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THE IMPACT OF HUMAN RESOURCE EXPENDITURES AND THE MINIMUM FOUNDATION PROGRAM'S LEVEL 3 SUBSIDY ON ACADEMIC PRODUCTIVITY IN LOUISIANA

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Education

in

The Department of Educational Leadership, Research, and Counseling

by

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In Sincerest Memory

of

My Mother

Mrs. Kathleen Beaudoin ☺

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ABSTRACT

This study investigated the impact of instructional salaries with and without a state-sponsored, supply-side subsidy on the academic productivity of schools in Louisiana. The subsidy under investigation was the Level 3 allocation for instructional salaries outlined in Louisiana's Minimum Foundation Program (MFP) that provides fiscal support for educational costs to local school boards. An educational production function model within the general systems framework outlined by Rossmiller and Geske (1977) was used in this study. This framework, the Educational Production Process under School Condition (EPPSC), is based on the fundamental idea that the process of schooling is amenable to analysis using economic techniques. All selected variables were aggregated to the school-level, which served as the unit of analysis for the study. The study's final sample (n = 296) approximated the population of secondary schools in Louisiana.

This study examined eight hypotheses. Bivariate correlation analyses examined the first four hypotheses. Four additional hypotheses were tested using hierarchical, regression analysis within four production function models with data collected during academic year (AY) 95-96 and AY 97-98. The bivariate correlation analyses suggested that the exogenous factor and community type inputs were significantly (p < .01, one-tailed) correlated with academic productivity during both academic years. Per-pupil expenditures for instructional salaries with and without the presence of the Level 3 subsidy were not positively correlated with academic productivity during AY 97-98.

The four production function models provided no evidence that per-pupil expenditures for instructional salaries, with and without the Level 3 subsidy, influenced
the academic productivity of schools in the sample. The exogenous factor and community type input produced significant (p < .01) Beta values and accounted for a majority of the variance in the dependent variable.

The findings from this study provides evidence that Louisiana’s educational finance policy of using the Level 3 subsidy to increase the academic productivity of secondary schools has been unsuccessful. Data suggest the benefits received by producers as a result of instructional salary increases being shifted to a third party were not reflected in academic productivity. Further, the findings suggest simple increases in per-pupil expenditures for instructional salaries had no significant impact on academic productivity in Louisiana’s public secondary schools.
CHAPTER 1
INTRODUCTION

"The devotion of democracy to education is a familiar fact. The superficial explanation is that a government resting upon popular suffrage cannot be successful unless those who elect and who obey their governors are educated" (Dewey, 1916, p. 87).

The bedrock of the American democratic process is founded on the notion that its citizens will make "educated" decisions regarding the leaders elected to serve the country. As Robert Reich (1992) stated, "Each nation's primary assets will be [due to the new global economy] its citizens' skills and insights" (p.3). Formal education using the medium of public schools is one mechanism used to purport democratic ideals and economic opportunity from generation to generation; hence, it is in the state's interest to insure its citizenry obtains basic academic skills (Sizer, 1984).

Excluding basic academic skills, other educational outcomes such as citizenship, creativity, attitudes and work ethics, which are not often measured by state accountability programs, are fundamental components in developing individuals to become productive members of the greater society. The aforementioned private benefits of education to the individual student clearly have a degree of spillover benefits (McConnell & Brue, 1993) to society. Many of these social benefits can be quantified in the form of lower (a) crime rates, (b) public health costs, and (c) dependence on welfare and unemployment benefits (Cohn & Geske, 1990), yet many benefits remain "mostly elusive and intangible" (Psacharopoulos, 1980, p.160). The value of any economic good is technically dependent on its scarcity (Solmon, 1987) but because the
consumption of educational services produce benefits for both the individual (private) and society (social) education can be considered as an economic good.

Psacharopoulos (1980) reported that higher rates of return were associated with individuals who completed high school versus those who completed only elementary school. Rates of return for those individuals completing college versus high school were significantly lower, supporting the hypothesis that the law of diminishing returns can be appropriately applied to education (Psacharopoulos, 1980). This phenomenon may exist because those opportunity costs associated with attending post-secondary education are significantly higher than those accrued by individuals entering the labor market upon graduating from high school. According to Geske (1982), opportunity costs must be addressed in “terms of foregone earnings and foregone learning” (p. 325) when measuring educational inputs using a human capital approach.

The impact of the individual’s opportunity benefits from education have been historically outlined in human capital investment theory, which describes those lifetime private benefits received by an educated individual (Jorgenson & Fraumeni, 1989). The gestation period for educational inputs to be transformed into monetary and non-monetary benefits accrued upon entering the labor market has obfuscated the measurement of school outputs. To address this limitation, researchers often estimate lifetime labor incomes based on cohorts who consumed different levels of educational goods and services prior to entering the labor market.

