

A STUDY OF SELECTED VARIABLES OF SCHOOL
CONSTRUCTION COSTS

by

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DEDICATION

This research is dedicated to my father, Clacy Sr., who offered me encouragement and inspiration when it was needed most, and to my deceased mother, Zenith, who instilled in me the value and desirability of education, and who would, this day, have been proud of her son.

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CHAPTER I
INTRODUCTION

Educational administrators in West Virginia have, for quite some time, had the opportunity to grow accustomed to the conservative swing of the pendulum that is sweeping our nation today. The passage of such legislation as Proposition 13 in California and Proposition 2 1/2 in Massachusetts¹ were nationally publicized as extraordinary changes in the funding base for school finance, but these states have just become members of a growing minority in which taxpayers are demanding limitations on the rates of personal property taxes. In West Virginia, this occurred in 1932 with a statewide referendum on the Tax Limitation Amendment to the State Constitution.² This amendment, which received an 88.42 percent statewide mandate, summarily reduced the maximum regular tax rate to 50 cents per \$100 valuation for Class 1 properties, but allowed the local levying body the right to assess special levies via election to increase funds for specific purposes.³ Traditionally in West Virginia, these special

¹Richard A. Bumstead, "One Massachusetts School System Adapts to Proposition 2 1/2," Phi Delta Kappan, June, 1981, p. 721.

²Thirty Seventh Biennial Report--W. Va. Tax Commission, West Virginia State Tax Department, 1977-78, p. 29.

³Todd C. Willis, Bethel Adkins, and Karl C. Lilly, eds., West Virginia Blue Book, (Charleston, West Virginia: Jarrett Printing Company, 1980), Vol. 64, p. 440.

levies in conjunction with bond sales have been the method by which school facility construction has been funded.

From 1971 to 1981, 49 of West Virginia's 55 counties have attempted school bond issues for the purpose of facility construction. Of these 49 districts, only 28 (47.41%) have passed one or more issues. The full impact of the bond issue in funding capital outlay is recognized when one realizes that of the 635 million-dollar budget approved by the State Board of Education through comprehensive educational facilities plans, 313 million (49.3%) was to have been funded through local bond issues. Of the 313 million dollars in proposed issues, only 148 million dollars (47.3%) was actually realized in passing issue referendums. This represents a failure rate of 54.7% of all bond issues attempted.⁴

Operating in this environment of economic hostility, the school administrator not only had to be able to make fiscal decisions regarding educational programs that filled the needs of the students, but also how to best house them in facilities that adequately provided an environment conducive to learning and assured their safety and well being. Consequently, school construction costs have become an important issue for school administrators.

⁴West Virginia Better School Buildings Amendment Reports, West Virginia Board of Education, December 31, 1981.

Traditionally, the cost per square foot and the cost per pupil have been used as units of measure to report school construction costs throughout the nation. Cost per square foot reflects the floor space of the building itself and has therefore undergone considerable criticism in the literature. Richard O'Brian, in a paper prepared for the Department of Health, Education, and Welfare, states:

The cost to be related to floor area is defined as contract cost which is the cost of actual construction as shown in the contract between the local education agency and the general contractor. Included are costs of permanently fixed equipment, plumbing, heating, and electrical work. . . . The inclusion of remaining costs such as legal and administrative fees, architectural and engineering fees, and site and site improvements tend to overestimate total square foot costs.⁵

The other unit by which building costs have been described is related to the capacity of the building and expressed in cost per pupil. Utilizing this unit allowed inclusion of site cost and preparation, and provided a descriptive measure for project comparisons as extraordinary cost variables for housing special programs, i.e., special education and occupational education programs, could be considered as well as specific district characteristics previously unrelated to the cost per square

⁵Richard O'Brian, "Cost Model for Large Urban Schools," A paper prepared for the U.S. Department of Health, Education, and Welfare, National Center for Educational Statistics, Technical Note #30, April, 1967, pp. 1-2.

foot measure. Another characteristic of per pupil cost was its ability to be easily conceptualized. In dealing with the laymen of a community, an understanding of costs related to the number of students housed in the facility is much more easily understood than costs defined by a unit of measure to which they may or may not readily relate. This understanding contributes to better communications with and support from the community.

Not only does the cost per pupil measure offer a descriptive comparison of total project costs, but in statistical analysis, it may also provide certain predictive implications for determining the effect of such factors as geographic location or federal funds on project cost. Additionally, the potential for comparison of construction costs from one district to another has significant ramifications for the possibility of statewide distribution of funds to construct school facilities should the West Virginia Legislature choose to provide further funding once Better School Buildings Amendment money is exhausted.

STATEMENT OF THE PROBLEM

How do selected variables in the areas of building descriptors, district characteristics, and finance relate to the per pupil cost of new school construction in West Virginia?

Evolving from this question are the following research questions which this study will address:

1. What is the relationship between selected descriptors of school facilities and the cost per pupil?
2. What is the relationship between selected characteristics of the district and the per pupil cost?
3. What relationships exist between selected financial factors of the school district and the per pupil cost of construction projects?

PURPOSE OF THE STUDY

It was the purpose of this study to consider the factors that contribute to the per pupil cost of new school facility construction and investigate their relationship to some of the components that have historically effected construction costs such as: geographic location, rated student capacity, time expiration from bidding to completion of the project, source of funding, and percentage of non-instructional spaces.

SIGNIFICANCE OF THE STUDY

Through utilization of the data gathered and analyzed in this research, the development of a predictive model to approximate the cost of school construction projects can be developed.

Presently in West Virginia, the state legislature is seriously examining school facilities and construction costs statewide. For the first time, the state legislature and the State Department of Education are receiving

judicial pressure based on the "thorough and efficient" clause of the West Virginia Constitution regarding the equitable distribution of educational funds. Although most immediate concerns have been in equity of current operational budgets, it is observably evident that the funding of capital outlay in West Virginia is a function of the wealth of the local school district. Consequently, a method to comparatively examine new construction cost on a per pupil basis could be of significant value should additional state funding now under consideration be adopted.

LIMITATIONS

The following limitations focused the efforts of this study on the construction costs of schools specifically in West Virginia.

1. The data for this study consisted of information available from the records of the Better School Buildings Amendment on file in the West Virginia Board of Education's Facilities Planning Division.

2. This study was limited to newly constructed facilities built during the Better School Buildings Amendment era which began in 1972 and continued through the availability of funds in 1982.

3. This study does not address school additions or renovations.

4. Assessed values utilized in this study are those

available from the West Virginia State Tax Department. Equalization of these values lags behind in some districts and may not represent current market values of property but are the most representative figures available.

5. The uniqueness of each state in funding capital outlay for school facilities precludes the application of this study to states other than West Virginia.

DEFINITIONS

For this study, the following terms will be defined:

1. Site Cost--Amount paid by the Local Education Agency for the purchase of property.

2. Site Preparation Cost--Amount paid by the LEA to prepare the site for construction and landscaping.

3. Fixed Equipment--Any equipment which once installed becomes attached to the building and becomes immobilized.

4. Total Fees--Amount paid by the LEA to cover the fees of the architects, engineers, and lawyers necessary in such a construction project.

5. Rated Capacity--The number of students the structure was designed to accommodate.

6. Operational Capacity--The actual number of students the facility is accommodating.

7. Instructional Space--Areas within the building used for the support and transmission of knowledge. Includes classroom storage space, teachers' offices,

administrative offices, gymnasiums, and auditoriums.

8. Non-Instructional Space--Areas within the building that are structurally required or offer student support services; i.e., hallways, lobbies, restrooms, kitchen/cafeterias, maintenance storage rooms, mechanical rooms, and others.

9. Assessed value per pupil--The property values in each district for the 1982 taxable year as reported by the West Virginia State Tax Department and divided by the net enrollment of the district.

10. Educational Expenditures--Expressed in dollars per pupil, this figure represents the total expenditures of the district for the most recent school year, 1980-81, as reported by the West Virginia State Department of Education.

SUMMARY

As inflation and reduced financial support for education have severely impacted educational spending in recent years, the need to effectively compare the cost of construction of school facilities has increased. It was the purpose of this study to consider the factors that contribute to the per pupil cost of facility construction and investigate its relationship to selected district characteristics, descriptors of the building, and financial variables in order to more discriminately compare these cost figures.

This study represents a step toward development of a comparative model that could be utilized by (1) local school administrators to gain insight into project costs and (2) by state administrators to assure the equitability of the distribution of funds for school construction among school districts statewide.

Specifically, the study addresses the lack of accurate or current information concerning the relationship of the factors leading to the cost per pupil of school construction and specific cost determining components.

The introduction to this study has delineated the problem to be addressed and the purpose of the research. Chapter II will review the literature related to school construction cost and funding; Chapter III will describe the collection of data from the West Virginia State Board of Education's Office of Facility Planning and the statistical tests used to determine relationships between cost components and selected cost determiners; Chapter IV will present the data analysis and results; and Chapter V will discuss the implications of the study and recommendations for further research.

CHAPTER II

REVIEW OF LITERATURE

During the fifties and sixties, much consideration was given to the construction of school facilities in educational literature. This was in part due to the rapidly expanding need for facilities to house the post-war population boom. During the seventies, as school enrollments declined, the emphasis on this aspect of educational expenditure decreased sharply. However, shifting populations, consolidation of schools, and abandonment of obsolete, expensively operated buildings have still required continued planning and construction of new facilities to house educational programs. Not only has it been the responsibility of the educational administrator to evaluate programs to assure their validity in the educational process, but to assure that they are housed in physical plants that are conducive to learning and provide a safe and healthful environment for children. In so doing, consideration must not only be given the students who use the building, but also the taxpayers who finance it. Consequently, the responsibility is an awesome one, to expend public money in such a manner as to sufficiently meet the needs of educational programs for students without overburdening the already wary taxpayer.

In order to more clearly understand expenditures for facilities construction and the impact of the selected

variables upon them, this literature review will concentrate on the components of construction cost and their relationship to certain building descriptors, district characteristics, and finance variables.

CONSTRUCTION COSTS

The cost of school construction has risen sharply in recent years. Furno reported that the cost of school construction was increasing during the late 1960's and 1970's. His national statistics indicate that the average per pupil cost of construction in the U.S. was \$1,706 in 1966.¹ This increased in 1967 to \$2,240 per pupil, and by 1973 registered \$4,899 per pupil, a 287% increase since 1966.² His study also showed specific increases in West Virginia's per pupil cost.

	<u>1966</u>	<u>1967</u>	<u>1970</u>	<u>1973</u>
New Elementary	\$ 910	\$ 860	\$1,154	\$1,250
New Secondary	\$1,340	\$2,240	\$2,081	\$3,899

Although below the national average for total per pupil construction costs, the expenditures in West Virginia are indicative of the national trend.

More recent statistics on the cost per square foot

¹Orlando Furno, "How the School Construction Dollar is Being Spent," School Management, (July, 1967), Vol. 7, No. 7, p. 69.

²Orlando Furno, "1974 Cost of Building Index--Up, Up and Away," School Management, (May, 1974), Vol. 18, No. 5, p. 20.

indicate that the trend continued throughout the 1970's and into the 1980's. Dr. Frank Brouillet, Superintendent of Public Instruction for the State of Washington, acknowledged that the cost of building new school facilities in his state has risen from \$9.50 per square foot to over \$60 per square foot in the thirty years since 1950.³

Abramson reported in American School and University that the national average for building secondary schools in 1979 was \$43.97 per square foot⁴ when compared to the \$36.65 per square foot that he reported in 1975. It is clearly evident that costs are rapidly increasing in every section of the nation. But as costs increase, there is a trend for the number of schools being built to decrease. Studies show that from 1965 to 1975, facility construction has decreased nationally from 6,000 projects to less than 2,000 projects per year. This might be contributed to a trend toward larger schools with more classrooms, but statistics show an actual decrease in the number of classrooms as well, from over 7,500 in 1965 to 3,200 in 1974. One of the major factors in this abrupt turnabout in school construction can be attributed to the skyrocketing costs of construction. When the school construction

³Harvey C. Childs, et. al., School Facilities Development Procedures Manual, (Olympia, Washington: Office of Superintendent of Public Instruction, February, 1981), Forward.

⁴Paul Abramson, "Educational Construction: Sixth Annual Cost Report," American School and University, (April, 1980), p. 48.

expenditures from 1965 to 1975 were examined, the line of regression was essentially flat. This indicated that school boards were attempting to keep construction expenditures relatively constant each year, but with cost increases, the number of schools and classrooms being bought each year dwindles.⁵ These findings reveal a greater need than ever before to assess the building needs of the state and districts, and plan more efficiently for the programmatic replacement or renovation of existing facilities.

The rising cost of school construction is a composite of several components which contribute to it. In Step by Step to Better School Facilities, Boles divides this cost into four basic categories: acquisition of the site, architectural planning, construction, and equipping the building.⁶ Examination of these components indicated their relationship to the overall cost of new school facilities.

Site acquisition and preparation is an important component of the overall cost of a new school facility project.⁷ It is, however, more than a building location;

⁵Armond Thieblot, "School Supplies and Equipment, 1976," Council of Educational Facility Planners Journal, (January, 1977), p. 6.

⁶Harold W. Boles, Step by Step to Better School Facilities, (New York: Holt, Rinehart, and Winston, 1965), pp. 106, 124, 155, 190.

⁷A Study of Economies in School Construction, (Olympia, Washington: Washington State Office of Public Instruction, 1971), p. 26.

it is an integral part of the educational plan. Site location first requires a study of the past and present as well as some projections of the future to determine the trends in community growth and enrollment as well as in educational/community service programs in order to meet the needs of the community.⁸ Additionally, wise selection may result in savings amounting to tens of thousands of dollars in cost of site preparation, construction, utility provision, and fire protection.⁹ Acquisition and preparation of a site form such a large part of the capital budget that if it could be eliminated or reduced, the total capital cost of a project could be lowered between 10% and 25% depending on local property values.¹⁰ As desirable as it may be, however, lowering these costs is not always possible. One community, cited by the Educational Facilities Laboratories, spent over \$400,000 to prepare a site for the construction of a new high school.¹¹ That amount was equivalent to roughly 25,000

⁸Margrit I. Kennedy, Building Community Schools, (Paris, France: UNESCO, 1979), p. 15.

⁹Leo Doherty and Artrelle Wheatley, "A Review of Studies in Economies in Schoolhouse Construction," (University of the State of New York and the State Education Department, 1960), p. 9

¹⁰Educational Facilities Laboratories, Guide to Alternative for Financing School Buildings, (New York: Educational Facilities Labs, Inc., November, 1971), p. 8.

