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# District Size, Teacher Qualifications, and Pupil Performance in Maine School Districts[1]

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## INTRODUCTION

This study examines the relationships between district size, faculty educational qualifications and academic achievement in Maine's eighth grade students. Such relationships are often posited in the educational literature [3; 6; 16; 21]. Mean grade eight scores in mathematics, reading, and writing on the 1985 Maine Assessment Test are utilized as the measure of pupil performance. Aggregated to the school system level, these scores are often considered to be indicators of educational quality [12].

School system size and the qualifications of teachers within the school system are variables that have been important factors in the formulation of policies and practices intended to improve educational outcomes at the state level. For Maine, and other legislative jurisdictions that are predominantly rural, these variables have been associated with school district consolidation and teacher certification requirements. Thus, the variables are also of substantial interest to school board members and educators.

Recent educational reforms have been primarily directed toward the improvement of learning outcomes as measured by pupil scores on norm-referenced, standardized tests [12]. Guthrie [11] and Mitchell and Encarnation [17] stressed that the contemporary emphasis on cognitive outcomes of schooling is the result of the emergent preeminence of the cultural value of quality which has been accompanied by reduced emphases on the values of equity and efficiency. This shift in cultural values is considered to be the result of perceived deficiencies in the quality of American education [5].

While the objective of increasing educational quality has received broad public and political support, most state-level reform initiatives have been established in haste [14], and have required substantial increases in funding for implementation [1]. Kirst [14] has argued that policy makers at the state level have formulated reform initiatives that, in fact, have had a negative influence on pupil performance.

More importantly, little research has been conducted at the school system level to examine relationships among existing factors that are theorized to be associated with pupil achievement. MacPhail-Wilcox and King [16] have warned that contemporary reform efforts that are directed toward redefined certification requirements, merit pay, uniform teacher qualities, and standardized instructional practices are based on the unwarranted assumptions that they will eliminate the perceived inadequacies in public education. These reform initiatives tacitly assume that teacher attributes are the critical factors associated with pupil performance, and fail to acknowledge that teacher effects vary by student, classroom, and organizational variables.

Within this context, Bidwell and Kasarda [3], Butler and Monk [4], and MacPhail-Wilcox and King [16] have argued that the school may not be the appropriate unit of analysis for examining the effects of schooling on pupil performance. These authors have contended that alterable variables are the crucial elements in the transformation of educational inputs into learning outcomes. Thus, it is suggested that the focus of research must be on the school district rather than the individual pupil, classroom, or school. For legislatures and school boards, the need for information that is based on existing practices in education is vital to the development of sound reform initiatives.

## REVIEW OF THE LITERATURE

Is pupil performance in cognitive skills better in some school systems than in others? What system-level factors are significantly related to pupil performance?

Initial research designed to investigate these questions

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focused on a number of physical characteristics of schools and school districts to establish relationships with pupil performance. A limited number of studies utilized school systems as the unit of analysis, and of these, most centered on large, urban systems. These studies were summarized by Averch, Carroll, Donaldson, Kiesling and Pincus [2], and were found to include such factors as types of facilities available, number of volumes in school libraries, and expenditures for school construction and/or repairs. The studies concluded that none of the variables utilized were consistently correlated with pupil achievement. As a result, they fostered the belief that "schools don't matter."

The view that schools did not make a difference was supported by the findings of Coleman et al. [6] on the Equality of Educational Opportunity [20]. Bidwell and Kasarda [3] reported that the Coleman study found that resources and facilities, teacher qualifications and skills, and peer characteristics had little or no effect on pupil attainment in either elementary or secondary schools.

These conclusions are counter-intuitive, and are in sharp contrast to the beliefs held by society in general, and educators in particular. Clearly, school systems do vary in the learning outcomes of their pupils, with some school systems consistently held to have higher levels of pupil achievement than others [15]. While the Coleman study provided evidence of the strong relationship between socioeconomic status and achievement, the study by Bidwell and Kasarda [3] demonstrated the significance of organizational and staffing variables associated with learning outcomes. The study emphasized that the immediate concern of school districts is the transformation of educational inputs into student achievement, and focused on staff and community conditions as variables that affected learning outcomes. This same concern forms the basis for the selection of the three system-level variables included in this research.