The findings of some researchers have suggested that the benefits received from the consumption of educational services are significantly larger than educational expenditures associated with its production. Empirical studies have further shown that
individuals' lifetime incomes are positively influenced by the level of consumption of educational goods and services (Jorgenson & Fraumeni, 1989; Ribich & Murphy, 1975); however, "educational wastage" occurs when individuals dropout of school or are retained at a specific grade level. Loxley (1987) defines educational wastage in economic terms as those costs associated with "the total number of pupil-years spent by repeaters and dropouts" (p.63). The impact of educational wastage on rates of return for educational expenditures is illustrated by the high level of inefficiency found in public education. Furthermore, the use of scarce human and material resources to produce educational services not directly linked to school productivity goals further exacerbates the phenomenon of educational wastage.

Recent Movements in Education

Since the late 1970s, reformists at the state and federal levels have advocated the financing of school improvement efforts. These improvement efforts have emphasis on increasing greater accountability and effectiveness (Odden, 1984), yet evidence suggests specific federal categorical programs (e.g. Title I) began addressing accountability issues a decade earlier (Odden, 1982). Historically, the role of the federal government has been to indirectly support education by providing large flat grants such as the National Defense Education Act of 1958 and the Elementary and Secondary Education Act of 1965.

Public education is not mentioned in the Constitution and as a result of the Tenth Amendment, education is viewed as a state right. The Tenth Amendment reserves power not delegated to the federal government to each state and their citizens (Alexander & Alexander, 1992). Most states outline the basic educational rights of its
citizenry and the organizational structure of the educational bureaucracy in their constitutions. For example, in the Constitution of the State of Louisiana of 1974, the Preamble states,

The goal of the public educational system is to provide learning environments and experiences, at all stages of human development, that are humane, just, and designed to promote excellence in order that every individual may be afforded an equal opportunity to develop to his full potential (p.94).

This language articulates clearly that each person in Louisiana should have the opportunity to receive quality educational services from the public education system.

The "equal opportunity" provision of numerous state finance systems has come under judicial scrutiny since the 1970s. Many state finance systems have been involved in litigation concerning issues of equity and adequacy; however, the courts have rarely addressed the issue of efficiency. Green (1996) explained that this phenomenon may exist "in part to the courts' belief that they lack the expertise to judge the legislative decisions [of state governments] and the doctrine of separation of powers" (p.95).

Although evidence suggests public schools are operating inefficiently, educational reform efforts in the past 30 years have focused on four issues: (a) equity, (b) choice, (c) accountability, and (d) excellence (Loveless, 1998). Issues of equity primarily involve reducing the link between district wealth and spending, which results in the extreme variance in per-pupil expenditures across school districts (Geske, 1982). After the Serrano vs Priest (1971) case, state aid programs increased their attempts to reduce fiscal disparities between district wealth and spending (fiscal neutrality), thus reducing the inter-district inequalities as measured by per-pupil expenditures (Alexander & Alexander, 1992; Geske & LaCost, 1990). Although two decades have passed since the landmark Serrano case, substantial inter-district differences in per-
pupil expenditures exist in a number of states. Odden and Clune (1999) note that fiscal neutrality has improved modestly but horizontal equity has not improved because many wealthier districts are allowed to increase their tax rates, thus maintaining spending differentials across districts. In a recent study using data from Pennsylvania, Hartman (1999) found “a strong relationship between spending level and district wealth” (p.407) with wealthier districts lowering teacher-pupil ratios and increasing expenditures for instructional salaries.

The issue of school choice basically involves the empowerment of parents to decide the educational setting for their child. Advocates of increased levels of educational choice believe greater levels of efficiency can be obtained by placing an element of competition among schools. Market choice in the form of tax-credits, vouchers, and charter schools may increase efficiency of schools through competition, but market accountability may hinder educational reform efforts (Geske, Davis & Hingle, 1996; Levin, 1991). Regardless of a market-based “choice” criterion, schools receiving funds from the public coffers must provide services to all children within those parameters outlined by statutory and policy mandates. Further, students will continue to have control over learning (Monk, 1981) which will inevitably have a direct influence on the technical efficiency achieved by schools.

Regardless of the system control barriers reducing the efficient use of scarce resources, politicians and pundits have castigated educators’ ability to produce learners who can compete internationally. After the publication of A Nation at Risk (1983), accountability and effectiveness research fulminated as academia began to respond to growing public concerns regarding utilization of fiscal resources. Early production
studies attempted to measure the relationship between per-pupil expenditures using an input-output paradigm. The results purported that increased levels of per-pupil spending could not be systematically associated with increased student achievement scores (Hanushek, 1981, 1986, 1987, 1989; Levin, 1974).

These early production studies primarily used multi-level data with either single-equation, ordinary least squares or two-stage least squares to regress selected inputs against targeted outputs, usually student scores on standardized achievement tests. Because of the multi-level research context and the hierarchical nature of the data, some researchers have questioned the appropriateness of using statistical methods found in "traditional" productivity studies (Raudenbush & Bryk, 1986; Sirotnik & Burstein, 1985). Other issues of concern with early production studies included the assumption that standardized test scores were appropriate proxies for cognitive development and the omission of non-cognitive factors on either side of the production function model (Cohn & Millman, 1975), thus limiting the programmatic value of their findings.