¹¹Educational Facilities Laboratories, The Cost of a Schoolhouse (New York: Educational Facilities Labs, Inc., May, 1960), p. 72.

square feet of additional finished structure at the 1960 building rate of \$16 per square foot. It was a choice made after the reluctant rejection of other less suitable sites; it was the most appropriate alternative available.

Site preparation is the nomenclature for a number of variables that can influence total costs. The following is a comparison of two school site locations. This study originally appeared in Economy Handbook, November, 1953, published by the New York State Commission on School Buildings, but was adapted for use by the Educational Facilities Laboratory in Cost of a Schoolhouse.¹²

Comparison of Site Costs

	<u>Site A</u>	<u>Site B</u>
1. Clearing and Grubbing	\$ 100	\$ 1,500
2. Demolition of Old Building	1,200	
3. Excavation	5,000	7,000
4. Drainage--Athletic Field		3,200
5. Storm Drains	300	8,000
6. Gravel--Roads, Parking Lot	1,000	7,500
7. Cobble Gutter		950
8. Sodding New Slopes		1,800
9. Driveways and Parking Area	8,200	9,500
10. Supply and Place Top Soil	2,800	600
11. Water Supply	7,600	11,200
12. Sewage Disposal	<u>4,500</u>	<u>4,500</u>
13. Total for Development and Placement	30,700	55,750
14. Purchase Price	<u>20,000</u>	<u>Gratis</u>
15. Total Estimate 11/1/52	50,700	55,750
16. Additional Cost for Piling Indicated by Test Boring 11/10/52	<u>30,000</u>	<u>None</u>
17. Total Estimate 11/10/52	\$80,700	\$55,750

¹²Ibid., p. 73.

This table emphasizes the necessity of having engineers and architects involved in the site selection process. Despite the fact that Site B was a gift, it would have been less expensive to purchase and develop Site A with a savings of \$5,050. However, test drilling by the engineers revealed that Site A would require \$30,000 for foundation pilings in order to stabilize the building. Subsequently, the school board changed their minds, elected to use Site B, and realized a \$24,950 savings. Close scrutiny of the details involved in this decision resulted in considerable savings for the school project and the community. The \$25,000 expenditure that would have been required below ground could be utilized in the improvement of the facility itself.

The need for an architect introduces a second component affecting the total cost of school construction: the design or architectural fees. The services of an architect should be retained early in the process of facility planning and site selection phases of the project. In making this selection, the board should develop a criteria by which to make its choice and search out the architect who best meets the requirements of the job.

When the selection process is completed and the designer who best fills the board's criteria has been found, the amount of his fee must be determined. The most popular method for fee setting in educational construction is a percentage of construction cost using the American

Institute of Architects fee schedule.¹³ Under this method, the payment to the architect is determined on a declining basis, the larger the construction cost the lower the percentage.¹⁴ Generally the construction of most new educational facilities fall within the 6% to 6.5% range. Another method which is growing in popularity is the fixed fee plus percentage. This procedure sets a fixed percentage fee based on an agreed cost estimate; a percentage is added to the architect's fee for completion of the project under the initial estimate and penalized for completion over the initial estimate. This method controls the temptation to allow cost escalation thereby increasing the architect's fee.

The third major component of school facility costs is the construction itself. This cost is comprised of three basic components: materials, equipment, and labor, all of which may and will vary greatly from one project to another. These costs, particularly materials and equipment, are affected by the quality of the building desired, and make the comparison of physical plants a difficult task.

The selection of materials and equipment to be utilized in a facility can result in considerable savings

¹³Dwayne Anderson, an architect with Tag Architects, interviewed by Clacy Williams, (Charleston, West Virginia), January 8, 1981.

¹⁴Op. Cit., School Facilities Development Procedures Manual, Chapter 6, p. 10.

in capital outlay. However, the underlying premise of that decision should be the long term cost of the materials selected. Stautz reported that it was not uncommon for school boards to become so zealous in reducing initial cost of the buildings that they lose sight of the maintenance cost of a specific product.¹⁵ Gibson and Eatough, in a study for the California State Department of Education, indicated that material and equipment costs revolve about the relationship between capital costs and operation/maintenance costs. They found that better materials resulted in higher capital outlay and lower maintenance costs, while cheaper materials resulted in lower construction cost but meant higher maintenance costs over the life of the building. In studying twenty California districts, they found that ten cents of every educational dollar was being spent for capital outlay, twenty cents for administration, fixed costs, transportation and operations, and seventy cents for instructional costs. Savings attributed to lowering the quality level of school building construction amounted to only two cents. However, this placed additional financial burdens on the current expense budget through excessive maintenance cost and considerably lowered the value of the seventy cents that was being spent on the instructional program by creating a poorer teaching-

¹⁵Carl H. Stautz, Planning Your School Building Dollar, (Philadelphia, New York: Chilton Company, 1960), p. 57.

learning environment.¹⁶

A national survey conducted by the Educational Facilities Laboratories in 1960 indicated that the mean square foot cost of the 72 schools surveyed at that time was \$15.99. These costs were categorized according to the following:

Excavation	\$.34	2.13%
Footings and Foundation	1.00	6.25%
Structural Frame	1.57	9.82%
Structural Floor	1.25	7.81%
Roof and Insulation	.95	5.94%
Exterior Walls	2.00	12.50%
Interior Partitions	2.45	15.32%
Finished Floors	.40	2.50%
Ceilings	.28	1.75%
Plumbing	1.15	7.19%
Heat and Ventilation	1.90	11.88%
Electrical and Fixtures	1.45	9.07%
Miscellaneous Fixed Equipment	.75	4.70%
Contractors' Overhead	<u>.50</u>	<u>3.14%</u>
Total Dollars/Square Foot	\$15.99	100.00%

Based on these data, the study concluded that there was little room for dramatic savings in any single area, that economy could only be gained through careful attention to each detail in the building which comprised the \$15.99 per square foot cost.¹⁷

The selection of materials should be guided by these important fundamentals: (1) how is the material to

¹⁶Charles D. Gibson and Clair L. Eatough, School Construction Cost Report, (Sacramento, California: California Department of Education, December, 1962), pp. 17-22.

¹⁷Op. Cit., The Cost of a Schoolhouse, p. 66.

be used; (2) how will it affect insurance and maintenance costs; and (3) what is the ability of the owner to pay. Careful selections made with these precepts in mind will increase the quality of the building substantially in relationship to the total project budget allowed for its construction.¹⁸

BUILDING DESCRIPTORS

The description of a facility details a number of characteristics that may be an inherent part of the design, size, practicality, or aesthetics of the building. However, the characteristics of interest to this study are the rated pupil capacity of the facility, its percentage of instructional space, and the length of time required in its construction.

The rated or standard capacity of a school building is directly related to the program of the school. If the school was simply considered a shelter from the weather, and activity consisted of passively waiting out the storm, large numbers of students could be placed in a given space before it became overcrowded. If, however, facilitation of the instructional process is the primary objective, the number of students who can be placed in a given space is greatly affected and limited by the activity or process that takes place. Again this capacity will vary according to the program or curriculum. Assume that the educational

¹⁸Op. Cit., Carl H. Stautz, p. 58.

program of a school consists of reading, writing, and arithmetic; and its capacity is two hundred students. The addition of home economics, physical education, and industrial arts courses, which require special equipment and spaces, will result in overcrowding. Davis reported that the enrichment of educational programs without additional spaces will, in most cases, reduce the pupil capacity of the building.¹⁹ In order to exemplify this concept, he illustrated how its reverse has often been utilized to reduce overcrowding in many school situations--kindergartens have been closed or relocated to make room for primary classes, or art and music rooms converted into general classrooms thereby reducing or moving art and music programs to other locations.²⁰

Consistent with the philosophy that different educational curricula and activities have different space requirements, many educational agencies have set out to determine what the optimum space per pupil is for these activities. Results of these studies can be found in the facilities guidelines published by the Departments of Education in Pennsylvania, Maryland, New York, West Virginia, Washington, New Jersey, and many others. There is considerable agreement in these publications as to square footage per pupil needs. A high degree of consensus was

¹⁹J. Clark Davis, The Principal's Guide to Educational Facilities, (Columbus, Ohio: Charles Merrill Publishing Company, 1966), p. 95.

²⁰Ibid., p. 96.

observed and is probably due to the wide utilization of the methods suggested by Conrad in A Manual for Determining the Operating Capacity of Secondary Schools,²¹ and by Castaldi in The Castaldi Nomogram.²² These studies have resulted in approved guidelines for square footage per pupil in specific curricula in many states nationally.

The rated capacity of a facility is a function of the educational program it is to house. Based on the approved square footage per pupil for the particular program occupying each classroom, the rated capacity of a facility can be attained.²³ This capacity measure is directly related to the cost of the facility. Dingman indicates that the costs per pupil in public school construction is a function of the area per pupil and the cost per square foot.²⁴ In the universities where there is a higher degree of specialization and diversity of programs, a cost formula²⁵ using these two major components has been

²¹M. J. Conrad, A Manual for Determining the Operating Capacity of Secondary Schools, (Columbus, Ohio: Bureau of Educational Research and Service, Ohio State University).

²²Basil Castaldi, The Castaldi Nomogram, (Cambridge, Massachusetts: The New England School Development Council), 1953.

²³Op. Cit., J. Clark Davis, p. 155.

²⁴C. Wesley Dingman, "The Cost of a School," American School and University, (September, 1971), Vol. 44, No. 9, p. 45.

²⁵Committee on the Cost of Education, School Building Programs, (Toronto: Ontario Executive Council, October, 1972), p. 82.

developed. Utilizing net square footage per pupil and a unit cost per square foot, construction expenditures are expressed in cost per pupil. This measure allows teachers, supervisors, administrators, boards, and architects to be more creative in planning facilities to accommodate the needs of students and programs as they exist at the local level, and yet allow maximum flexibility in altering objectives, programs, and priorities.²⁶

Knowing that the cost per pupil is a composite of the square foot per pupil needed for the instruction of particular programs and the cost per square foot, it is reasoned that one method of reducing the costs of new building construction is to reduce the proportion of non-instructional area in the facility. Bowen stated that building areas are reported as either net or gross.²⁷ He defined net area as the amount of space needed to meet the functional requirements for which the building was constructed. The gross floor space he described as the total space in the facility including circulation area, support services area, and the structural area necessary for the integration of usable space. He recommended that the best design for a school plant maximizes net floor space and minimizes the gross floor space. Effectually, this reduces the amount of non-efficient area in the

²⁶Ibid., p. 83.

²⁷Brian Bowen, "Are Your School Costs OK?," American School and University, (March, 1977), Vol. 49, No. 7, p. 38.

facility. It was observed, however, that this basic premise is often given little consideration as great discrepancies in net to gross floor ratios generally exist from school to school. A recommendation was made in the report to school boards and superintendents to challenge design consultants to package space requirements in the most efficient manner possible, even to the point of setting limits on net to gross floor area ratios.

When observing the relationship of instructional and non-instructional space, Thiessen concluded that by minimizing circulation areas such as corridors and lobbies, and eliminating isolated and unused spaces in a building, costs could be reduced substantially.²⁸ He also noted that luxury spaces such as covered entrances, ports, tunnels, and basements are non-instructional spaces that add to the cost of construction. This was exemplified by the Fort Smith Lutheran School in Oklahoma where design limited hallways, made use of multipurpose spaces as both instructional and circulation areas, eliminated luxury spaces and assured instructional spaces were maximized by careful study of each program's activity needs. At building costs of the day, around \$25 per square foot, the school district saved \$25,000 in the construction of the facility.

²⁸Val Thiessen, "Economy in School Structure," School Management, (May, 1974), Vol. 18, No. 5, p. 40.

In studying school designs, architect Donald Burr²⁹ demonstrated the effect of circulation space and interior walls on overall area. He found that 15 percent of the total space in most schools was dedicated to student passageways. In comparing two designs, one--the traditional classroom-hallway arrangement, the other--a more open concept where instructional areas were also used as circulation areas, he found that the total instructional space requirement of the facilities programs could be met, and a savings of nearly 8,000 square feet could be realized in the latter building. At 1970 construction cost rates, this would reflect a savings of over \$200,000. This conservation was attributable to the elimination of corridors and numerous space consuming interior walls. However, he concluded that school programs are not always adaptable to the open design. Facilities should always reflect curricular needs, not design concepts.

Other studies have also reflected the impact of non-instructional space on gross school space and cost. The Allied Masonary Council notes in their publication, "New Trends in the Design, Cost, and Construction of Modern School Buildings," that the thickness of walls may be an important economic matter in school construction because of the usable floor space they occupy and the subsequent

²⁹Donald F. Burr, "The School House of the 1980's", A paper presented to the 25th Pacific Coast Builder's Hardware Conference, Victoria, B.C., May 25, 1970, p.7.

effect on reducing the instructional area of the school.³⁰ In advising school architects, the Washington State Office of Public Instruction reflects the need for a high instructional/non-instructional ratio by recommending that school facilities be designed to obtain maximum usable floor space within a minimum cubage, striving to limit ceiling heights, exterior perimeter wall length, and circulation areas in addition to maintaining a high ratio of instructional/non-instructional space.³¹ Designing passageways to serve as both corridors and instructional areas was repeatedly suggested as a space conservator.

Recognizing cost per cubic foot as a standard engineering measurement, Burke and Strevell found that this unit of measure was drastically reduced by such excessive spaces as empty attics, oversized foyers, exceptional corridor widths and large basements. But, conversely, an efficiently designed layout of all building spaces yielded maximum utility and a well organized building plan that lessened the total plant cost for the function and service load specified.³²

³⁰Allied Masonary Council, "New Trends in the Design, Cost and Construction of the Modern School Building," (McLean, Virginia: Allied Masonary Council, 1968), p. 20.

³¹"A Study of Economies in School Construction," (Olympia, Washington: Washington State Office of Public Instruction, 1971), p. 13.

³²W. H. Strevell and Arvid Burke, Administration of School Building Program, (New York: McGraw-Hill, 1959), p. 311.

In a national survey of state departments of education, Earthman found that the total space requirement per student was comparably less in states where winter temperatures are less severe.³³ This he attributed to the ability of these regions to utilize exterior circulation patterns thereby reducing the non-instructional space constructed. As a result of lessening the total building space, the cost of construction is also diminished.

In addition to the rated capacity of the facility and the percentage of its total space devoted to instructional purposes, another factor affecting school construction costs was the actual time required for the construction itself. This is reflected in the efforts that have been made in recent years to reduce construction time through various construction methods such as, fast tracking or construction management. For example, the utilization of fast tracking can reduce construction time as much as 25 percent by telescoping the steps of planning and construction.³⁴ The objective is to take bids and start construction of major building components such as foundations and superstructure before final details of the building are completed. By so doing, fast tracking saves

³³Glen I. Earthman, "A Report on Space Allocations," (Philadelphia, Pennsylvania: Philadelphia Board of Education, School Planning Department, August, 1967), p. 6.