*Pupil Performance*

From an organizational perspective, schools are open systems and are subject to the influences of a number of inputs in the production of outputs [19]. Cohn and Millman [7] emphasized that a lack of consensus as to what society considers to be the purpose or outcome of the schooling process is a major disruptive influence in education. Given this caveat, the contemporary environment of education has been described as requiring increased emphasis on quality, and is accompanied by more frequent use of such terms as excellence, competencies, and basic skills in cognitive outcomes [5; 12].

Cognitive outcomes are defined by Gage and Berliner [9] as those educational objectives that "deal with processes like knowing, perceiving, recognizing, thinking, conceiving, judging and reasoning" (p. 57). These outcomes are generally characterized by academic achievement as demonstrated by pupil performance on standardized tests in such areas as mathematics and reading. This view of pupil performance has been incorporated in the Maine Assessment Program, which is the source of pupil achievement data in this study.

*School System Size*

School system size has been both a controversial topic and a frequent focus of educational research. While the variable has been subjected to examination from a number of perspectives, the specific area of interest in this study centers on research that investigates the relationship between school system size and pupil achievement. This relationship has been a significant component of legislative efforts to consolidate schools and school systems and is a vital concern to rural communities and educators.

Tyack and Hansot [22], in tracing the development of the American school, documented the formation of the "common school" movement. Small schools, supported by local taxes and subject to close community supervision and controls, were considered to be the critical factor in the creation of an educated public.

The early decades of the 1900s were characterized by waves of immigrants arriving in the nation's urban areas, and resulted in a massive expansion in the demand for schooling. According to Tyack and Hansot [22], the period gave rise to demands for technical expertise in the management of schools that emphasized efficiency in the operation of school systems.

Efforts to control the costs of public education centered on the establishment of optimal class sizes, grouping students on the basis of age and ability levels, and the consolidation of small community schools [18; 23]. These small schools were held to be both ineffective and inefficient in the production of learning outcomes. Thus, the belief that "bigger is better" was fostered by the view that larger schools were cheaper to operate and could provide students with a broader range of comprehensive programs. Butler and Monk [4] defined this concept as "economy of scale," and noted that it emphasized the relationship between school and school system size and expenditure per pupil. While small school systems are often characterized by higher expenditures per pupil, other factors associated with small and/or rural schools were either ignored or given little consideration in the drive to improve efficiency in education.

Foster and Martinez [8] reported a number of alleged weaknesses associated with small schools. These weaknesses were considered to be in the areas of curriculum, student achievement, and staffing. The authors noted that the alleged deficiencies tended to diminish as enrollment approached 700 pupils.

In her study of school district size and differences in mathematics achievement in the state of Washington, Wilson [23] found a number of positive factors associated with small school systems. Those school systems of less than 2,000 pupils had greater proportions of higher achieving schools. Teachers in smaller districts were found to use standardized tests more often than those in larger districts and were more likely to use homework to measure student progress.

Pratt [18], in his study of multiage classrooms commonly found in small, rural and/or isolated school systems, found no consistent effect on academic achieve-

ment in reading and mathematics. Pratt reported that higher self-concept and attitude measures tended to be associated with multiage classrooms.

Turner, Camilli, Kroc and Hoover [21], in their study of 102 Colorado school systems, found that as district enrollment increased the level of elementary pupil achievement decreased. This finding was not supported in Coleman's [6] study of British Columbia school systems. Using data from all school districts in the province ($N=75$), Coleman found consistent positive associations between school size and mathematics and reading achievement.

In summary, findings from these studies provide both inconsistent and conflicting results regarding the relationship between school system size and pupil performance. As reported by Helge [13], rural schools comprise 67% of American school systems. This fact highlights the need for additional research designed to clarify the relationship.