Regardless of the findings of early production studies, per-pupil expenditures have increased 205% (after adjusting for inflation) in the past 30 years; however, student academic outputs have not matched these increased levels of spending (Levin, 1989b; Odden, 1992, 1994; Walberg, 1994). According to the National Center for Educational Statistics (1998b), current expenditures have increased 47% since 1983 (constant dollars) and projected expenditures were estimated to increase to $269.7 billion by the end of 1997. Although cost have significantly increased, academic productivity has remained relatively constant.
The increasing demand to educate subpopulations previously excluded from educational services such as handicapped and minority children is one explanation for the fiscal expenditure increases since the 1960s. According to Garms (1986), education is "the single largest item of state and local governmental expenditures and constitutes over 35% of all state-local governmental expenditures" (p. 278). This phenomena is exacerbated by states such as Louisiana who operate a more centralized educational finance program, which allocated approximately 52% ($2.5 billion) of all state revenues to education during academic year (AY) 95-96 (Louisiana Department of Education, May 1997).

The National Center for Education Statistics (1998b) has provided evidence that per-pupil expenditures have significantly increased over the past 40 years; however, how efficient schools utilize fiscal resources to produce educational goods and services has not been clearly defined. Some researchers have suggested counter-productive spending, lack of technical skills in resource management, political homeostasis, lack of incentives, and bureaucratic growth have reduced the amount of money necessary to provide educational services available for student consumption (Guthrie, 1995; Hanushek, 1997; Walberg, 1994). Information regarding the process of mixing scarce resources in the production of learning may become clearer when the unit of analysis is moved closer to the student, which "should help refine future studies of the relationship between financial resources and student outcomes" (Picus, 1997).

Educational productivity research using school-level data can provide information for school administrators about those available resources necessary to increase the quality of educational services to students, thus increasing overall school
productivity (Kazal-Thresher, 1993). As stated earlier, productivity studies using the educational production function as a theoretical model have focused on the relationship between inter-district differences in per-pupil expenditures and student achievement on standardized tests. The mixed results have not lead to the establishment of a causal model (Monk, 1997) that systematically explains how and to what degree scarce resources should be allocated to increase educational productivity. One argument posited by researchers for the ambiguous results of early productivity studies was that expenditure data at the school level have been missing from inquiries, which would facilitate micro-level analysis of school productivity.

Data collection at the school level (Berne, Moser, Stiefel & Goertz, 1997; Busch & Odden, 1997; Monk, 1997) may reduce the lacunae between researchers and administrators’ use of econometrics to measure how scarce resources are being mixed to optimize productivity. By using school resources in a manner that maximizes educational outputs, schools can increase their productivity. Schools developing strategies to operate with a higher level of technical efficiency will subsequently move closer to the production frontier.

Hanushek (1997) has suggested that school administrators are not guided by incentives or may not understand the production process; hence, schools are technically inefficient and not operating on the production frontier (Hanushek, 1987). Technical efficiency is defined in economic terms as the degree to which those individuals having a direct influence in production of a targeted output are attempting to reach the maximum level of output possible while holding inputs constant. Because of the unique involvement of students, teachers and parents in the production process, technical
efficiency cannot be achieved unless all individuals involved in the process of learning attempt to maximize its production.

Theoretical Framework

Following the recent emphasis on economic analysis at the school level, this study utilized an educational production function model within the general systems framework outlined by Rossmiller and Geske (1977). This framework, the Educational Production Process under School Conditions (EPPSC), was developed under the notion that the process of schooling is "amenable to economic analysis" (Rossmiller, 1982, p.86) and provides a heuristic model for investigating the problems associated with school productivity (Rossmiller & Geske, 1977). This model tracks resources from their external sources through the process of schooling to their educational outcomes.

Researchers using the School-Site Microfinancial Allocation Model (SMAM) by Griscom, Cooper, & Cohen (1993) and by Cooper, Sarrel, Darvas, Alfano, Meier, Samuels & Heinbuch (1994) have advocated the tracking of resources through the educational system in a manner similar to those advocated by the EPPSC's authors. Analyses of school-level resource allocations have recently begun in California, Florida, Minnesota and Texas under the rationale that these data will provide a greater understanding of how human and material resources are being used in producing educational outcomes (Nakib, 1995; Picus, 1997).

According to the EPPSC framework, four factors encompass the educational process: (a) inputs to the system, (b) configuration and processes of the formal educational system, (c) outputs of formal schooling, and (d) feedback (Rossmiller, 1982). The inputs into the educational process come from a plethora of exogenous...
sources, which can be organized into clusters such as community, economic, social and demographic. Fiscal inputs into the educational production process are directly impacted by the economic resources available to a community and its willingness to levy tax burdens upon otherwise disposable income for schools. These economic factors interact with certain system control factors, such as federal and state statutes, local rules and regulations, and contractual agreements between local school boards and teacher unions.