³⁴The 1972 McElroy Commission Report, "Save for a Change," Nations Schools, (August, 1972), Vol. 90, No. 2, p. 114.

money by compressing the total construction time. This is especially important at a time when construction costs have been rising at a rate of 1 percent or more per month.

Although the construction industry is one of the largest in the United States, it is primarily composed of small independent companies. Because of this corporate structure, most school construction projects require multiple subcontractors and suppliers, thus leaving lots of room for passing the responsibility from one to another. This results in time loss due to disputes over jobs, quality of craftsmanship, and frequent change orders, all of which add to the delay of completion and contribute significantly to increasing the total cost of the project.³⁵ Two-thirds of the sample schools in Abramson's Massachusetts study were not completed on time and the average delay accounted for an additional 30 to 40 percent of the time originally agreed upon for completion of the project. He concluded that school construction as a process is characterized by high cost due to the fragmentation of responsibility, inadequate time control, wide fluctuation in the amount of work in progress, and seasonality.³⁶

In an address to the Great Lakes Regional Conference of the Council of Educational Facilities Planners,

³⁵Paul Abramson, ed., A Systems Approach for Massachusetts Schools: A Study of School Building Costs, (Boston, Massachusetts: Massachusetts Advisory Council on Education, November, 1971), p. 12

³⁶Ibid., p. 13.

McMahon reported that the continual rise in construction costs were making time one of the most important factors in facility planning and construction. His research indicated that projects in the Detroit school district were taking 50 to 70 percent longer to complete in 1970 than in 1960, and significant cost differences were resulting. He identified the optimal time frame for a 5 million dollar building consisting of classroom spaces as follows:³⁷

Program Development	5 weeks	3.1%
Program Analysis	7 weeks	4.4%
Schematic Drawing	10 weeks	6.3%
Design Development	15 weeks	8.8%
Construction Documents	26 weeks	16.1%
Bidding	5 weeks	3.1%
Review and Award	2 weeks	1.2%
Construction	83 weeks	52.0%
Occupation and Punch List	8 weeks	5.0%

In analyzing the time conservation or loss in this schedule, McMahon indicated that time could be gained during program analysis if a basic program was completed and given to the architect, then completion of the details was accomplished while schematics were being drawn. The cooperation of approval agencies was also cited as a necessity in conserving time during the planning period. Getting timely releases from fire marshalls, health departments, and building authorities to proceed with

³⁷Charles H. McMahon, "Management of Time, Cost and Quality in Public Construction Today," A speech given at the Kellogg Center, Michigan State University, East Lansing Michigan, at the Great Lakes Regional Conference of CEFP, March 17, 1971.

construction can save considerably during this phase. Once construction begins, usually one delay after another occurs. Weather, labor disputes, and accidents are to be expected and cannot be controlled; however, delays due to poor or lack of management are costly. Construction management is recommended as a means of approaching this problem. Bids are generally awarded to separate subcontractors for the construction trades, mechanical work, and one or more for equipment, under the construction management technique. In most instances, the successful bidders have probably never worked together. This lack of experience sometimes leads to a situation where confused areas of responsibility result. Although awarding separate bids began in the interest of saving money, McMahon reported that it has resulted in greater cost in many cases. This is due to the increased time and quality control problems that all too often are not closely supervised by a construction manager.

CHARACTERISTICS OF THE DISTRICT

There are many characteristics of the school district which could influence school construction costs. One such characteristic is the geographic location of the district.

Since the responsibility for educational facilities has traditionally resided at the local level, the usual connotation that accompanies a discussion of location and

permeates the majority of research studies centers on the location of the facility within the school district, e.g., site. This is not the concept of interest to this research. Instead, a more broadly viewed concept is considered--the geographic characteristics of the district's locality in relation to other districts where construction has occurred. Many researchers have eluded to the variations in school construction costs due to the location of the project; however, no major study was found. Bowen indicated that construction prices vary according to where the building is being constructed.³⁸ These regional differences were attributed to the variations in property values, labor and materials costs, and differing micro-economic factors in given regions. He reported that differences in extreme locations such as a remote rural area and New York City can account for 20 to 30 percent differentials in total construction costs. Abramson reported that costs in the industrialized areas of the northeastern United States are higher than in the southern and western regions of the nation.³⁹ Furno, in his annual construction cost study for School Management, reported national figures by regions as well as by individual state. Thus, comparable differences from one region of the nation to

³⁸Op. Cit., Bowen, p. 38.

³⁹Paul Abramson, "Educational Construction in 1977: A Look at Details," American School and University, (March, 1978), Vol. 50, p. 30.

another could be examined though no serious study was done to specifically identify the contributors to these variations.⁴⁰ In an effort to identify the variables that may affect the cost of an individual school project, the American Association of School Administrators indicated that as much as 25% variation in total construction costs could occur within a single state due to the geographic location. Hauling charges to remote areas, labor shortages, and the reluctance of contractors or subcontractors to submit bids for construction in out-of-the-way places were cited as responsible factors for much of this differentiation in cost.⁴¹

In a study to design an equitable formula to apportion state funds for school construction, Strevell studied 85 rural consolidated schools.⁴² He found that school plants with enrollments of less than 700 students, which are indigenous to rural areas, were progressively more expensive per pupil to construct. This disparity he found to vary in about the same ratio as the cost per teacher for an equivalent educational program. One of his major recommendations to reduce construction costs in sparsely

⁴⁰Op. Cit., Furno, p. 20.

⁴¹AASA Building Commission, Planning America's School Buildings, (Washington, D.C.: American Association of School Administrators, 1960), p. 186.

⁴²W. H. Strevell, State Aid for Central School Buildings, (New York: Bureau of Publications, Teachers College, Columbia University, 1949) p. 43.

populated rural areas was to consolidate institutions in an effort to increase the potential size of the new facility.

FINANCE

Historically, the costs of new school construction have been the responsibility of the local district. Barr and Jordan found that 4.3 billion dollars were spent nationally on capital outlay in 1970.⁴³ Of this total, 98 percent was used for the purchase of sites, structures and equipment for facilities, and 2 percent for the purchase of buses. They found that the total capital outlay could be divided into three primary sources:

<u>Source</u>	<u>Dollars</u>	<u>Percent of Total</u>
Local Districts	3,500,000,000	81.3
States	512,000,000	12.0
Federal	76,000,000	1.8

Building authorities, a quasi government agency that may operate at the state or local level supplied the remaining 164 million dollars or 3.3 percent of the total. These four sources accounted for 98 percent of the total capital expenditure in the United States in 1970. Barr and Jordan also found that the amount of local funds expended for capital purposes varied from 77.7 percent in 1953 to 82.5

⁴³W. Montford Barr, K. Forbis Jordan, C. Cale Hudson, Wendell J. Peterson, and W. R. Wilkerson, Financing Public Elementary and Secondary School Facilities in the U.S., A Study for the U.S. Office of Education, (Washington, DC: G.P.O., 1970), p. 26.

percent in 1967.⁴⁴ These figures emphasized the importance of the role local revenues have played in capital funding; they were indeed the primary source of money for this type of educational expenditure and were usually generated from the sale of property or general obligation bonds. Retirement of these bonds usually relies upon the taxation of local properties. The use of local funds is common to all states. Even Hawaii, acclaimed to have the only fully state funded educational structure in our nation, has allowed local contributions to capital expenditures.⁴⁵ The procedures and policies by which local funds can be utilized may vary from one state to another. They may be appropriated to meet specific costs, reserved or accumulated to meet future construction costs, or appropriated to meet the retirement of bonded indebtedness of the district. In any case, more local flexibility is available with local funds. Gwynne observed that some of the fiscal options found nationally include pay-as-you-go, reserve funds, long-term and short-term indebtedness as the major options.⁴⁶ In studying local funds as a source of financing educational construction, the understanding

⁴⁴Ibid., p. 28.

⁴⁵Richard Salmon, "Improving School Finance in Louisiana," (Gainesville, Florida: Economics and Education Institute and Gulf South Research Institute for the Louisiana State Department of Education, 1980), p. 12.

⁴⁶Susan K. Gwynne, ed., Guide for Planning Educational Facilities, (Columbus, Ohio: Council of Educational Facility Planners, International, 1976), p. L8.

of two major concepts is essential: local capacity and local effort.

One of the primary measures of local capacity, the ability of the local jurisdiction to fund education, has long been based on the assessed value of property subject to taxation for educational purposes. This has been retained from an era when the nation was more agrarian and property values were more valid as indicators of wealth than they may be today. Despite this limitation, however, utilization of the property tax has some advantageous characteristics for school districts:⁴⁷

1. The property tax is relatively stable. This is especially important in the present economic situation where other taxable economic factors experience substantial variation in revenue production.

2. The property tax is relatively easy and inexpensive to administer.

3. Although varying property assessments among school districts are given consideration in locating homes and industries, they are less of a consideration than other local taxes.

The administration of property taxes, however, suffers from assessment practices which vary widely from district to district and yield considerable local dissent.

⁴⁷Charles W. Rudiger and Rubin Pollack, "Wealth's Effect on Education," School Management, (February, 1972), Vol. 16, No. 2, p. 37.

These practices are usually outside of the control of local school authorities.⁴⁸

Another aspect of local funding is the effort made by the district to support education. There are, according to Johns and Morphet, several possible measures of effort.⁴⁹ A rough estimate of local effort is the educational expenditures of the district. This measure may, however, be misleading as a district with high ability can expend a larger amount of funds than a less wealthy district yet enjoy a much lower local effort. Therefore, expenditures are an indication of the investment in education but not necessarily indicative of the local effort being made.

Local levies, though often considered indicators of local effort, may also give an unrealistic picture because districts with low assessment ratios and high levies may be making less effort than a district with high assessment ratios and a low levy rate. The measure supported by Johns and Morphet is the quotient attained by dividing the local tax revenue by the districts' equalized assessment value. The measure is expressed as the equalized tax levy.

Although traditional in nature, heavy fiscal dependence on local revenues has resulted in disparities among

⁴⁸Ibid., p. 37.

⁴⁹Roe L. Johns and Edgar Morphet, The Economics and Financing of Education, (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975), p. 195.

school districts. In a study for the National Education Finance Project, Rossmiller, Hale, and Frohreich sampled 223 school districts in 8 states to study the fiscal capacity and local effort of school districts.⁵⁰ One of the major functions of the study was to research the effect of utilizing market values of local property, personal income, and retail sales as indicators of fiscal capacity. They concluded that since all taxes must ultimately be paid from income, that heavy reliance on property tax to finance education creates inequities in the fiscal capacity and effort of the districts. They based this conclusion on a near zero correlation they found between market value of property and fiscal capacity as measured by income per capita.

Because of the tremendous differences in local financial resources due to variations in fiscal capacity and local effort, many poorer school districts are finding it practically impossible to adequately provide educational facilities. The tradition of exclusive local responsibility in the financing of school buildings is one of the major barriers to achieving this objective. Financially poor school districts must resort to prolonged use of unsafe, overcrowded, inefficient buildings while wealthier districts have ample funds to house their programs in adequate physical plants.⁵¹

⁵⁰Ibid., p. 123.

⁵¹Op. Cit., Salmon, pp. 51-53.

In a study of educational equity for the Louisiana State Department of Education, the fiscal effort made to finance school construction was measured by computing a debt ratio for each district.⁵² Debt ratios were determined by dividing the average bonded indebtedness of each local education agency for three consecutive years by 100 percent equalized valuation of property and multiplying the quotient by 100. The resulting debt ratio was indicative of the fiscal effort local districts invested in the construction of school facilities. A positive relationship was found to exist between this local fiscal effort to construct schools and the growth rate of the district in average daily membership. This relationship indicated that districts who were experiencing student increases were applying more educational dollars to capital outlay than declining or status quo districts. However, the study also discovered a negative relationship between the levels of fiscal effort to construct school facilities and the local fiscal capacity of the school district. This indicated that wealthier districts required less fiscal effort to support their school construction programs than districts with less fiscal capacity.

In the state of Indiana, the State Legislative Council had a study of the educational structure completed in 1974. In this study, Jordan and Alexander found that

⁵²Ibid., p. 57.

the local ability of the districts depended upon the distribution patterns of industry, farms, and types of workers throughout the state as well as inconsistencies in the measurement of property valuations.⁵³ They concluded that since the tax source for local schools was primarily property, the discrepancies in receipts from one district to another were obvious and that the facilities and quality of education in the poorer districts were inhibited due to fiscal inability. They reasoned that since taxpayers are not historically apt to over tax themselves to offset this disparity, that poorer districts will not effectuate a local effort high enough to raise resources to an equivalent of the wealthier districts.

Researchers studying 18 school districts in the state of South Dakota revealed that the state's larger school districts, which typically have a higher tax base, had sufficient debt leeway to enter into major building programs while smaller districts with lower tax bases were hard pressed to meet the facility needs of their district.⁵⁴ Historically, they found that South Dakota's larger communities have had active building programs while major problems

⁵³Forbis Jordan and Kern Alexander, "Financing the Public Schools of Indiana--A Report to the Interm School Finance Study Committee and Legislative Council." (Indianapolis, Indiana: Indiana Legislative Council, December, 1974), p. 181.

⁵⁴National Educational Finance Project, "Financing the Public Schools of South Dakota." (Pierre, South Dakota: State Division of Elementary and Secondary Education, 1973), p. XVII.

have existed in poorer rural districts where enrollments were stable or declining.

In a national study conducted for the United States Office of Education, Wilkerson polled 519 school districts in 43 states to determine the effect of certain financial variables on capital indebtedness through multiple regression analysis.⁵⁵ Utilizing correlations and t-tests for differences between means, relationships among the variables were also analyzed. His major finding indicated that wealthier districts have a higher debt per pupil for capital outlay and pay considerably more per year for debt service per pupil than poorer districts; yet the effective tax rate for debt service in these districts amounted to only 40 percent of that in poorer districts nationally. Wilkerson thus emphasized the inequity of dependence on local property tax resources to fund educational construction.

