity} = 2^x \]

\[ \text{quantity score of quantity} = 1^x \]

therefore

-7-
\[ C = 103.08500. \]

On substitution of these values, the equation of prediction became:

\[ Q_2 = -.1732732147W + .1224963626X + 103.085. \]

The analysis of regression predicting quality of education from size of school and cost per pupil is presented in Table 13.

The \( F \)-value of 7.99, with 2 and 97 degrees of freedom, was significant at the one percent level of confidence. The multiple correlation coefficient, \( R \), was .376.

The foregoing prediction equation was used to predict quality of education for the range of schools used in this study, i.e., the schools having 180 to 480 pupils in average daily attendance in the elementary school, with one attendance unit only. The quality of education scores were expressed in terms of standard scores, with a mean of 100 and standard deviation of 30. The predicted scores of quality of education are presented in Table 14.

As in Table 10, the lowest scores of quality of education are found among the smaller schools. A school of average daily attendance of 200 and spending $200 per pupil has a quality score of 84. It can increase its score to the mean score by spending $350 per pupil or increasing its size to 260 and spending the
### Table 13
Analysis of Multiple Regression of Regression-Weighted Quality of Education

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-variable regression</td>
<td>2</td>
<td>12753.972</td>
<td>6376.986</td>
</tr>
<tr>
<td>Residuals</td>
<td>97</td>
<td>77417.018</td>
<td>798.11</td>
</tr>
<tr>
<td>Totals</td>
<td>99</td>
<td>90170.99</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{2,97} = 7.99 \quad R = .376 \]

same amount per pupil.

In general, a school of average daily attendance of 260 or more pupils can expect a better than average quality of education by spending $225 per pupil. A comparison of the entries in Table 10 and Table 14 indicates small differences in the quality of education to be anticipated where the criterion of quality has been found by equal-weighted or by regression-weighted indexes of quality.

It was desirable to find whether a significant loss in ability to predict quality of education would occur if the cost
Table 14

Standard Scores of Regression-Weighted Quality of Education, Predicted from Average Daily Attendance and Cost per Pupil

(Mean = 100, and Standard Deviation = 30)

<table>
<thead>
<tr>
<th>Elementary Average Daily Attendance</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
<th>325</th>
<th>350</th>
<th>375</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>72</td>
<td>74</td>
<td>77</td>
<td>80</td>
<td>83</td>
<td>86</td>
<td>89</td>
<td>92</td>
<td>95</td>
<td>99</td>
</tr>
<tr>
<td>200</td>
<td>81</td>
<td>84</td>
<td>87</td>
<td>90</td>
<td>93</td>
<td>97</td>
<td>100</td>
<td>103</td>
<td>106</td>
<td>109</td>
</tr>
<tr>
<td>220</td>
<td>89</td>
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Table 15

Analysis of Regression Eliminating Cost per Pupil

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<thead>
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<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
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<td>Two-variable regression</td>
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<td>1275.972</td>
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<td>11140.602</td>
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<tr>
<td>Loss due to elimination of cost per pupil</td>
<td>1</td>
<td>1613.370</td>
<td>1613.37</td>
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<tr>
<td>Residuals</td>
<td>97</td>
<td>77417.018</td>
<td>798.11</td>
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<tr>
<td>Totals</td>
<td>99</td>
<td>90170.99</td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{1,97} = 2.02 \]

per pupil or size of the school were respectively eliminated from the scheme of prediction. The test of loss due to elimination of cost per pupil is presented in Table 15. The F-value of 1.45 with 1 and 97 degrees of freedom was not significant. Therefore a significant loss would not result in prediction of quality of education by elimination of cost per pupil.

The test of loss due to elimination of average daily attendance is shown in Table 16. The F-value of 11.48 with 1 and 97 degrees of freedom was significant at the one percent level.
Table 16

Analysis of Regression Eliminating Average Daily Attendance

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
</tr>
</thead>
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<tr>
<td>Two-variable regression</td>
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<td>12753.972</td>
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<tr>
<td>Cost per pupil regression</td>
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<td>18.263</td>
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<td>Loss due to elimination of size of school</td>
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<td>12735.709</td>
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<td>Residuals</td>
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<tr>
<td>Totals</td>
<td>99</td>
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</table>

\[ F_{1,97} = 15.96 \]

Therefore, a significant loss in prediction of quality of education would occur by elimination of size of school from the prediction scheme.