The formal educational system is the second major factor in the EPPSC framework, which can be subcategorized as either school resource inputs or applications (Rossmiller & Geske, 1977). School resource inputs include those scarce human and material resources used in the production of educational outcomes. These resources are mixed to obtain the goals and objectives of the educational system but are regulated by certain system controls. System controls from state departments of education occur in the form of subsidies, curricula mandates and accountability systems. These external influences often manipulate the goals and objectives established by local school boards by providing fiscal resources contingent upon a prescribed mandate such as those outlined in California's Senate Bill 813 (Picus, 1991). Endogenous factors influencing resource utilization within a particular school may be contingent upon teacher quality, instructional effectiveness, administrative leadership style, and instructional organization.

The numerous exogenous and endogenous influences on the application of school resources may have a direct effect on how human and material inputs are used to achieve established objectives. According to Rossmiller and Geske (1976), "A major
task of the school administrator is to recruit and organize a staff of professionals to maximize achievement of the school's objectives" (p.497). This investment in the human capital of a school's professional staff is a costly endeavor, especially due to the labor intense nature of the schooling process. Because the costs associated with staff salaries and benefits account for an estimated 60% and 90% of the per-pupil expenditures of an entire school (Hanushek, 1989; Peternick, Sherman & Guarnera, 1999; Picus & Fazal, 1995; Rossmiller & Geske, 1976), expenditure analyses of instructional salaries at the school level are appropriate (Geske, 1979).

The fiscal resources within each school directly allocated to instructional salaries and benefits have been the focus of recent research. These research efforts have culminated as teacher unions and policy-makers continue to advocate decreases in the teacher-pupil ratios, thus requiring further human capital investment by local boards of education. These investments for additional teachers are sensitive to scale economies because of the relationship between increased costs associated with lowering teacher-pupil ratios and/or increasing school enrollment (Fox, 1981; Riew, 1986; Thompson, 1994; Verstegen, 1990). Unfortunately, a causal relationship between low teacher-pupil ratios and high levels of academic productivity has not been established (Fowler & Walberg, 1991; Odden. 1990). The pattern of increased expenditures on inputs having a limited influence on the academic productivity of schools provides evidence that policy-makers and special interest groups have limited concern with issues of efficiency.

The third major component of the EPPSC framework addresses the outputs of the educational system, which can be organized into a matrix of interrelated short and long range outputs, or monetary and non-monetary outputs (Rossmiller & Geske, 1977).
Although these outputs are categorized, they are not exclusively independent of each other. Short-range outputs of academic skill mastery or cognitive learning (non-monetary) have dominated production function studies in the past 40 years. Hanushek (1997) reviewed 377 production estimates since 1966 and found 282 (75%) of them had used student scores on standardized achievement tests as an educational output. Long-range outputs, usually measuring earning differences between the educational levels of cohorts, are often analyzed using the direct returns to education approach (Cohn & Geske, 1990). This analytic approach attempts to associate lifetime income differentials with differences in educational attainment. Empirical studies have shown that lifelong earnings are positively associated with educational attainment until completion of the baccalaureate program (Jorgenson & Fraumani, 1989) and negatively associated with exiting school prior to graduation (Blakemore & Low, 1984; Catterall, 1987).

The interrelationship among educational outputs has been a methodological limitation for educational researchers attempting to establish causation associated with incremental levels of a selected resource with a targeted output. The effects of most educational resources are diffused across a myriad of school objectives within those categories outlined by the EPPSC. This phenomenon is characterized in the vernacular of economists as a spillover or externality effect. Externalities exist when the costs of production or consumption of a benefit unintentionally influences a third party (McConnell & Brue, 1993). These effects are categorized as “joint” outputs in the EPPSC framework. This category is defined as “those [outputs] which occur whether or not they are sought and which indeed may be unintended” (Rossmiller & Geske, 1977, p.63). Joint outputs resulting from schools operating closer to the production
frontier may be in the form of lower levels of students exhibiting self-handicapping behaviors (Urdan, Midgley & Anderman, 1998) and/or dropping out of school prior to graduation (Felter, 1989; Hamby, 1989). As schools operate more technically efficient, educational services are produced and consumed at higher rates while providing students with increased opportunities to be academically successful.

The fourth and final component of the EPPSC framework is the feedback loop, which is described by Rossmiller and Geske (1977) as “the system’s self-correcting mechanism” (p.64). This internal monitoring characteristic facilitates the use of program evaluative techniques to assess the impact of school resources on selected educational objectives. This feedback loop should be viewed as those regulatory actions initiated by the stakeholders within the public sector of the educational system rather than from a self-corrective “invisible hand” (Smith, 1952) perspective found in competitive market systems.