School finance has in recent years undergone considerable scrutiny from the courts in the United States. The 1971 landmark decision of the California Supreme Court in Serrano v Priest found that the state's school finance system resulted in substantial disparities among school districts in per pupil revenues. Although the presentation of the plaintiff cited many examples of inequities, the

⁵⁵William R. Wilkerson, "Equalization of School Construction Financing", Selected Papers in School Finance, 1976, (Washington, D.C.: U.S. Dept of H.E.W., 1976), p. 204.

primary comparison was between the Baldwin Park and Beverly Hills Unified School Districts. Testimony revealed that school expenditures in the Beverly Hills district was 2.10 percent as much as Baldwin Park but that the tax burden in Baldwin Park was 230 percent greater.⁵⁶

	<u>Assessed Value per ADA</u>	<u>Tax Rate</u>	<u>Expenditure per ADA</u>
Beverly Hills	\$50,885	\$2.38	\$1,232
Baldwin Park	3,706	5.48	577

This comparison can be visualized more readily by referring to the above table. The expenditures of educational dollars per average daily attendance in the Beverly Hills district was \$1,232 as compared to \$577 in Baldwin Park, 46 percent of the Beverly Hills figure. The discrepancy in wealth between the two districts is illustrated by the disparity in the assessed value of property per average daily attendance. The Beverly Hills district enjoyed a 92.72 percent advantage. The inequity suffered by the taxpayers in Baldwin Park is indicated by the prevailing tax rate in each district. Although taxes were 230 percent higher for Baldwin Park residents, their students received only 46.8 percent of the educational dollars generated in the Beverly Hills district by the lesser tax rate.

These inequities were created by reliance on local

⁵⁶Op.Cit., Pollack and Rudiger, p. 37.

property tax to generate school funds. Because of the wide variance in taxable wealth between the districts, these disparities were quite large. It was, therefore, the decision of the court that the finance system discriminated against those who lived in low property wealth districts and violated their right to equal educational opportunity.⁵⁷

Since Serrano, similiar cases have been filed in 31 other states. Although the primary point of contention in these cases has been the current operating budget of the school district, the expenditure of funds for capital outlay was explicitly addressed in Hollins v Shofstall in Arizona:

Funds for capital improvements in school districts are even more closely tied to district wealth than are funds for operating expense. The capability of a school district to raise money by bond issue is a function of its total assessed valuation.⁵⁸

At the turn of the century, no state had developed a plan for assisting local districts with capital outlay expenditures. The first state to do so was Alabama in 1901, closely followed by Louisiana in 1904, and South Carolina in 1909.⁵⁹ However, only since World War II

⁵⁷Stephen J. Carrol and Rolla E. Park, "Equity: School Reforms Elusive Goal," The Education Digest, (Condensed from Rand Research Review, October, 1979).

⁵⁸Hollins v Shofstall, Superior Court of Arizona, Maricopa County, No. C-253652, June, 1972.

⁵⁹Op.Cit., Johns and Morphet, p. 279.

has state assistance become widespread among the states. Today about forty-six states have programs to aid local districts in capital outlay and debt service expenditures.⁶⁰ Nationally, state money has contributed 15 percent of these funds since World War II.⁶¹ However, this is not indicative of the wide variation that occurs from state to state. State contributions may range from near full support as in Hawaii and Maryland, to no state support as in Iowa and Arizona.⁶² But in most states, it is still the local government that provides the largest percentage of funding for capital facilities, even though state contributions have increased in recent years.

The American Association of School Administrators reported that the amount of state funds available to local districts for capital outlay increased from \$126 million in 1950 to \$255 million in 1957 and that the number of states that provided support to local school districts increased from 10 to 37 states.⁶³

⁶⁰Roy M. Blizzard, "Alternative Methods of Financing School Facilities Construction," (Charleston, West Virginia: A paper presented to the West Virginia Legislative Subcommittee on Public Education and Education of Handicapped Children, October, 1981), unnumbered.

⁶¹Thomas H. W. Jones, "Planning to Finance School Facilities," from Designing Learning Environments, ed. by Phillip J. Sleeman and D. M. Rockwell, (New York: Longman, 1981), p. 135.

⁶²Op. Cit., Salmon, p. 16.

⁶³Op. Cit., AASA School Building Commission, p.

In a comparative study of Georgia's state capital outlay program, McGuffey completed a national survey to obtain information about programs in other states.⁶⁴ From his results, he categorized each state into one of eight types of capital outlay programs based on the primary feature of their program.⁶⁵

1. No capital outlay program--States in this category provide no support for capital outlay from the state level. Funding of school construction is solely a local responsibility.

2. Emergency funding--These programs are designed to assist poorer school districts that have exhausted local bonding capacities or have extensive emergency conditions.

3. Loan programs--States who use loan programs provide funds to local school districts at a reduced interest rate to be repaid from local tax levies.

4. Consolidation grants with cost sharing--This category includes those state programs designed to provide incentives to school districts to consolidate schools or merge school districts.

5. General aid formula--This fiscal plan provides funds for school buildings as a part of the minimum

⁶⁴Carrol W. McGuffey, An Analytical Study of the State Capital Outlay Program in Georgia, (Athens, Georgia: University of Georgia, 1979), p. 32.

⁶⁵Ibid., p. 33-38.

foundation program. The local district's share is computed as a component of the total support program.

6. Debt service retirement--This classification was intended to cover those states with legal provisions to award capital outlay funds to local districts for the purpose of retiring outstanding bonded indebtedness.

7. State grants with district cost sharing--States which offer a grant made with the requirement that local districts must share the costs of projects for which state funds are allocated are in this category. These provisions are separate from the regular state aid programs.

8. State funding with no cost sharing--This model provides funds to local districts with no matching or other cost sharing requirements. Some states in this classification have provided full state funding.

McGuffey concluded that approximately 75 percent of the states have some form of school building aid program available to local school districts. He then draws comparisons of Georgia's funding program to those of states in other categories.

In a study for the Gulf South Research Institute and the Economics and Education Institute, Salmon classified state aid programs into five major categories which he defined and gave advantages and disadvantages of each method. The categories he identified included: complete state support, grants-in-aid, loans, authorities,

and no state assistance.⁶⁶

1. Full state support--As the name indicates, placed entire burdens of capital outlay and debt service at the state level. Only three states, Hawaii, Maryland, and Florida, have systems approximating this level. Neither Florida nor Maryland totally fund school construction, and Hawaii allows a small local contribution.

2. Grants-in-aid--This classification was subdivided into three different categories: equalizing, percentage-matching, and flat grants.⁶⁷ Salmon indicates that most experts in school finance recognize the equalizing grant as the best method for distribution of state money. This allows consideration of both the needs of the school district and its ability to pay. Percentage-matching grants provide a fixed percentage of state support for each local project. The amount of state assistance varies according to the project cost, and the ability of the local district to pay is not taken into consideration. The most popular method for state facility grants is the flat grant which also is a supplement to local funds. Flat grants may be based on the ADA or ADM of the district or may be a fixed amount per approved project. As a result, large variations in the quality of school facilities generally occur as well as inequitable tax efforts

⁶⁶Op. Cit., Salmon, p. 12.

⁶⁷Ibid., p. 22.

between districts within the states utilizing this method.

3. Loans--States in this classification have established loan funds which provide a direct source of money for local districts to utilize for capital expenditure.⁶⁸ These funds are available as low interest loans without consideration of the fiscal ability of the local district and consequently have no equalizing effect.

4. Authorities--Many states have laws restricting the tax level and/or the level of indebtedness. The authority is an agency which can help negate the restrictive effect of these laws. They operate outside of the usual governmental organization attaining their funds through sale of revenue bonds. Once the school is constructed, the local education agency enters a long-term agreement for rental of the facility with the authority. This assures revenue to retire the revenue bonds.⁶⁹

5. No State Assistance--States in this category have no mechanism by which to support local school construction. Consequently, the burden of cost is totally at the local level.

In addition to the state and local funds expended for capital outlay, a small percentage of federal funds are also utilized by local school districts for building new schools each year.

⁶⁸Ibid., p. 24.

⁶⁹Ibid., pp. 26-27.

Historically, there has been a major controversy about the right of the federal government to become involved in public education. This stemmed from the Tenth Amendment of the Constitution of the United States which mandated that powers not specifically delegated to the federal government by the Constitution were reserved to the states or to the people.⁷⁰ There has been little argument that states should have control over public educational systems. The disagreement centered around the constitutionality of the federal government expending funds in the area of education. Although few cases have dealt specifically with the issue, it appears to have been established through a Hamiltonian interpretation of Article I, Section 8 of the Constitution in Helvering v Davis that Congress could tax and spend under the general welfare clause.⁷¹ This decision was upheld in Ivanhoe Irrigation District v McCraken⁷² in 1958 and the establishment of reasonable conditions for the use of federal money in education was allowed. There are four primary sources of federal funds from which local districts can attain finances for school construction: Impact Aid, Disaster

⁷⁰Kern Alexander, Ray Corns, Walter McCann, Public School Law, Cases and Materials, (St. Paul, Minn.: West Publishing Company, 1969), p. 43.

⁷¹Ibid., p. 35.

⁷²E. Gordon Gee and David Sperry, Education Law and the Public Schools: A Compendium, (Boston, Mass.: Allyn and Bacon, Inc., Sept., 1979), p. F-4.

Aid, the Vocational Education Amendments, and the Appalachian Regional Commission.

One of the major sources of federal money for school construction is Public Law 81-815 which was enacted in 1950 and superseded the Lanham Act of 1941.⁷³ It was administered by the U.S. Department of Education, Division of School Assistance for Federally Affected Areas, and was commonly referred to as Impact Aid. To be eligible for these funds, a school district had to be located in a federally impacted area in which the presence of government installations adds significantly to the present school enrollment. Because the federal government did not pay local property tax on these installations, it was the intent of Impact Aid to help support the local schools. Qualifying school districts must have a 6 percent increase in federally related student enrollment over a four-year period in order to secure an Impact grant-in-aid for school construction purposes. The amount of money for which a district is eligible was determined by the number of federally related students multiplied by the established per pupil cost of construction in the state. Congress has appropriated \$1.564 billion for constructing school facilities under Public Law 81-815 since its enactment in 1950.⁷⁴

⁷³Op. Cit., Educational Facilities Laboratories, p. 48.

⁷⁴Ernest L. Boyer, Administration of Public Laws 81-874 and 81-875, (Washington, D.C.: G.P.O., 1978), p. 37.

The second source of federal money for school construction has generally been referred to as Disaster Aid. Created by the 1965 passage of Public Law 89-313, it became a section of the Impact Aid law amending it to authorize the Commissioner of Education to provide financial assistance to replace or restore educational facilities damaged or destroyed by a major disaster.⁷⁵ When the President declares a disaster area, the Federal Disaster Assistance Administration defines the geographic limits of the affected area, and school districts within those boundaries are eligible to apply for disaster aid. During the 1978 fiscal year, \$8,329,124 was allotted to local school districts under this law.

One of the objectives of federal participation in education has been to assist specific groups of individuals such as handicapped or disadvantaged students or to emphasize specific programs as in the National School Lunch Act, the National Defense Education Act, and the Elementary and Secondary Education Act of 1965.⁷⁶ These and other similar programs were enacted to strengthen areas of the public education system which were thought to be weak or in which a growing national concern for achievement existed. The first program to receive federal assistance and set the precedent for federal participation in

⁷⁵Ibid., p. 43.

⁷⁶Op. Cit., Gee and Sperry, p. F-1.

education was vocational education through passage of the Smith-Hughes Act of 1935.⁷⁷ Federal support for this program was reaffirmed and further supported by passage of the 1963 Vocational Education Act and its subsequent extension through the Education Acts of 1976. Under these latter bills, federal funds for the construction of area vocational education school facilities were made available. Money was authorized to the states in basic grants and decisions concerning their use were made at the state level according to the guidelines and requirements of the Act.⁷⁸ Basic grant money could be applied to construction of vocational facilities that were included in the state's five year plan and met federal construction regulations.⁷⁹

Federal funds for vocational education were expanded by the Appalachian Regional Act of 1965. This Act initially made available 16 million dollars for the funding of vocational education facilities in the Appalachian area where citizens could receive the training and education necessary to obtain employment.⁸⁰ This money was authorized in accordance to the provisions of the 1963 and subsequent

⁷⁷Op. Cit., Johns and Morphet, p. 373.

⁷⁸Vocational Education Amendments (PL 94-482), 90 Stat. 2081 (1976), 20 USC 1001 § 2311 et seq, (1976).

⁷⁹U.S. Bureau of Occupational and Adult Education, The Handbook: A Vocational Education Legislative Reference, (Washington, D.C.: G.P.O., January, 1978), p. 113.

⁸⁰U.S. Congress, Committee on Public Works, Appalachian Regional Acts of 1965, Hearing, 89th Congress, March, 1965, (Washington: GPO, 1965), p. 9.

Vocational Education Acts.

Studies relating the effect of federal money on school construction costs were not found in the literature; however, it was known that the rate of wage payment on construction projects where federal funds are involved were subject to federal regulations that tend to increase the cost of labor. This practice came into existence after congressional approval of the 1931 Davis-Bacon Act. Passed during a period of severe economic depression, this law was designed to protect the wages of workers on government projects. It required that any contract for the construction, alteration, or repair of any public facility, to which the United States or the District of Columbia was a party, include provision for payment of the prevailing wage to mechanics and laborers in accordance to the work they were performing.⁸¹ The prevailing wage was to be determined by the Secretary of Labor for corresponding classes of laborers and mechanics after consideration of the wage rates in the locale of the project. In a recent federal case, the court upheld the liberal interpretation of the Davis-Bacon Act to include any project, public or private, where government revenues were being utilized to partially or completely fund the construction.⁸² This broadened concept of the law mandated inclusion of school building

⁸¹Davis-Bacon Act of 1931, 40 USCS § 276a, et seq.

⁸²North Georgia Building and Construction Council v Goldschmidt, (1980, CA 5 Ga.), 621 Fd. 697.

projects when the local school district has received assistance from a federal source.

Additionally, wage rates in West Virginia are further regulated by state statute which requires that any private contractor who is working on a state funded project must pay according to the prevailing wage rate as determined by the West Virginia Department of Labor.

The effect of these regulations on school construction costs has been described by Beeman as substantial.⁸³ He indicated that the cost of actual construction could usually be divided into materials/equipment costs and labor costs in an approximate one to one proportion. In an illustration of two projects in southern West Virginia where federal money was not involved and construction was completed by Board of Education employees, he indicated that a savings of as much as 20 percent of the construction costs were realized by the local district.