*Teacher Qualifications*

According to Coleman [6], little is known regarding the conditions within school districts that contribute to educational quality. As a result of his study, Coleman argued that school district characteristics are important influences on pupil achievement and that practices within exemplary school systems should be the focus of additional research.

In their review of input-output studies in education, Glasman and Biniaminov [10] expressed support for this view, and stressed the importance of research on instructional personnel and school conditions to assist policy makers in the decision-making process. They determined that the most frequently utilized personnel and school condition variables employed in previous studies included pupil-teacher ratios, administrative intensity, ratios of professional support staff to classroom teachers, and the percentage of teachers holding Master's degrees. These variables are subject to manipulation by policy makers and are determined primarily by fiscal resources that are immediately obvious to citizens and special interest groups. Within this study, the percent of teachers with a Master's degree is the variable of interest.

Research designed to examine teacher qualifications in relation to pupil performance has been based on the belief that technical skills and overall instructional competence are attained and improved through advanced training [21]. Summers and Wolfe [20] reported that nearly all teacher salary schedules reflect the view that extra training is associated with improved teacher performance and ultimately influences pupil learning outcomes.

MacPhial-Wilcox and King [16] noted that traditional state-level measures to control teacher certification are an additional expression of this belief. Kirst [14] has pointed out that essentially all contemporary state reform initiatives have included attempts to strengthen teacher qualifications required for certification.

Initial research on the relationship between teacher qualifications and pupil achievement found that the possession of a Master's degree had little or no effect [2]. Summers and Wolfe [20], in their study of 103 Philadelphia elementary schools, also reported that teacher education at the graduate level had no impact on pupil learning.

Bidwell and Kasarda [3] hypothesized that teachers' qualifications were related to teaching skills. They theorized that the teacher-intensive nature of instruction implied that Colorado school districts with higher proportions of well-qualified teachers would have higher levels of student achievement in the cognitive areas of mathematics and reading. While results of their study supported the hypothesis, the relationship between staff qualifications and mathematics achievement was not statistically significant.

Turner et al. [21] employed path analysis in their study of Colorado school systems, and found that percent of teachers holding a Master's degree was a significant determinant of elementary pupil achievement in both mathematics and reading.

A summary of these studies suggests that while early research failed to establish a relationship between teacher qualifications and cognitive pupil outcomes, recent investigations have demonstrated significant positive correlations. For rural school systems that often have difficulty in the recruitment and retention of teachers, the quality of those teachers employed may have a significant influence on the level of pupil performance.

## METHOD OF THE STUDY

This study examined the population of Maine school systems. To achieve this objective, data were required on the level of elementary pupil achievement, number of elementary teachers employed, their professional qualifications, and the elementary pupil enrollment for each school system. These data were obtained from the Maine Department of Educational and Cultural Services for the 1985-1986 school year. It is important to note that for the purpose of this study all data are confined to system-level measures.

For each school system, pupil performance was measured by aggregating school mean scores on the 1985 grade eight statewide assessment test in the three cognitive areas of reading, writing, and mathematics (ACH). The assessment instrument was developed in compliance with the mandate of the Maine Educational Reform Act of 1984 which required that all public school pupils in grades four, eight, and eleven participate in such a process.

Results from grades four and eleven were specifically excluded from the study. While grades four and eight are classified as elementary grades, it is reasonable to hold that the grade eight results provide a more accurate indication of the temporal effects of the schooling process within any given school system. Grade eleven results were excluded because of the substantial reduction in the number of systems that operate secondary schools and in an attempt to avoid the biases that are reported to accompany both the "drop out" and "tracking" effects. Thus, it is assumed that grade eight results provide the

optimal measure of system-wide pupil performance.