The feedback loop outlined in the EPPSC would use an “administrative production function” (Rossmiller & Geske, 1976, p.488) to estimate the level of technical efficiency within schools. The assumption being those school personnel would use information concerning program effectiveness to operate their schools closer to the production frontier. This would be done by motivating individuals with discretionary power over productivity to maximize available resources in the production of targeted educational outputs. Kennedy (1997) has suggested that teachers should not be viewed as technical production managers but rather as dilemma managers operating within a changing production frontier. From this perspective, the production frontier is viewed as constantly changing due to the student’s input into production of learning.
Hanushek (1997) and Mullin (1982) have suggested that school personnel lack the incentive of market competition needed to operate their schools in an efficient manner. Researchers have speculated about the use of educational incentive programs for schools but recent empirical findings in California have suggested that changes in school practices were ephemeral. Senate Bill 813 in California developed an incentive program for districts throughout the state to increase fiscal allocations directed at instructional services. Districts that complied with Bill 813 received additional state funding, which motivated most of the school districts to increase instructional allocations. Picus (1991) reported that most participating school districts reverted back to pre-incentive resource distribution patterns once cessation of the incentive program began, thus supporting Hanushek’s contention that schools continue to operate far from the production frontier once cessation of incentives occurs.

In summary, the EPPSC is a framework for organizing those factors involved in the production of educational services available for student consumption. This framework was developed under the pretense that educational systems were amenable to economic analysis and can be analyzed using an educational production function. The unique characteristics of the EPPSC facilitated the use of regression analysis within four production function models. This analytical technique provided the researcher with the ability to statistically control for the variance accounted for on the dependent variable by exogenous influences. Once the influences of exogenous factors was taken into consideration, the unique variance accounted for by human resource expenditures, with and without the Level 3 subsidy, on the dependent variable was ascertained. These data provided insight into the current policy trends in Louisiana of increasing
instructional expenditure in hopes of increased academic productivity among schools, thus providing a further illustration of lacunae between empirical evidence and decision-making protocol.

The subsidy investigated in this study was limited to those Level 3 expenditures outlined by Louisiana's Minimum Foundation Plan (MFP) allocated for instructional personnel. The MFP is currently the finance system used in Louisiana to provide fiscal support to local education agencies (LEAs) for the cost of operating their public education systems. Figure 1 illustrates those components of the EPPSC framework used to investigate the research questions in this study.

![Diagram of EPPSC Framework]

**Figure 1.** Selected Components of the Educational Production Process under School Conditions (EPPSC) Outlined by Rossmiller and Geske (1977).
Statement of the Problem

In the past decade, states have devoted significant fiscal resources in the development of state-level accountability models for the purpose of evaluating the productivity of their public school systems. The typical measure of academic productivity continues to be student performances on standardized achievement tests. For example, an investigation of eight, state-level accountability models conducted by the Council of Chief State School Officers (1999) revealed that these states used standardized achievement tests to measure the level of school productivity. Behavior indicators such as dropout and attendance rates were also used in the aforementioned states’ accountability systems as non-cognitive measures of school productivity.

Recently, the Louisiana Department of Education (LDE) has developed a comprehensive school and district accountability system. This system is designed to measure the academic productivity of schools using data obtained primarily from criterion-referenced tests (Louisiana Educational Assessment Program (LEAP) for the 21st Century and Graduate Exit Examination) and norm-referenced tests (The Iowa Tests of Basic Skills and The Iowa Tests of Educational Development). In addition to data from standardized test scores, attendance and retention rates are used to compute a School Performance Score (SPS). A SPS is computed from the aforementioned indices using several formulas based on the grade configuration of a school.

The SPS is used by the LDE to make value judgments regarding whether a school’s productivity level is below an acceptable range (currently a SPS ≤ 30). Regardless of the SPS, all schools are expected to increase their productivity at such a rate as to attain the State’s 10 and 20-year goals. A series of consequences are outlined
in Louisiana’s School and District Accountability System for those schools who fail to show evidence of increased productivity.

One rationale for developing this accountability system has been the continued low level of academic productivity found throughout many schools in Louisiana. This trend of low performance has continued during the past decade although per-pupil expenditures have increased. Per-pupil expenditures from AY 95-96 to AY 97-98 have increased 21% but academic productivity has remained stagnant. According to data obtained from Bulletin 1472 (LDE, 1997; 1998; 1999) scores on the Scholastic Aptitude Test have remained stagnant and the percentage of students passing the Graduate Exit Examination has declined since AY 95-96.

Beginning in AY 96-97, the MFP implemented a state-level, supply-side subsidy (Level 3 funding) specifically targeted for instructional salaries rather than simply increasing general expenditures for public education through Level 1 funding. Level 1 funding accounts for a majority (approximately 90%) of the expenditures appropriated each year for public education in Louisiana by using a formula designed to promote equity across the sixty-six city/parish school districts. According to Bulletin 1947 (LDE, 1996), “local school systems must ensure that seventy percent (70%) of local school system general funds, including all revenue sources, are expended on instruction” (p.50).

Level 3 expenditures are beyond those allocated by the MFP for both Level 1 and 2 funding. Level 2 funding is primarily used to “institute taxpayer equity through equalizing tax rates and rewarding tax efforts” (LDE, 1996, p.46) and comprises only a small percentage of the overall expenditures for public education. Level 3 expenditures
are those specifically targeted for instructional salaries as outlined in Bulletin 1929 and exclude related benefits. The aforementioned expenditures have both a minimum and maximum range and awards are allocated based on the relative wealth of LEAs in an effort to provide some degree of fiscal equity. For example, beginning in AY 96-97, the Level 3 subsidy ranged from $750 to $1,200 for all instructional salaries based solely upon the wealth of the district in which they were employed.