The foregoing evidence lead to the conclusion that size of school was more important than the cost per pupil in determining quality of education in the elementary schools of Iowa.
V. SUMMARY

In the United States, the increase in pupil attendance, the increased demand for more and better educational services, and the declining value of the dollar have resulted in the great increase in educational expenditures. Many local school districts whose main source of revenue is the property tax, can no longer finance an adequate program of education without assistance from other sources. Demands have been made upon the states to contribute a larger proportion of educational expenditures. The states in turn have insisted on more efficient use of school funds through more adequately organised school districts. The study of relationships between size, cost and quality of education, therefore, seems very important.

The purpose of this study was to determine the relationship between size of school, cost of education and quality of education in the elementary schools of Iowa.

A review of previous studies on the size-cost-quality relationship revealed that as size of school increased, the quality of education generally improved; the increase in size was accompanied by decrease in cost per pupil; and the increased expenditures produced improved quality. But most of the studies dealt with the school systems either larger or more expensive than the
average schools in Iowa. Two studies which included all the public schools of the state, attempted to determine the complex interrelationships between size of school, cost per pupil and number of course offerings in secondary schools only. The present study attempts to determine these relationships in the elementary schools of Iowa.

Due to lack of evidence of cost of a good program in smaller schools and the weight of opinions of experts that an elementary school of less than 175 to 210 pupils could not provide an adequate program without excessive expenditures, the study was limited to the school districts which maintained 12 grades of instruction and which had an enrollment of 200 or more in the elementary school but not more than one elementary attendance unit in 1952-53. Copies of A Time-Scale and The Growing Edge along with score sheets were sent to a 50 percent sample of 255 such schools. One hundred schools responded. The community school scores were obtained from the responses to two previous studies and the pupil achievement scores were obtained from the Director, Basic Skills Testing Program, State University of Iowa, Iowa City.

In order to get a more comprehensive measure, four different measures of quality; i.e., a Time-Scale score, the Growing Edge score, the community school score and the pupil achievement score
were used. Coefficients of correlation were computed between all the possible pairs of these measures. All the correlations except two were non-significant. It indicated that they measured different aspects of quality independently of one another. The scores of these four measures of quality were combined into single standard scores (mean = 100 and standard deviation = 30) in two ways, (a) by weighting them equally in terms of their standard deviations and (b) by weighting them by regression of size, discarding the Growing Edge score, whose correlation with size was negative but not significant. The coefficient of correlation of .848 between the standard scores of quality as thus determined indicated that the two scores of quality were not significantly different from each other.

A highly significant negative correlation between cost per pupil and average daily attendance indicated that inverse relationship existed between the two, i.e., the larger the school, the lower the cost per pupil.

Six different curves were tried to see which one best fitted the data. The evidence found indicated that the relationship between the average daily attendance and cost per pupil was curvilinear. The quadratic and the reciprocal curves had the highest correlations, of .342 and .327 respectively, but the former showed a tendency for an increased cost per pupil beyond average daily
attendance of 353 pupils, which, from a logical consideration, was indefensible if quality of the program was held constant. The reciprocal curve showed that the cost per pupil decreased as the size of school increased but tended to level off at approximately $190 per pupil. The smaller schools were spending 23 percent more money per pupil than the larger schools included in this study.

The highly significant correlation between the standard scores of quality and W-scores \[ W = 10,000,000/(\text{average daily attendance})^2 \] indicated that as the size of the school increased, the quality also improved. The single variable regression showed that the quality score of a school of 180 pupils was 77 while that of a school of 480, was 121.

Sufficient evidence was not found to support the statement that relationship existed between the quality and cost per pupil.

Regression equations were developed to predict equally-weighted and regression-weighted standard scores of quality from the cost per pupil and the average daily attendance. Caution must be used in applying these equations for prediction of quality of education by extrapolation to schools smaller or larger than the 255 herein studied. Tables of equally-weighted and regression-weighted scores of quality were constructed for the ranges of size of school and cost per pupil included in the study. The Table of
equally-weighted scores of quality showed that the smaller
schools had lower scores of quality. A school of 200 pupils
spending $200 per pupil had a quality score of only 84. It
could increase its score to 100 by spending $375 per pupil or
increasing its size to 240 and spending $225 per pupil.