The Maine Assessment Test was administered to essentially all grade eight pupils in the public schools during the period between November 11 and November 22, 1985. The pupils tested included most special needs students with some testing conditions modified to reflect methods used in their usual classroom instruction. Although the tests consisted of 16 different forms, all students took a common core of questions in reading, writing, and mathematics. Of the 16,802 pupils enrolled in the eighth grade, 15,868 completed the three tests (94.44%).

Mean test results in each subject area were reported for each school as scaled scores to allow for comparisons in future years. Statewide results for each content area were scaled to a mean of 250, with a standard deviation of 50.

In those systems consisting of one elementary school, the system mean was calculated by simple averaging. For multi-school systems, each school mean was weighted by enrollment prior to averaging. Within Maine, the elementary designation includes grades K to eight, and 634 schools provide instruction in one or more of these grades. When aggregated to the school system level, a total of 200 Maine school systems were identified as providing instruction at the eighth grade level.

School system size (SIZE) was measured by the mean number of elementary pupils enrolled during the 1985-1986 school year. These data were obtained from the Annual Statistical Report of the Maine Department of Educational and Cultural Services (DECS). The mean elementary enrollment was determined by averaging the number of pupils enrolled in grades K to eight on Oct. 1, 1985 and April 1, 1986.

Teachers' qualifications (MASTERS) was measured by the percent of elementary teachers holding at least an earned Master's degree. Data on number of elementary teachers employed in each school system and the number of those teachers holding at least a Master's degree were obtained from the DECS data base for the 1985-1986 school year. A total of 8,209 elementary teachers were employed in the 200 schools systems.

Data analysis was conducted using the SPSSX statistical package for the generation of Pearson correlations.

## RESULTS

Results of pupil achievement on the Maine Assessment Test were established for each *school system* by aggregation of school mean scores in each of the three subject areas of interest.

Following aggregation, the minimum system mean was found to be 100, and the maximum system mean was 400. The mean of all school system scores was 251, with a standard deviation of 50.5. Thus, the distribution of aggregated school system scores was found to be consistent with the distribution of individual school scores.

Measures of school system size ranged from a minimum of four elementary pupils in an island school system, to a maximum of 5,409 elementary pupils in the state's largest municipal school system. Of the 200 school systems that provided instruction to grade eight pupils, 28 systems enrolled less than 100 elementary pupils, and of these, 12 enrolled less than 50 pupils.

The relationship between pupil achievement and school system size was found to be a zero-order correlation ($r = .008$). This result demonstrates that pupil achievement in Maine school systems is not associated with the size of the school system, and is in contrast to the findings of Turner et al. [21] and Coleman [6].

Teacher qualifications was found to have a low positive correlation with pupil achievement ($r = .186$), and was found to be significant ($p < .01$). While this finding indicates that proportion of elementary teachers possessing an advanced degree is associated slightly with increased learning outcomes in Maine school systems, it is in substantial agreement with the findings of Bidwell and Kasarda [3], and Turner et al. [21].

The correlation between teacher qualifications and school system size ($r = .218$), while low, was also found to be both positive and significant ($p < .01$). Thus, better qualified teachers are associated with larger school systems. This result is a substantive finding within the context of Maine school systems, and small rural systems in particular.

For Maine's school systems, the low correlation between MASTERS and ACH indicates the importance of other factors associated with pupil performance. For example, Turner et al. [21], have reported that small school systems are often characterized by low class sizes which provide for increased pupil-teacher interaction.

## CONCLUSIONS

The study provides evidence that school systems within single legislative jurisdiction vary in the level of pupil achievement produced. This supports the need for a research agenda that is designed to address system-level variables that are held to be associated with educational quality.

For Maine and other states that are predominantly rural, the failure to identify a relationship between school system size and pupil achievement may be considered a significant result. The belief that "bigger is better" is not shown to be applicable to Maine school systems, and offers encouragement to those educators in small, rural and/or isolated systems.

Decision makers concerned with the development of policies to improve pupil performance should give consideration to the significant positive relationship between teachers' qualifications and achievement. The results of this study have implications for teacher certification and re-certification, as well as the delivery of university graduate-level outreach programs.

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