A rationale for classifying Level 3 funds as a subsidy is based upon its distributive characteristics and lack of local effort. Unlike those expenditures found in Level 1 and 2, Level 3 funds are simply allocated in addition to other MFP funding levels and require no fiscal effort from locally generated revenues. Economic theory suggests this type of funding is an attempt by state officials to shift the supply curve downward in order to correct for the underallocation of resources. This “tax in reverse” (McConnell & Brue, 1993) reduces the impact for locally generated revenues and shifts those costs associated with increased human resource expenditures from the district to the state. A rationale for the Level 3 subsidy may be based on the belief that investments in human capital will increase both the overall quality of the instructional labor market and productivity of schools throughout the state.

Understanding of the supply curve in educational systems has been advocated by Katzman (1971), although no empirical evidence has been forthcoming regarding the use of a supply-side subsidy to correct for the underallocation of fiscal resources within a general systems framework such as the EPPSC. Katzman (1971) purports that knowledge of the supply curve “specifies expenditure-output packages” (p.104) and has benefits in educational research, yet the market demand curve for many school outputs
remains underestimated and not fully understood. This phenomenon partly exists because of the difficulty in quantifying non-marketed benefits, such as competitiveness in the labor market and consumer awareness (Cohn & Geske, 1990). These non-marketed benefits are obtained from the consumption of educational services but are rarely measured by school productivity researchers.

Spillover costs to local communities resulting from technically inefficient schools moves the market demand curve downward. As inefficient schools move the market demand curve downward, the costs of educating all students becomes lowered as some of the costs for educational services are shifted to a third party. For example, having individuals exit school prior to earning a high school diploma often reduces the total cost of educating all students. This foists the burden of under-educated persons into local labor markets or social welfare programs. The following figure illustrates how technically inefficient schools create spillover costs.

Figure 2. Spillover Costs Associated with Technical Inefficiencies.
Although the market demand curve for many educational outputs is underestimated, the primary output of schools remains skill mastery of those curricula necessary to be competitive in the labor market and/or post-secondary education. Skill mastery of the general curricula is currently measured by Louisiana’s minimum competency test, the Graduate Exit Examination (GEE). The use of the GEE, rather than other norm-referenced tests, was based on the GEE’s ability to measure those skills mastered within the greater curricula and its requirement for graduation from high school. Because the GEE is considered a “high stakes” exam, it is reasonable to assume students will attempt to maximize their performance on each of the five tests. A logical measurement of a secondary school’s productivity would be to ascertain the level of skills mastered by its students.

This study investigated the effects of a state-sponsored, supply-side subsidy for human resource expenditures to improve the academic productivity of secondary schools in Louisiana. A positive relationship is believed to exist among the aforementioned variables based on a review of the literature. Expenditures for instructional salaries (Cooper et. al, 1994; Ferguson, 1992) and salary supplements (Harter, 1999) have been positively correlated with student performances on standardized achievement tests. Previous production function studies have either aggregated instructional expenditures at the district level or utilized general, per-pupil expenditures. Per-pupil expenditures often included indirect costs such as debt service and capitol outlay. The inclusion of indirect costs in productivity studies has obfuscated the relationship between instructional expenditures and student performances, which provides a greater rationale for using school-level expenditure data.
The use of the Level 3 subsidy directly allocated to human resource expenditures for instructional salaries has not to this date been investigated using an educational production function. This study used selected components of the EPPSC framework outlined by Rossmiller and Geske (1977) to organize data for use with an educational production function model. The use of a production function allows the researcher to ascertain the effect of targeted inputs on the dependent variable while controlling for exogenous factor influences. Once the variance accounted for by the exogenous factor has been controlled, the effect of instructional salaries and the inclusion of the Level 3 subsidy on the output can be ascertained.

The use of a state-level subsidy to positively influence the level of academic productivity was investigated to determine if the current level of spending has caused a "threshold" effect. Bridge, Judd and Moock (1979) defined a threshold effect as the input levels necessary for a change to appear on a targeted output. Specifically, this investigation into whether the Level 3 subsidy allocated to LEAs for instructional salaries are at such a level as to have a positive influence on GEE scores in Louisiana's secondary schools.

In general, governmental agencies have historically used supply-side subsidies to correct for the underallocation of resources by providing revenues to producers in an attempt to shift the supply curve downward. This action moves the consumers' demand for a good or service to an "optimum" level, thus increasing demand without increasing costs to producers. The demand on LEAs for well-paid teachers needed to produce high quality educational services for students is partially achieved by shifting some of those costs to the State, which subsequently moves the supply curve downward. Simply
stated, the LEAs receive the benefit of higher paid teachers without having to incur the expense because the State is subsidizing those costs through Level 3 funding.