Further substantiation was given by Hughes who supplied the specifics on one of the projects Beeman cited. He indicated an even greater savings than earlier considered. Utilizing the present building cost rate of \$62 per square foot in West Virginia, Hughes estimated the conventional construction price of a recently completed project at \$300,000. By constructing the facility using

⁸³David Beeman, Architect, S.E.M. Partners, Inc., interview conducted in Beckley, West Virginia, March 24, 1982, by Clacy Williams.

district personnel, this figure was trimmed to \$171,000.⁸⁴ Obviously, this variation also reflected savings in factors other than personnel cost, but labor savings were credited as the primary contributor. Further investigation indicated that the specific labor cost restrictions and variances illustrated in Table 1 were operating in this 1980 project; wages are expressed in dollars per hour.

The possible savings in labor costs are illustrated by the increase in wages between the hourly wage rate of specific skill tradesmen employed by the county board of education,⁸⁵ the state prevailing hourly wage rate,⁸⁶ and the federal hourly wage rate⁸⁷ in effect at that time period. Rather large increases were visible between district wages and those required by the state and federal wage restrictions. Additionally, federal restrictions, while slightly less for masons and sheet metal workers, required considerably higher wages for painters and general laborers.

⁸⁴John Hughes, Superintendent of Schools in Mercer County, West Virginia, interview conducted in Princeton, West Virginia, March 25, 1982, by Clacy Williams.

⁸⁵Mercer County Board of Education, Maintenance Personnel Salary Schedule, Princeton, West Virginia, 1980-81 school year.

⁸⁶West Virginia Department of Labor, "Building Construction Rates Report--1980," Charleston, West Virginia, wage rates for Mercer County, unpublished, unnumbered.

⁸⁷The Federal Register, Vol. 45, No. 205, (Washington: GPO, October 24, 1980), pp. 70674-70676.

Table 1

A Comparison of District Wage Rates with State and Federal Wage Minimums
in Selected Construction Occupations

Occupational Title	District Hourly Wage Range	Federal Hourly Wage Rate	State Hourly Wage Rate	Percentage of Increase*		
				Dist. to State	Dist. to Federal	State to Federal
Carpenter	7.05--7.95	12.73	12.46	57%	60%	.02%
Mason	7.05--7.95	12.12	12.45	57%	52%	-.03%
Plumber	7.05--7.76	12.07	11.98	54%	56%	.01%
Painter	6.86--7.39	10.87	8.96	21%	47%	21.00%
Electrician	7.05--7.95	10.86	10.16	28%	37%	.07%
Sheet Metal	7.05--7.76	12.56	12.73	64%	62%	-.01%
Gen. Laborer	6.86--7.39	10.56	8.32	13%	43%	27.00%
Foreman	7.49--8.39	-----	-----	-----	---	-----

*Based on district maximum.

Based on the practical experiences of these men in building school facilities and the wage rate differentiation, it was apparent that the stipulations placed on the expenditure of federal funds could, in these instances, have had potential effect on the total cost of the facility being constructed.

SUMMARY

This review of the literature has surveyed the cost of school construction and identified some of its specific components. Components discussed were site costs, site development costs, architectural fees, and construction costs. These costs were demonstrated to have increased steadily for the past 30 years and to have presently reached an all-time high. The importance of implementing potential economies in these areas of expenditure throughout the building program was emphasized and specific illustrations were given showing how savings were potentially possible from initial planning and site procurement through design and completion of the facility.

Additionally, the review of literature identified some of the variables that tend to effect the cost of school construction projects. These variables may be categorized as descriptors of the building, characteristics of the district, and financial variables.

Variables that were descriptive of the building included its rated pupil capacity, the percentage of its

total space dedicated to instructional uses, and the length of time that was required to construct the facility.

District characteristics which were acclaimed to affect the cost of construction included the geographic location of the district and whether it was primarily rural or urban.

Financial variables were illustrated to be the assessed value of the district, its local fiscal effort, and the source of funds used in the construction project.

Although the worth of these variables in affecting construction costs is reiterated by writer after writer, little empirical evidence has been made available to support the importance of the contribution most of them have made to school facility costs.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to discuss the research methodology that was employed to conduct this study, describe the data that was assimilated, state the research questions, and describe the statistical treatment that was utilized.

RESEARCH METHODOLOGY

This research study falls within the classification of descriptive research as it described, analyzed, and interpreted data that presently exists in the school districts of West Virginia. It involved exploration of a possible cause-effect relationship between school construction costs per pupil and selected independent variables in three specific categories: descriptors of school plants, characteristics of the district, and funding factors.

Components of Cost

In studies of the cost of school construction projects, five variables appear to be the most instrumental contributors to the cost per pupil. These include site cost, site preparation cost, architectural/engineering fees, construction costs, and movable equipment costs. In order to standardize these costs to a 1981 level, an inflation factor was calculated for each year. Total project cost was expressed in cost per pupil.

Descriptors of School Plants

In this study, the descriptors that were examined in order to analyze their impact on total per pupil cost were: the percentage of instructional space in the facility, the length of construction time, and the type of facility--whether it is to house elementary, secondary, or vocational students.

Characteristics of the District

Other factors which may influence per pupil construction costs are specifically related to the characteristics of the district and includes: geographic location--as determined by the boundaries of the state's seven building trades districts; whether the district is urban or rural--as defined by the U. S. Bureau of Census; and the size of the district--represented by its net enrollment.

Funding Factors

In order to determine the effect of funding on the total per pupil cost of new school construction, inquiry into the following variables was conducted: wealth of the district--the assessed value of each district for the 1982 taxable year as reported by the West Virginia State Tax Department divided by the net enrollment of the district; the local effort of the district toward facilities construction--the quotient of the total amount of local dollars invested in facilities by the district over the study period divided by the 1982 assessed value of the

district; the source of the funds utilized for capital expenditures--local, state, and/or federal. The final variable to be analyzed was the total cost per pupil of education within the districts--the total educational expenditures of the district for the most recent, 1981-82, school year as reported by the West Virginia State Department of Education. This included state aid, funds from local tax sources, and special levies.

Data Collection

There were three primary sources from which the data for this study were collected: the West Virginia Board of Education, the United States Department of Commerce--Bureau of the Census, and the architects who have designed new school plants in West Virginia under the Better School Buildings Amendment.

In 1972, the citizens of West Virginia, through passage of the Better School Buildings Amendment, made available 200 million dollars in state grants for the purpose of constructing school facilities. Today, practically all of this money has been distributed according to Better School Buildings Amendment guidelines and utilized within the school districts of West Virginia. The primary source of data for this study was the West Virginia Department of Education form P-1¹ utilized by

¹Daniel B. Taylor, "Procedures for Approval of School Construction Projects," Memo, May 23, 1974, to All County Superintendents, p. 1.

local education agencies to submit project specifications for approval prior to release of B.S.B.A. funds. A second major source was the West Virginia Department of Education's form BP-13A--Certificate of Project Completion. It supplied much of the necessary descriptor information as well as specific project costs.² Copies of these forms are found in the Appendices A and B. Additionally, the reports from the Statewide Assessment of School Facilities project completed in November, 1981, were also used to gather data concerning specific project descriptors. Finally, the year-end financial reports submitted by local district superintendents to the Department of Education's Bureau of Finance and Administration furnished the remaining financial data needed.

Data from the P-1 and BP-13A forms, as well as the Statewide Assessment of School Facilities project, were available from the Facilities Planning Division. The Bureau of Finance and Administration provided data from the year-end reports submitted by LEA superintendents, and from data prepared for legislative hearings during the 1980-81 sessions during which the state aid formula was revised. The collection of this data was conducted through review of these forms and transcribed onto a compilation sheet to facilitate its computerization. Data concerning the assessed value of property were obtained

²Ibid., p. 2.

from the West Virginia State Tax Department and added to the compilation sheet.

The data concerning the characteristics of the districts were obtained from three sources: (1) the Bureau of Census Publication--"Estimates of the Population of West Virginia Counties and Metropolitan Areas"; (2) the architects of the respective projects--a request for information was submitted to attain information regarding the time differentiation between bidding and completion of construction, and the percent of instructional space in each respective facility; (3) the West Virginia Building Trades Council--provided data concerning the geographic boundaries of West Virginia's seven building trades jurisdictions. These were used to identify specific geographic locations of school projects within the state. The following outline is a quick reference indicating the source and characteristics of the data gathered.

I. West Virginia Department of Education

A. Facilities Planning Division

1. Total cost of new school construction projects
BP 13-A
2. Construction costs BP 13-A
3. Site acquisition cost BP 13-A
4. Site preparation cost BP 13-A
5. Fixed equipment cost P-1
6. Architectural/engineering costs
P-1
7. Total cost/pupil BP 13-A
8. Rated capacity BP 13-A
9. Instructional space SASF
10. Non-instructional space SASF
11. Elementary BP 13-A

- A. Facilities Planning Division (continued)
 - 12. Secondary BP 13-A
 - 13. VTE SASF
 - 14. Sources of funds for the project
BP 13-A
- B. Bureau of Finance and Administration
 - 1. Wealth of the district = assessed value/pupil--LEA superintendents' year-end report (SYER)
 - 2. Total educational expenditure/pupil/district--SYER
- II. West Virginia State Tax Department--
Assessed value of property in each district/county
- III. Architects
 - A. Ratio of instructional to non-instructional space
 - B. Number of months/days expiring between bid and occupancy
- IV. West Virginia Building Trades Council--
Geographic location of building projects throughout the state
- V. United States Department of Commerce, Bureau of the Census--Standard Metropolitan Statistical Areas in West Virginia

Accumulation and compilation of the data was accomplished through reviewing state department of education records, U.S. Census Bureau publications, and the West Virginia Building Trades jurisdictions. Letters were sent to architects in order to determine the additional data in Item III of the outline.

METHOD OF ANALYSIS

Once compilation of the data was achieved, all data were recorded on computer via terminal input for each project. Compilation was done in a grid that minimized the chances of errors by the computer operator.

The data were analyzed through use of the Statistical Package for the Social Sciences (SPSS),³ a computer program package designed for the behavioral sciences at the computer facilities of VPI&SU. Multiple regression was used to determine the significance of the impact of the independent variables on the dependent variable--cost per pupil.

SUMMARY

In this chapter, the research study was described as utilizing a descriptive research methodology in order to determine the impact that related school plant descriptors, district characteristics, and school funding variables have had on the per pupil cost of school construction projects completed in West Virginia during the past ten years. The data and its sources were outlined and the collection procedures discussed. The procedures for statistical analysis were also identified.

³Norman H. Nie, C. Hadlai Hull, Jean G. Jenkins, Karin Steinbrenner, and Dale Bent, Statistical Package for the Social Sciences, (New York: McGraw-Hill Book Co., 1975), p. 330.

CHAPTER IV
ANALYSIS OF THE DATA

The major purpose of this research was to determine the effect of specific financial and descriptive data on the cost per pupil of school construction in the state of West Virginia. In order to accomplish this end, a data compilation instrument was devised, State Department of Education and State Tax Department records were examined, communications, both by letters and interviews, with school architects and State Building Council personnel were effected, and U.S. Bureau of Census publications were obtained and utilized. In this chapter, the data are presented and discussed. It includes a description of certain adjustments to and computation of the variables, descriptive analysis of the data, the results of the statistical analysis, and a summary of the findings.

Description of the Study Projects

The data source for this study was the new school construction projects funded through West Virginia's Better School Buildings Amendment. One of the purposes of this Amendment was to improve the quality of educational facilities in West Virginia by providing state funds on a grant basis and additional incentive money to help generate local revenues for school construction and improvement. The Amendment was passed in November, 1972; guidelines and procedures were designed, and money was made available

in mid 1973. The study group consisted of 128 elementary, secondary, and vocational-technical school facilities. One special education facility in Kanawha County was excluded because of its specialization for exceptional students. The first facility in this study was completed in 1974 and was the only new school built during that year. It was learned that this facility was already being planned at the time the Amendment was passed and consequently was the first submitted to the State Board of Education for approval. A complete listing of study projects can be found in Appendix C. Further study shows a fluctuation in the number of completions in subsequent years. This could be attributed to the highly volatile economic atmosphere that prevails throughout most of the state due to heavy reliance on the coal industry and/or the political atmosphere within the districts that influence the decisions of superintendents regarding the timing of bond referenda. The years that reported the greatest number of project completions were 1976 and 1978, both reporting 27, followed by 1980 during which 20 buildings were completed. These years are considerably above the mean of 14.22 completions per year for the entire nine-year period of time.

DESCRIPTION OF VARIABLES

Adjustments to and Computations of the Dependent Variable

The nature of the problem being studied in this research was such that a multiple regression analysis

provided the primary statistical result in the study. Prior to submitting the data to such an analysis, however, procedures were necessary to adjust the dependent variable, cost per pupil of construction projects completed during the past nine years, to the 1982 level. In order to achieve this, an inflation index for school construction in West Virginia was developed. In the first step of this development, means for each year's construction in cost per square foot were determined. These means were then found to be a percentage of the 1982 mean. By dividing this percentage into 1, an inflation factor was determined for each year. Adjusting construction costs consisted of multiplying the total capital cost of each project by the inflation factor respective of its completion date. Table 2 indicates the years this study examined, the number of schools completed in each year, the mean cost per square foot of buildings completed during the year for each type of facility as well as the total for each year. Additionally, the percentage of the yearly cost to the 1982 cost and the inflation factor is shown. The table indicates that in 1976, 17 elementary schools with a mean cost of \$35.16 per square foot, 8 secondary schools with a mean cost of \$37.96 per square foot, and 2 vocational-technical centers with a mean cost of \$39.88 per square foot were constructed. This accounted for a total of 27 new facilities at a mean cost of \$36.34 per square foot. The table further indicates that this \$36.34 per square foot mean

Table 2

Breakdown of Costs Utilized in Development of an Inflation
Index to Adjust Costs of Construction Projects

Year	Elementary		Secondary		Vo-Technical		Total		% Inflation	
	Freq.	\bar{X} Cost Per Sq. Ft.	Freq.	\bar{X} Cost Per Sq. Ft.	Freq.	\bar{X} Cost Per Sq. Ft.	Freq.	\bar{X} Cost Per Sq. Ft.	1982 Cost	Factor
1974	0		1	\$31.78	0		1	\$31.78	.5587	1.78986
1975	9	\$34.47	3	34.18	1	\$48.13	13	35.43	.6229	1.60539
1976	17	35.16	8	37.96	2	39.88	27	36.34	.6389	1.56519
1977	6	37.13	5	40.26	2	44.19	13	39.41	.6929	1.44321
1978	14	41.12	9	43.07	4	41.16	27	41.78	.7345	1.36147
1979	6	41.37	3	44.44	1	42.86	10	42.44	.7461	1.34030
1980	15	41.82	3	37.32	2	48.49	20	42.66	.7500	1.33333
1981	9	53.12	2	55.18	2	54.58	13	53.66	.9434	1.05999
1982	1	52.92	3	58.20	0		4	56.88	1.000	1.00000
Sums	77	3113.25	37	1557.25	14	629.93	128	5,300.23		
\bar{X}		40.43		42.09		45.00		41.41		

was 63.89 percent of the 1982 mean cost. When divided into 1, the factor used in the index to represent 1982 costs, the resulting quotient of 1.56519 was identified as the index by which the costs of each 1975 project was multiplied. This product reflected the cost of the same facility at 1982 cost levels.