The contribution of the size of school and cost per pupil
in production of quality of education in elementary schools of
Iowa within the noted size range was found to be in the ratio
of 49 : 1.

The general conclusion of the study is that size of school
is much more important than the cost per pupil in the determi-
nation of quality of education, as herein defined, in the elemen-
tary schools of Iowa having 200 or more pupils and not more than
one attendance unit.
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University. 1915.

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University. 1899.

University. 1898.

University. 1897.

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VII. APPENDICES
Table 16

List of Schools Included in Study

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* - Score sheets not returned or incomplete
** - Score sheets received too late to be included in the study
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<tr>
<td>Redfield**</td>
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* - Score sheets not returned or incomplete
** - Score sheets received too late to be included in the study
DEFINITION OF SYMBOLS

\[ X_1 = \text{Time-Scale score} \]
\[ X_2 = \text{Adaptability score} \]
\[ X_3 = \text{Community school score} \]
\[ X_4 = \text{Pupil achievement score} \]
\[ Y = \text{Cost per pupil} \]
\[ Z = \text{Average daily attendance} \]
\[ W = \frac{10,000,000}{(\text{average daily attendance})^2} \]
\[ Q_1 = \text{Equally-weighted standard score of quality of education} \]
\[ Q_2 = \text{Regression-weighted standard score of quality of education} \]
\[ Q_3 = \text{Equally-weighted raw score of quality of education} \]
Table 17

Sums and Sums of Squares

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<tr>
<td>$\Sigma Z^4$</td>
<td>722,052,697,464</td>
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Table 18

Crossproducts

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Raw score</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Sigma X_1 X_2 )</td>
<td>35,124</td>
<td>1032.41</td>
</tr>
<tr>
<td>( \Sigma X_1 X_3 )</td>
<td>50,542</td>
<td>1182.65</td>
</tr>
<tr>
<td>( \Sigma X_1 X_4 )</td>
<td>99,486</td>
<td>451.51</td>
</tr>
<tr>
<td>( \Sigma X_2 X_3 )</td>
<td>90,101</td>
<td>837.15</td>
</tr>
<tr>
<td>( \Sigma X_2 X_4 )</td>
<td>178,378</td>
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</tr>
<tr>
<td>( \Sigma X_3 X_4 )</td>
<td>258,913</td>
<td>-394.35</td>
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<tr>
<td>( \Sigma X_1 Y )</td>
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<tr>
<td>( \Sigma X_2 Y )</td>
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<tr>
<td>( \Sigma X_3 Y )</td>
<td>768,181</td>
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<td>( \Sigma X_4 Y )</td>
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<td>6237.34</td>
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<tr>
<td>( \Sigma X_1 W )</td>
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<td>-12333.60</td>
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<tr>
<td>( \Sigma X_2 W )</td>
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<tr>
<td>( \Sigma X_4 W )</td>
<td>1,209,245</td>
<td>-3981.60</td>
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Table 18 (Continued)

<table>
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<td>$\Sigma Q_2W$</td>
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<td>$\Sigma Q_1Q_2$</td>
<td>1,076,928</td>
<td>76427.96</td>
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</tbody>
</table>
VITA

Wadhawa Singh Theophilus, the author of this study, was born on October 1, 1918 at Jullundur City, Punjab, India. He attended the Mission School in Jullundur but soon his parents moved to Kasur, District of Lahore, which is now in Pakistan. He graduated from Government High School at Kasur in 1935, and joined Forman Christian College at Lahore. He received the B.A. degree from the University of the Punjab, Lahore, in 1940. He taught English to the special classes at the Training School for Village Teachers at Moga.

In 1941, he joined the Central Training College, Lahore, for a year's course for the Senior Anglo-Vernacular Teacher's Certificate. In 1943, he received the degree of Bachelor of Teaching from the Punjab University.

He has been working as a second-master in the United Christian Schools, Jullundur City, India, since 1944. In 1951, the Presbyterian Board of Foreign Missions, New York, gave him a scholarship for graduate work in Rural Education and Educational Administration. He received his M.S. degree from Iowa State College in June, 1952, and has continued graduate work toward his Ph.D. in Vocational Education since that time.