Statement of Purpose

Research has attempted to understand the relationship between school inputs and their associated outputs. Early productivity studies investigated the relationship between general, per-pupil expenditures and student performances on standardized achievement tests using the input-output paradigm of the production function. The production function model was originally developed by economists to determine those specific amounts of land, labor and capital necessary to produce a given output (Mankiw, 1992). Empirical studies using the production function have suggested non-school inputs account for a majority of the variance across standardized test scores (Coleman et al., 1966; Jencks & Brown, 1975; MacPhail-Wilcox & King, 1986; Thompson & Correa, 1989). These findings have led some researchers to deduce that no systematic relationship exists between fiscal inputs and the academic productivity of schools (Fowler & Walberg, 1991; Hanushek, 1981, 1986).

Some studies using an educational production function model have found selected expenditures at the school-level have had a positive effect on student test performances (Cooper et al., 1994; Hedges & Greenwald, 1996; Hedges, Laine & Greenwald, 1994; Summers & Wolfe, 1977). Further, researchers have reviewed past production function studies using a meta-analytic method and have concluded that "school resources are systematically related to student achievement and that these relationships are large enough to be educationally important" (Laine, Greenwald & Hedges, 1995, p.57). These findings suggest that expenditures for instructional services
were positively associated with academic productivity, although a plethora of methodological shortcomings have been identified in early productivity studies.

The lack of clarity provided from the findings of early production function studies and/or political pressures for increased school efficiency during the early 1980s shifted the inquiry paradigm used by many researchers. Using an inductive approach typically associated with qualitative research methods, researchers investigated those specific characteristics found in unusually successful schools (Brookover, Schweitzer, Schneider, Beady, Flood & Wisenbaker, 1978; Cuban, 1989; Edmonds, 1979; Purkey & Smith, 1983; Rutter, Maugham, Mortinmore, Ouston & Smith, 1979; Teddlie, Kirby & Stringfield, 1989). This research approach provided further insight into the process whereby unusually successful schools manipulate human and material resources to produce high quality, educational services for student consumption.

One limitation of the effective schools findings was their inability to establish casual relationships among inputs, processes and outputs. Little information concerning the levels of human and material inputs necessary to increase targeted outputs was provided by these qualitative studies. Because the level of school inputs necessary to produce measurable changes in schools was not established, the technical efficiency of unusually successful schools could not be ascertained. As noted by Bridge, Judd and Moock (1979), the input levels necessary for a threshold effect to be manifested may cause school inputs to appear to have no influence on targeted outputs. Using the threshold effect rationale, an argument could be posited that the expenditure level of most schools has not been significant enough to reach the “threshold” necessary to obtain significant changes in school productivity. Teacher advocacy groups and unions
have used the threshold effect argument to justified increased expenditures on human resources.

Of the fiscal expenditures allocated to education, many researchers recognize that schools do not operate on the production frontier and are subsequently inefficient with those scarce resources located within the system (Cohn & Geske, 1990; Geske & Teddlie, 1990; Monk, 1981). The lack of incentives found in the private market sector (Mullin, 1982) and the paucity of econometric training for school personnel (Hanushek, 1997) provide a rationale for limited school productivity. Further, the amorphous nature of the educational production frontier (Hanushek, 1997), the discretionary controls over production inherent to students (Monk, 1981), and the limited understanding of instructional methods that maximize learning (Bloom, 1964; Bloom, 1983) have been given as explanations for the inefficiency found in public schools.

These explanations have provided little information to guide programmatic changes necessary to increase the academic productivity of those schools under the auspices of the sixty-six parish/city school districts found in Louisiana. Even less information has been made available concerning the spillover costs incurred by communities because of the inefficient use of educational resources in schools with low levels of academic productivity. Felter (1989) has suggested schools with higher levels of academic productivity have lower dropout rates. The logic of the aforementioned finding can be based on 'a priori knowledge that academically successful students will remain in school until graduation because they are positively reinforced by the belief further consumption of educational services will increase their competitiveness in the labor market. Research has provided evidence that life-long earnings are significantly
higher for individuals with a high school diploma (Catterall, 1987; Levin, 1972) than those students who drop out of school prior to graduation.

Inefficient use of scarce resources by high school officials can be reflected in high dropout rates as students who determine, either consumption of additional educational services will not provide substantial monetary benefits, or those services most appropriate to address their needs are not available. Some researchers (Felter, 1989; Fine, 1991; Pittman, 1986; Pittman & Haughwout, 1987) have suggested the instructional organization (Bossert et. al., 1983) of schools may influence a student’s decision to dropout. As schools attempt to operate more efficiently and move closer to the production frontier, student retention must be addressed in conjunction with the quality of instructional services available for consumption.

Recent empirical studies have provided evidence that those expenditures directly allocated for instructional services are positively associated with higher levels of academic productivity (Cooper et al., 1994; Hedges & Greenwald, 1996; Kazal-Thresher, 1993). Increased academic productivity provides both private and public externalities, such as increased competition in the labor market and a greater ability for individuals to compete in such a market. The spillover benefits accrued by a society having an educated populace can be quantified in the number of citizens participating in the labor market and politics. Because of the spillover benefits accrued from academically productive schools, politicians frequently advocate for increased fiscal inputs into the educational system, especially in the area of instructional salaries.