In order to determine a per pupil cost, this adjusted figure was then divided by the rated capacity of the facility. This capacity was derived from application of the utilization guidelines recommended by the State Board of Education in The West Virginia Handbook on Planning School Facilities, and § 18-5-18a of the West Virginia Code. The utilization guidelines offer optimal capacities for secondary and vocational facilities based upon program offerings and required space. A condensed listing of these guides appears in Appendix D. The capacities of kindergarten and elementary schools are restricted by the number of classrooms available due to § 18-5-18a of the West Virginia Code which limits the teacher/pupil ratio to 1 to 20 and 1 to 25, respectively.

Examination of project floor plans and interviews with county officials revealed the number, size, and type of classrooms in the facilities. Capacities were assigned based on these observations for secondary and vocational plants in accordance with the approval guidelines. The product of the adjusted project cost divided by the rated capacity yielded the adjusted cost per pupil which was

utilized as the dependent variable in this study. Costs per pupil ranged from \$3,482 to \$8,003. Characteristically, vocational-technical facilities were most expensive with a mean of \$6,635, secondary facilities were next with a \$5,840 mean, and elementary schools were least expensive with a mean of \$4,494 per pupil over the nine-year span from 1974 to 1982.

Independent Variables

Independent variables selected as possible contributors to the variance in per pupil costs are shown in Table 3. They are categorized as financial, characteristic of the district, or descriptive of the building, and their respective means and/or frequencies are shown. Both the expenditures of the district and the assessed value of the district are expressed in dollars per pupil; the local effort of the district toward facility construction is expressed as a computed index; and state, local, and federal funds are represented by the mean dollars from those sources that were contributed to the number of facilities shown in the frequency column.

The size of the district is represented by the net number of pupils enrolled in the district, the average of which is 8,113 students. Examination of the Standard Metropolitan Statistical Areas--SMSA--indicates that only 25 of the 128 new facilities were built in urban districts, with a mean cost of \$5,352 per pupil as compared to 103

Table 3

Independent Variables with Frequencies and/or Means

		Variable	Frequency	\bar{X}
Financial Variables	[Per Pupil Exenditure of the District		\$1,903
		Per Pupil Assessed Value of the District		\$37,900
		Local Effort (An Index Scale)		
		State Funds	121	\$906,942
		Local Funds	123	\$946,758
		Federal Funds	21	\$953,148
District Variables	[Net Pupil Enrollment of the District		8,113
		Standard Metropolitan Statistical Area:		
		Urban	25	
		Rural	103	
		Geographic Location (See Figure 2)	7	
Descriptive Variables	[Percent of Instructional Space		74.5%
		Length of Construction Time in Weeks		75.5
		Type of Facility:		
		Elementary	77	
		Secondary	37	
		Vocational-Technical	14	

rural schools at a mean cost of \$5,060 per pupil. This reveals that 19.53 percent of the construction sites were in the seven urban districts that reported construction. Three of the SMSA districts reported no construction. The amount of instructional space in the facility is represented as a percentage figure and averages 74.5 percent statewide. Construction time is related by the number of weeks that were involved in completing the project. The average completion time was 75.5 weeks. Both the type of facility and geographic location were put into the multiple regression analysis as dummy coded variables. The frequencies given represent the number of schools in each category and the number of geographic areas used.

Selection of the variables resulted from the literature review and the common attribution of causality in the variance of construction costs given them by authors and researchers in the field of facility planning. Data related to these variables were collected, but before the research question could be addressed, two variables, local effort and percentage of instructional space, had to be computed. These computations required utilization of portions of the acquired data to formulate the variables for entry into the multiple regression.

An index of local effort toward school facility construction was developed by dividing the total amount of local dollars invested by each school district in its facilities during the past 10 years by the 1981 assessed

value for that district. This resulted in an index continuum which could be used in the multiple regression procedure.

The percentage of instructional space was calculated by dividing the number of square feet in the buildings that were designated as instructional, by the total square feet in the facility. Instructional area included classrooms, auditoriums, gymnasiums, libraries, multipurpose rooms, administrative and counseling suites, conference rooms, health service rooms, and duplicating rooms. Excluded were furnace rooms, mechanical rooms, kitchens, dining areas, toilets, circulation space, lobbies, lounges, custodial storage space, showers, and locker rooms. The result of these calculations was a variable called percentage of instructional space. This ranged from a low of 58.32 percent to a high of 89.37 percent of the facility utilized for instructional purposes. The statewide mean for this variable was 74.5 percent.

Additionally, it was necessary to statistically dummy code the nominal variables, SMSA, type of facility, and geographic location. Districts located in the Bureau of Census Standard Metropolitan Statistical Areas were assigned a value of one, while rural areas were assigned a value of zero. The distribution of these areas is illustrated in Figure 1 and indicates the location of the 25 projects in the study that were completed in urban areas.

STANDARD METROPOLITAN STATISTICAL AREAS: WEST VIRGINIA

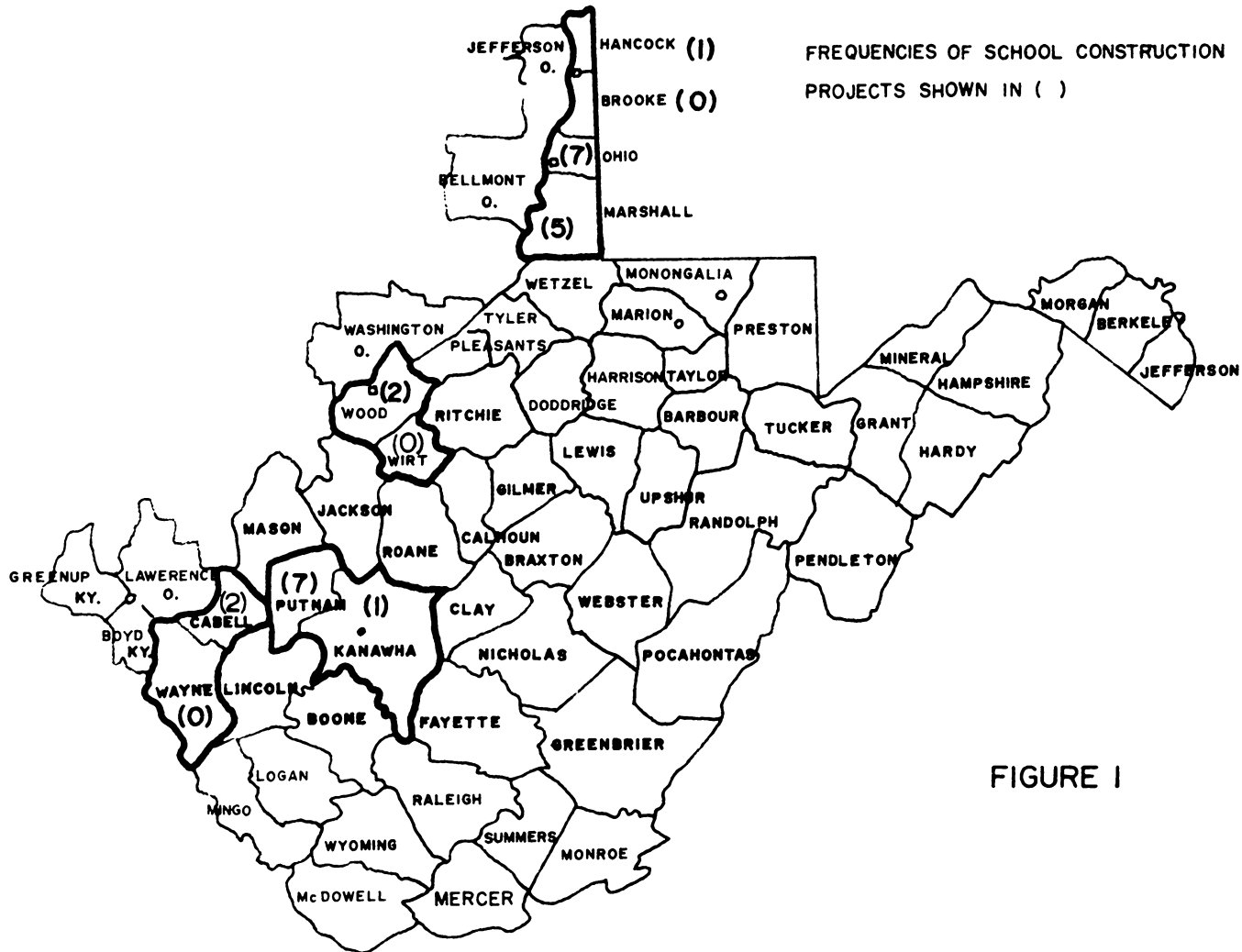


FIGURE 1

The type of each facility was determined and values of 1, 2, and 3 were respectively assigned to elementary, secondary, and vocational-technical projects. Table 4 illustrates the variance among these types in cost per pupil and the building descriptors, instructional percentage, and construction time. When analyzing elementary and secondary costs, these variances appear to agree with a premise often reiterated in the literature that a reduced percentage of instructional space and longer construction periods generally increase the project cost. An extraneous variable operating within the vocational-technical cell may have influenced its mean. West Virginia's guidelines for school capacities have indicated that these facilities should have a large square footage ratio per student for lab and shop areas. This is reflected in a 111.68 square feet per pupil mean for the 14 new centers in the state. Consequently, the cost per pupil is greater than in elementary and secondary schools where the mean square feet per pupil is 82.02 and 101.20, respectively. Additionally, the increased instructional percentage in vocational-technical centers may be attributable to the programs' demands for large, open space shops and a reduced need for circulation area. Secondary schools, on the other hand, often have large commons areas, student locker rooms, and increased circulation and lobby spaces that often contribute to a decline in the percentage of instructional space.

Table 4
Breakdown of Descriptors by Type of Facility

Type	Cost Per Pupil	Instructional Percentage	Construction Time--Weeks
Elementary	\$4,494.31	74.9	67.53
Secondary	5,840.20	71.6	91.41
Vo-Tech	6,634.93	79.8	77.71

Geographically, the boundaries of the local Building Trades Councils were utilized to locate projects throughout the state. These areas were chosen because of their obvious relationship to construction costs, wage rates, and their proximity to the geographic regions of the state. Figure 2 illustrates a breakdown of the areas by county and lists the number of projects completed in each area.

STATISTICAL ANALYSIS OF THE DATA

Having completed the necessary procedures for computing both the dependent and independent variables, the data were submitted to a regression analysis testing for the effect of the dummy coded variables, type, and geographic area. It was found that geographic area did not contribute significantly to the cost per pupil of new school facilities at the .05 level when entered as the final variable in the analysis and thus was omitted from later analyses.

The type of facility did show, however, a statistically significant contribution to the variance of the dependent variable ($F = 15.804$; $p < .05$). In order to determine the nature of this contribution to the regression analysis, an analysis of the covariance was utilized. In this analysis, the means of the dependent variable for the three types of schools were adjusted for the other independent variables. The result of the ANCOVA indicated there was a significant main effects F of 13.46, ($p < .001$).

WEST VIRGINIA BUILDING TRADES COUNCILS, AFL- CIO AFFILIATES

1. UPPER OHIO VALLEY
2. PARKERSBURG - MARIETTA
3. TRI- STATE
4. CHARLESTON
5. SOUTHERN WEST VIRGINIA
6. CLARKSBURG - FAIRMONT
7. NORTH CENTRAL

NO. OF SCHOOLS
17
11
8
37
18
22
15
TOTAL 128

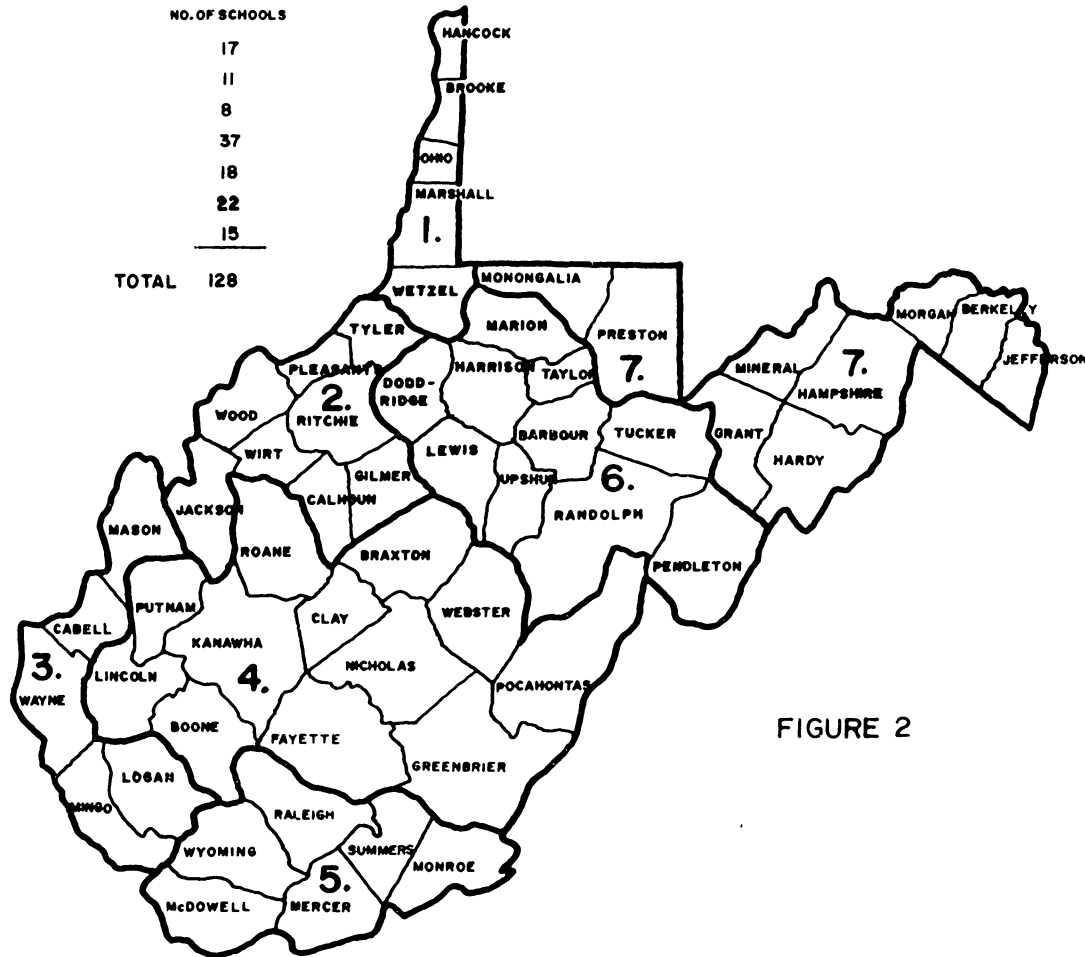


FIGURE 2

The Scheffe` post hoc test was done to make pair-wise comparisons of the adjusted means of the elementary, secondary, and vocational-technical costs per pupil. The conservative Scheffe` test was chosen because of the significant F-ratio in the ANCOVA and unequal number of observations in each group. The results of the Scheffe` test indicated a statistically significant difference between the means of each of the types at the .05 level of significance. (See Table 5.)

With the initial testing of the dummy coded variables completed, the data were again submitted to the SPSS multiple regression procedure to determine the relationship between the remaining independent variables and per pupil construction costs. The interrelation of the independent variables is illustrated by the correlation matrix in Table 6. When the independent variables were simultaneously entered into the regression equation, the overall F-ratio was statistically significant ($F = 11.23$; $p < .05$), and the R^2 indicated that 53.96 percent of the variance in construction costs per pupil was attributable to the 11 independent variables. An examination of Table 7 reveals that four of the variables were contributing significantly to this variance--assessed value, local effort, state funding, and the combined type of facility. Educational expenditures, SMSA, the percent of instructional space, the length of time in construction, federal money, and the size of the district as measured by net

Table 5
Scheffe` Test of Pair-Wise Comparisons
Between Educational Facility Types

Variable	Adjusted Mean	ANCOVA Mean Square Residual	F
T1 Elementary	\$4,494.33		Elem/Sec F = 59.80*
T2 Secondary	5,840.18	759,079.188	Sec/Vo-Tech F = 8.454*
T3 Vo-Tech	6,634.93		Vo-Tech/Elem F = 71.51*

*Significant at $\alpha = .05$; F (cv) = 5.36

Table 6

Matrix of Bivariate Correlation Coefficients Between
the Total Per Pupil Cost of School Construction
and Selected Variables

Variables	Ed. Expend.	Assessed Value	Local Effort	Inst. Space	Const. Time	State Funds	Federal Funds	Net Enroll.	Facility* Type
Cost Per Pupil	<u>.096</u>	<u>.149</u>	<u>.046</u>	<u>-.064</u>	<u>.254</u>	<u>.422</u>	<u>.431</u>	<u>.235</u>	<u>.426</u>
Educational Expenditure		.768	-.225	-.112	-.266	.091	.001	-.138	.018
Assessed Value			-.215	.053	-.228	-.023	.036	-.096	.011
Local Effort				.138	-.022	-.256	-.109	-.200	.023
Instructional Space					-.180	-.148	.295	-.183	-.161
Construction Time						.300	.141	.313	.079
State Funds							.084	.445	.305
Federal Funds								.096	.532
Net Enrollment									.042

*R scores reported for dummy coded variable

Table 7
Results of Multiple Regression Analysis Between
Construction Cost and Selected
Independent Variables

Variable	B	Beta	F-Ratio
Educational Expenditures	-.7183	-.1135	1.107
Assessed Value	.0243	.2993	6.056*
SMSA	-163.5260	-.0530	0.363
Local Effort	16762.49	.2158	9.162*
Instructional Percentage	-1310.626	-.0627	0.740
Construction Time	2.3312	.0719	0.954
State	.00033	.2418	7.567*
Federal	.00042	.1547	2.358
District Enrollment	.0208	.0918	1.283
Type 1 Elementary	-1603.567	-.6425	16.538*
Type 2 Secondary	-818.642	-.3037	4.204*

*Significant at $\alpha = .05$; $F(cv) = 3.92$

enrollments had no significant effect on the cost of construction.

In addition to the type of facility, other variables which significantly contributed to the regression were assessed value (Beta = .2993), state funds (Beta = .2418), and local effort (Beta = .2158). The positive coefficient indicates that as the values increase, so does the per pupil cost of school construction.

In order to determine the existence of any curvilinear relationships that might have affected the multiple regression analysis, scattergrams for each of the independent variables with the dependent variable were produced utilizing the SPSS subprogram scattergram. Examination revealed that no such relationships existed.

SUMMARY OF FINDINGS

The overall results of the multiple regression analyses as shown in Table 8 indicated that several significant relationships were found between various independent variables and the per pupil cost of school construction. All of the financial variables except educational expenditures and federal funds had a significant relationship with the dependent variable. This included the assessed value per pupil of the district, local fiscal effort, and funds contributed from the state level. None of the variables related to descriptors of the district, size, geographic location, or the rural-urban factor attained the

Table 8

Summary of Multiple Regression Analysis Between Per Pupil Cost of School Construction and Selected Financial, Demographic and Descriptive Variables, and the Multiple Regression Analysis Between Per Pupil Cost of School Construction and the Components of the Cost

Independent Variables	Financial	Demographic	Descriptive	Cost Components
Assessed Value	*			
Local Effort of District	*			
State Funds	*			
Federal Funds				
Educational Expenditures				
Standard Metropolitan Statistical Area				
Geographic Region				
Size of District--Net Enrollment				
Construction Time (in Weeks)				
Percentage of Instructional Space				
Educational Level of Facility				
Elementary			*	
Secondary			*	
Vocational-Technical			*	

*Significant at $\alpha = .05$

F-ratio required for significance. The type of facility was the only building descriptor that was significantly related. The amount of instructional space and the length of construction time were not significant contributors.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS

This chapter is divided into three sections. The first will summarize the purpose of the study and the methods and procedures utilized to complete the research. The second portion of this chapter will discuss the findings of the research and their relationship to those presented in the literature review. The final section of this chapter will discuss the implications of the research and make recommendations for further study.

SUMMARY

The purpose of this study was to ascertain the relationship between selected financial and descriptive variables, and the per pupil cost of school construction. A review of the literature indicated a void in research which had investigated the relationship between project costs and the variables which have historically been attributed the characteristic of causality. As such, it has been assumed these relationships exist and operate in the determination of school construction costs. Consequently, this study was designed to test the relationships between these variables and the cost per pupil of new school construction.

Methods and Procedures

The projects that were observed in this study included every new school built in West Virginia under the Better School Buildings Amendment. The first being completed in 1974 and the last in 1982. Data for the study were obtained from the records of the West Virginia Board of Education's Bureau of Finance and Administration and the Division of Facility Planning which administers the Better Schools Program. Additionally, data were provided by the United States Bureau of Census, the West Virginia State Tax Department, and the West Virginia Building Trades Council.

Data were analyzed by means of multiple regression analysis using the Statistical Package for the Social Sciences and the VPI&SU computer services to perform the calculations. The dependent variable was per pupil cost of new school construction which was calculated by multiplying each project's cost by an inflation factor respective of its completion date and dividing the product by the rated capacity of the facility. The independent variables were five financial factors, three district descriptors, and three building descriptors. A multiple regression procedure was used to test the relationship of variables that were dummy coded. Subsequent testing of the significant dummy coded variable, facility type, utilized an ANCOVA to gain insight into the significance of each type. A second multiple regression was computed

to analyze the association between the remaining variables and the dependent variable. This procedure tested the significance of the relationship of each independent variable while controlling for the effect of all other independent variables. The significance of the relationship between each independent variable and cost per pupil of new school construction was indicated by the F-ratios for each variable. The .05 level of significance was used as the criteria for establishing significance.

Discussion of the Results

The discussion of the results of this research will evolve around the three broad variable categories--financial, district descriptors, and building descriptors.

Of the financial variables, the assessed value of the district was found to be the largest contributor to the variance of the per pupil cost of new school construction in West Virginia. This indicates that as the wealth of the district increases, the mean cost of the new schools constructed also increases.

This supports the Hollins v Shofstall¹ decision in Arizona which indicated that funds for capital improvement were even more closely related to the district wealth than were general educational expenditures. This association is the product of the direct relationship between the assessed value of the district and the total amount of

¹Op. Cit., Hollins v Shofstall, p. 72.

funds that can be raised by bond issues. Article X, § 8 of the West Virginia Code limits a county to bonded indebtedness not to exceed five percent of its total assessed value.² This debt ceiling considerably restricts the amount of real dollars that can be raised by bonding in less wealthy counties and limits the availability of local funds for school construction. Consequently, counties with greater wealth are constructing school facilities that are more expensive on a per pupil basis. This finding substantiates Salmon's finding in Louisiana where poorer school districts were having difficulty funding new construction while wealthier districts were adequately meeting student housing needs.

The second largest contributor of significance to the dependent variable was state funds. This relationship evidences that the mean per pupil cost of school construction increases as the amount of funds from the state level increases. This is manifest in a fundamental reliance on local money as the basis for construction projects and utilization of state funds for additional items that improve the building structurally, instructionally or aesthetically. Assuming that more dollars per pupil constructs better buildings, this illustrates that West Virginia's Better School Buildings Amendment has achieved

²Op. Cit., Truby, p. 613.

one of its initial objectives--improving the quality of school facilities in the state.

The third largest contributor to per pupil cost was the amount of local effort put forth by the district. According to this finding, per pupil construction costs vary significantly with the proportion of local tax dollars invested in school facilities.

Beeman and Hughes discussed the financial increases encountered in meeting the mandatory regulations associated with the utilization of federal money in school construction. Although the impact of federal funds was indicated by its beta weight to be considerable, it did not attain a significant level in this study. This may have been affected by the small number of projects receiving federal money, only 22, of which 14 were vocational-technical centers.

Examination of the independent variables which describe the district reveal that none of these factors contributed significantly to the cost per pupil of new construction. These results are not consistent with the literature. The National Educational Finance Project found in a South Dakota study that smaller school districts were hard pressed to meet their facility needs. This was not substantiated as the net pupil enrollment of the district did not significantly contribute to the cost per pupil variance.

Strevell, in a study of 85 rural schools, found that smaller plants with less than 700 students were

progressively more expensive to construct on a per pupil basis. Bowen reported that both extremely rural and urban locations caused variation in construction costs. However, the results of this research did not indicate a significant variance due to these factors. Additionally, the American Association of School Administrators reported that costs could vary as much as 25 percent within a single state due to geographic location. They contributed this to the reluctance of contractors to bid on projects in out-of-the-way places due to labor shortages and transportation costs. This was not found to be the case in this study as none of the seven geographic subdivisions of the state caused significant variation in the per pupil cost.

Examination of the descriptive factors also indicated that two of these variables did not meet the expectation of the literature. In opposition to the indications of Thiessen, Earthman, and Barr, the cost per pupil was not significantly affected by the percentage of instructional space in the facility. McMahon's argument that length of construction time contributed to additional project cost was not supported either. However, the type of facility was found to have a significant impact upon the cost variance. It was found that construction costs increase progressively as the type of facility changed from elementary to secondary and finally to vocational-technical centers. This rise was due to the increased per pupil space needs created by increasingly diverse curricula

in secondary schools and shop/lab space required for vocational-technical training.

Those variables which were found to significantly impact the variance of school construction costs were the assessed value of the school district, the local effort of the district, funds from the state level, and the type of building.

CONCLUSIONS

As a result of the findings from this study. The following conclusions were drawn:

1. The per pupil cost of school construction is significantly affected by the assessed value of the school district, the local effort of the district in facility construction, and money from the state level.

2. The type of facility, whether elementary, secondary, or vocational-technical, significantly affects the per pupil cost of school facility construction.

Generalization of these conclusions to other states could be made provided there is similarity in the size, geography, economic status, organizational structure, and other variables between the two states. However, the uniqueness of each individual state in the factors which contribute to per pupil cost of school construction would most assuredly result in varied conclusions.

IMPLICATIONS

In viewing the results of this study from the state level, there are definite implications of inequity in funding school construction in West Virginia. These implications are founded in the utilization of assessed value of property as the determinant of local fiscal capacity as well as the criterion upon which the 5 percent debt limitations are set. These inequities are further compounded by the inconsistency in the amount of local fiscal effort being invested by the counties in the construction of school facilities. Encouraging the utilization of such funds for construction purposes does contribute to the inequity of financing school buildings. Additionally, it was found that money from the state level significantly contributed to the cost of construction and consequently to the quality of the facility. Therefore, these findings strongly imply that new legislation be adopted in West Virginia to continue funding the construction of school facilities with money from the state level. The immediacy of this need is emphasized by the near depletion of Better School Buildings Amendment funds.

This study further indicates need of a funding formula for the financing of school facilities. This formula should fund on an approved project needs basis. Funding by project rather than annually through the state aid formula is recommended based on the experience of other states. It has been found that annual allocations

to each district are insufficient to meet the facility needs of poorer and rapidly expanding districts, while money allocated to wealthier districts is often not needed for capital outlay and used for investment.³ Therefore, greater impact can be made on the improvement of school buildings in West Virginia by addressing specific needs rather than universal distribution of funds.

Additionally, this formula should address the variables this study found to be significant contributors to the variance of school construction costs. Provision should be made for the wealth of the district based on its assessed value, for an equalized local effort by each district, and for the type of facility for which construction funds are being granted. Money generated at the county level through execution of an equalized local effort on an assessment equalized at the state mandated minimum of 60 percent of the real value, should be accrued and administered at the state level. State appropriated funds, in conjunction with resources from the equalized local effort fund, should be sufficient to finance each year's approved projects without requiring additional money from bond referenda or special levies at the county level.

³Arnold Guess, Kentucky State Assistant Superintendent of Schools, interview conducted by phone from Blacksburg, Virginia, July 19, 1982, by Clacy Williams.

RECOMMENDATIONS

A study of this nature only begins to identify the problems in school construction costs and gives impetus to other research that might add to the conclusions already made.

First, why was no relationship found between the percentage of instructional space and the per pupil cost when the literature indicates a strong relationship? Further study of this variable with emphasis on the various types of space and their cost might clarify this relationship to overall cost.

Second, further study into the impact of federal funds is recommended. Because of the regulatory demands on wages required by utilization of federal money, it was expected that significant variance would be contributed. However, the influence of West Virginia's state wage restrictions accounted for a great deal of the same variance in labor costs. It would appear that a nationwide study utilizing a broader data base might be helpful in further clarifying the impact of federal funds on the per pupil cost of school construction. Further, most vocational-technical centers nationally receive federal funding, the study might best focus on impact aid money in elementary and secondary schools where cost variances would be greater.

Third, the relationship between per pupil cost, assessed value, and the amount of local effort applied to

school construction was addressed in this study. An additional study including the total local effort of each district would further delineate the status of inequities in facility funding in West Virginia.

Fourth, a detailed study of those factors which comprised the dependent variable--construction cost--would serve as a useful instrument in identifying and implementing specific economies in the areas of labor, materials, construction techniques, transportation, and others, thereby aiding local administrators in reducing project costs.

Finally, the variables found to be of significance to the per pupil cost of new school construction in this study should be utilized to construct a funding formula for West Virginia that would equalize the local effort of each county in facility construction and, in conjunction with state appropriations, fund approved projects on a needs basis.

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APPENDIX A

P-1--APPLICATION FOR PROJECT APPROVAL
WEST VIRGINIA DEPARTMENT OF EDUCATION

P - 1 Project Form Number 1

APPLICATION FOR PROJECT APPROVAL

WEST VIRGINIA DEPARTMENT OF EDUCATION
Roy Truby
State Superintendent of Schools



BUREAU OF SERVICES & FEDERAL ASSISTANCE
Capitol Building #6, Room B-264
Charleston, West Virginia 25305

COUNTY		ESTIMATED STARTING DATE					
PROJECT NAME & NUMBER		ESTIMATED COMPLETION DATE					
TYPE OF FACILITY		TYPE OF PROJECT					
		PROGRAM ESTIMATE		PRELIMINARY ESTIMATE		FINAL ESTIMATE	
ENERGY		TYPE		UNIT	TOTAL	UNIT	TOTAL
2	ANNUAL HVAC FUEL (BTU/SF)						
	ANNUAL HVAC ELEC. (KWH/SF)						
	LIGHTING (W/SF)						
3	ENROLLMENT						
4	SQUARE FEET IN BUILDING						
5	SQUARE FEET/PUPIL						
6	SITE USEABLE ACRES						
7	USEABLE ACRES/PUPIL						
PROJECT		UNIT COST	TOTAL COST	UNIT COST	TOTAL COST	UNIT COST	TOTAL COST
8	SITE ACQUISITION (\$/UA)						
9	LAND (\$/UA)						
10	FEES/SERVICES (%)						
11	CONTINGENCY (%)						
12	SITE PREPARATION (\$/UA)						
13	A/E FEES (%)						
14	CONTINGENCY (%)						
15	DEMOLITION						
16	CLEARING (\$/UA)						
17	ROADS TO SITE						
18	UTILITIES TO SITE						
19	UTILITY RELOCATION						
20	SEWAGE PLANT (\$/PUPIL)						
21	FLOOD CONTROL						
22	SPECIAL FOUNDATIONS						
23	ROUGH GRADING						
24	SITE DEVELOPMENT (\$/UA)						
25	A/E FEES (%)						
26	CONTINGENCY (%)						
27	SITE DEVELOPMENT (\$/UA)						
28	BUILDING (\$/SQ.FT.)						
29	A/E FEES (%)						
30	CONTINGENCY (%)						
31	SUB-STRUCTURE (\$/SF)						
32	SUPER-STRUCTURE (\$/SF)						
33	EXTERIOR CLOSURE						
34	WALLS (\$/SF)						
35	ROOFING (\$/SF)						
36	FENESTRATION (%)						
37	INTERIOR CONSTRUCTION						
38	WALLS (\$/SF)						
39	CEILING (\$/SF)						
40	FLOORS (\$/SF)						
41	LIGHTING/CEILING (\$/SF)						
42	CONVEYING SUB-SYSTEM						
43	PLUMBING (\$/PUPIL)						
44	ELECTRICAL						
45	SERVICE (\$/SF)						
46	LIGHTING (\$/SF)						
47	COM / SEC (\$/SF)						
48	HVAC SYSTEMS (\$/SF)						
49	HVAC NON-SYSTEM (\$/SF)						
50	FIXED EQUIPMENT (\$/SF)						
51	MOVEABLE EQUIP. (\$/PUPIL)						
52	CONTINGENCY (%)						
53	MOVEABLE EQUIPMENT (\$/PUPIL)						
54	VO-TECH EQUIP. (\$/VT-PUPIL)						
55	CONTINGENCY (%)						
56	VO-TECH EQUIPMENT (\$/VT-PUPIL)						
MISCELLANEOUS (%)							
58	LEGAL (%)						
59	PRINTING (%)						
60	ADM / SUP (%)						
61	INSPECTION (%)						
62	GRAND TOTAL (\$/PUPIL)						
FUNDING		PROGRAM APPROVAL		PRELIMINARY APPROVAL		FINAL APPROVAL	
63	COUNTY FUNDS						
64	STATE FUNDS						
65	VOCATIONAL (STATE & FEDERAL)						
66	TOTAL FUNDS (\$/PUPIL)						
AGENCY		PROGRAM APPROVAL		PRELIMINARY APPROVAL		FINAL APPROVAL	
67	STATE DEPARTMENT OF HEALTH						
68	STATE FIRE MARSHAL						
69	COUNTY BOARD OF EDUCATION						
70	STATE BOARD OF EDUCATION						

APPENDIX B

BP-13--CERTIFICATE OF PROJECT COMPLETION
WEST VIRGINIA DEPARTMENT OF EDUCATION

Form BP-13-A
Revised: 3-1-81

WEST VIRGINIA DEPARTMENT OF EDUCATION
ROY TRUBY
State Superintendent of Schools

CERTIFICATE OF PROJECT COMPLETION

Please complete and submit three (3) copies to: State Department of Education, School Facilities Planning Division, Bureau of Services & Federal Assistance, Capitol Building #6, Room B-264, Charleston, West Virginia 25305.

County _____ Completion Date _____

Project/School Name. . _____ Final Inspection Date . . . _____

SUMMARY OF PROJECT DATA:

Project Number _____ Enrollment. _____

Type of Facility _____ Sq. Ft. in Building _____

Number of Rooms _____

SOURCE OF FUNDS:

Site Acquisition Costs. . . \$ _____

State Funds. \$ _____

Site Preparation Costs. . . \$ _____

Local Funds (Bond) . . \$ _____

Building Construction Costs \$ _____

Local Funds (Other). . \$ _____

Moveable Equipment Costs. . \$ _____

Vocational (State) . . \$ _____

Vocational-Technical Equipment Costs \$ _____

Vocational (Fed.). . . \$ _____

Miscellaneous Costs \$ _____

Federal (ARC). \$ _____

Other Funds: (List)
_____ \$ _____

Other Costs: (Explain)
_____ \$ _____

TOTAL FUNDS. \$ _____

TOTAL PROJECT COST. . . . \$ _____

ARCHITECT

DATE

CONTRACTOR/CONSTRUCTION MANAGER

DATE

COUNTY SUPERINTENDENT

DATE

Inspected this date by a representative of the West Virginia Department of Education.

SIGNATURE

DATE

APPENDIX C

LIST OF PROJECTS IN THE STUDY
WEST VIRGINIA DEPARTMENT OF EDUCATION

APPENDIX C

LIST OF PROJECTS IN THE STUDY

WEST VIRGINIA DEPARTMENT OF EDUCATION

<u>County</u>	<u>School</u>
Barbour	Belington Middle School Century-Volga Elementary Junior Elementary Kasson Elementary Mt. Vernon Elementary Phillipi Middle Vo-Tech Center
Berkley	Hedgesville High School Tuscarora Elementary
Boone	Madison Elementary Van High School
Braxton	Flatwoods Elementary Gassaway-Davis Elementary Sutton Elementary
Cabell	Spring Hill Elementary Vo-Tech Center
Calhoun	Pleasant Hill Elementary
Clay	Clay Elementary
Fayette	Danese Elementary Fayetteville High School Midland Trail High School Oak Hill High School Scarbro Elementary Valley Elementary Valley High School
Gilmer	Glenville Elementary
Hancock	Vo-Tech Center
Harrison	Lincoln High School Salem Junior High School
Jackson	Ravenswood Elementary Ripley Middle School
Jefferson	Page Jackson Elementary

Kanawha	Elkview Junior High School
Lewis	Jane Lew Middle School
Lincoln	West Hamlin Elementary Woodville Elementary
Logan	Chapmanville High School Holden Elementary Vo-Tech Center
Marion	Monongah Elementary North Marion High School Vo-Tech Center
Marshall	Cameron Elementary McMechan Elementary McNinch Elementary Sherrard Junior High School Washington Lands Elementary
Mercer	Bluefield High School Princeton High School
McDowell	Fall River Elementary Kimball Elementary Mt. View High School
Mineral	Frankfort High School Keyser Middle School
Mingo	Matewan Junior High School Matewan High School Thacker Elementary
Monongalia	Daybrook Elementary North Morgantown Elementary South Morgantown Junior High School Vo-Tech Center
Monroe	Vo-Tech Center
Morgan	Great Cacapon Elementary Paw Paw Elementary Pleasant View Elementary Widmyer Elementary
Nicholas	Cherry River Elementary Muddlety Elementary Nicholas County High School Vo-Tech Center Zela Elementary

Ohio	Elam Grove Elementary Middle Creek Elementary North Park Elementary West Liberty Elementary Wheeling Junior High School Wheeling Park High School Woodsdale Elementary
Pleasant	Middle School PRT Vo-Tech Center
Pocahontas	Greenbank Elementary Hillsboro Elementary Marlington Elementary
Putnam	Eastbrook Elementary Hometown Elementary Hurricane Elementary Lakeside Elementary Vo-Tech Center West Teays Elementary Winfield High School
Raleigh	Bradley Elementary Coal City Elementary Hollywood Elementary Independence High School Liberty High School Shady Spring Elementary Stanaford Elementary Vo-Tech Center
Randolph	Elkins Elementary George Ward Elementary Midland Elementary North Elementary Third Ward Elementary Vo-Tech Center
Ritchie	Vo-Tech Center
Roane	Geary Elementary Reedy Elementary
Summers	Hinton Elementary
Tucker	Thomas-Davis Elementary Tucker County High School
Tyler	Boreman Elementary Sistersville Elementary

Upshur	Buchannon-Upshur High School French Creek Elementary Washington District Elementary
Webster	Glade Elementary Webster County High School
Wetzel	Paden City Elementary Grandview Elementary Hundred Elementary Valley-Reader Elementary
Wood	Blennerhassett Junior High School Mineral Wells Elementary
Wyoming	Glen Fork Elementary Glen Rogers Elementary Herndon Elementary

APPENDIX D

GUIDELINES FOR SCHOOL CAPACITIES
WEST VIRGINIA DEPARTMENT OF EDUCATION

APPENDIX D

GUIDELINES FOR SCHOOL CAPACITIES

WEST VIRGINIA DEPARTMENT OF EDUCATION

	Suggested Sq. Ft. Per Pupil	Suggested Capacity
<u>Secondary Education Facilities</u>		
1. General Purpose (Academic) Class- room or Instructional Area	30	25
2. Art Facilities	80	20
3. Industrial Arts Facilities	100	24
4. Music Facilities	24	
5. Physical Education		50
6. Science Facilities	45	28
7. Foreign Language Facilities	30	30
<u>Vocational Education Facilities</u>		
1. Vocational-Agriculture	40	24
2. Agricultural Mechanics	100	24
3. General Business	30	30
4. Stenography	35	30
5. Typing	35	30
6. Office Machines	60	20
7. Health Occupations Classroom	30	20
8. Health Occupations Lab	120	20
9. Home Economics	45	24
10. Food Service Occupations	135	20
11. Vocational Industrial Classroom	30	20
12. Vocational Industrial Labs	120	20
a. Appliance Repair	120	20
b. Draftsman	120	20
c. Radio & TV Technician	120	20
d. Commercial Art	120	20
e. Cosmetology	120	20
f. HVAC	120	20
g. Masonry	120	20
h. Commercial Cooking	120	20
i. Electrical	120	20
j. Plumbing	120	20
k. Power Mechnaics	120	20
l. Office Machines Repair	120	20
m. Graphic Arts	120	20
n. Power Sawing	120	20
o. Metal Cluster	120	20
p. Cabinet Maker	160	20
q. Construction Trades	160	20

	<u>Suggested Sq. Ft. Per Pupil</u>	<u>Suggested Capacity</u>
r. Welding	160	20
s. Sheet Metal	160	20
t. Auto Body	240	20
u. Auto Mechanics	240	20
v. Machinist	240	20
w. Mining Occupations	240	20
x. Diesel Mechanics	240	20
13. Technical Facilities	240	20
a. Civil Technology	120	20
b. Electrical Technology	120	20
c. Metallurgical Technology	120	20
d. Data Processing	120	20
e. Welding Technology	120	20
f. Mechanical Technology	120	20
g. Printing Technology	120	20
h. Building Technology	120	20
i. Electronics Technology	100	20
j. Broadcasting Technology	100	20
k. Chemical Technology	100	20
l. Drafting and Design	100	20
m. Architectural Design	100	20
n. Mining Technology	240	20
14. Auditorium	6	
15. Learning Resources Center	40	

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A STUDY OF SELECTED VARIABLES OF SCHOOL
CONSTRUCTION COSTS

by

Clacy Earl Williams II

(ABSTRACT)

Major Professor: Dr. Glen I. Earthman

This study investigated the relationship of selected building descriptors, district characteristics, and finance, to the per pupil cost of new school construction. Variables selected were: Financial--assessed value, local effort in facility construction, state and federal funds, and the educational expenditures of the district; Building descriptors--the length of construction time, the percentage of instructional space, and the type of facility; district characteristics--geographic location, urban/rural, and net enrollment.

The data were gathered from the West Virginia State Department of Education, the State Tax Department, and various architects who designed the 128 new schools constructed under the West Virginia Better School Buildings Amendment of 1972. Analyses utilized the multiple regression procedure to examine the relationship of the variables to construction costs.

The results indicated a significant relationship between per pupil construction cost and three financial

variables: (1) the assessed value of the district, (2) the amount of local effort put into facility construction and improvement, and (3) the amount of state funds utilized in the project. None of the district characteristics contributed significantly to the variance and the only descriptive variable to yield a significant contribution was the type of facility being constructed--elementary, secondary, or vocational-technical.

The study implied need for the standardization of assessed values in West Virginia, equalization of local fiscal effort in school construction, and legislation to inject additional state money in capital outlay. It was recommended that a funding formula for facility construction and improvement be instituted utilizing money from two sources: a local effort fund, accrued and administered at the state level, to which each county would contribute on an equalized basis; and state appropriations designated on a yearly basis. These funds would eliminate the need for local bond issues and special levies for this purpose.

It was recommended that further study be done to clarify the relationship between per pupil cost and federal funds, as well as instructional space.