The use of a supply-side subsidy is one system control state officials can utilize to reallocate scarce fiscal resources to specific educational programs. This policy of
using a state-level subsidy for instructional salaries, rather than simply increasing overall Level 1 funds, is illustrated in the utilization of Level 3 funding outlined in Louisiana's MFP. The political rationale for using a Level 3-type subsidy is based on the assumption that increases in instructional salaries will positively affect the academic productivity of schools throughout the state. To date, limited empirical research has focused on the use of Level 3-type subsidies to impact the academic productivity of public schools.

Research Question

The major research question of this study asked: To what degree does human resource expenditures allocated for instructional salaries positively affect academic productivity and is this relationship affected further by the presence of the Level 3 subsidy in Louisiana's secondary schools?

Research Hypotheses

1. Exogenous influences will be negatively correlated with academic productivity levels (Graduate Exit Examination scores) during AY 95-96 and AY 97-98.
2. Community type will be positively correlated with academic productivity levels during AY 95-96 and AY 97-98.
3. Human resource expenditures (per-pupil) for instructional salaries exclusive of the Level 3 subsidy will be positively correlated with academic productivity levels during AY 95-96 and AY 97-98.
4. Human resource expenditures (per-pupil) for instructional salaries inclusive of the Level 3 subsidy will be positively correlated with academic productivity levels during AY 97-98.
5. Exogenous influences will explain a significant proportion of the variance in academic productivity during AY 95-96 and AY 97-98.

6. Community type will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences has been accounted for during AY 95-96 and AY 97-98.

7. Human resource expenditures (per-pupil) exclusive of the Level 3 subsidy for instructional salaries will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences and community type have been accounted for during AY 95-96 and AY 97-98.

8. Human resource expenditures (per-pupil) inclusive of the Level 3 subsidy for instructional salaries will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences and community type have been accounted for during AY 1998.

It is theorized that using the educational production function within the greater context of the EPPSC framework could identify a relationship between instructional salaries and academic productivity. Understanding of the aforementioned hypotheses will contribute to the knowledge base of researchers and politicians regarding the effects of the Level 3 subsidy to influence levels of academic productivity in public schools. Information from this study may provide insight into the threshold level needed for a supply-side input to positively affect the levels of academic productivity in Louisiana’s secondary schools. Information regarding the use of increased per-pupil expenditures by state officials attempting to increase academic productivity have had mixed results. Further, the use of state-sponsored, supply-side subsidies for
instructional salaries and the significant social benefits reaped by having an educated populus, a rationale for conducting an empirical investigation can be established.

The research strategy selected for this study was based on the three conditions outlined by Yin (1994) that describe “(a) the type of research question posed, (b) the extent of control an investigator has over actual behavioral events, and (c) the degree of focus on contemporary as opposed to historical events” (p.4). Based on the primary research question, the lack of control over political decisions, and the current national and state interest in school productivity as measured by accountability programs, this study utilized an archival, analytic approach. This research approach is indicative of those used by educational economists and is “advantageous when the research goal is to describe the incidence or prevalence of a phenomenon” (Yin, 1994, p.6). The ex post facto research design of this study does not seek to establish causal links between the independent and dependent variables but rather to describe the magnitudes and directions of hypothesized relationships. Experimental designs using a random sampling technique were deemed inappropriate because of the ethical and legal restrictions surrounding the allocation of fiscal resources to schools.

Definition of Terms

Academic Productivity

For the purpose of this study, academic productivity was synonymous with student performances on standardized achievement tests. Academic productivity for the schools in this study was operationally defined as the mean, standard score of all test-takers on Louisiana’s minimum competency test. The use of this proxy as a measure of academic productivity was based on the requirements established by State Board of
Elementary and Secondary Education (SBSE) for a student to receive a high school diploma in Louisiana.

The GEE is a criterion-referenced test (CRT) measuring basic skill mastery in English-language arts, written expression, mathematics, social studies and science. Because this assessment instrument measures an assumed school objective (students meeting the academic skill mastery necessary to graduate) and provided a measure of instructional effectiveness within the established curricula, the use of this criterion-referenced test was deemed an appropriate measure of academic productivity. Norm-reference test data (NRT) were not used to measure academic productivity because “the achievement measured for low-ability students is less accurate than that for others” (Glasman & Binaminov, 1981, p.513). Scores from NRT protocols are currently not used as a criterion for students in high school to receive a diploma, thus eliminating the assumption that students will attempt to maximize their performance because the tests are “high stakes.”

Economic, Social and Demographic Influences

For the purpose of this study, a factor score estimated the economic, social and demographic influences on each secondary school in the sample. This factor score provided information regarding the “values, attitudes, expectations, occupations, and economic resources” (Rossmiller & Geske, 1976, p.496) of local communities. Empirical evidence has suggested exogenous influences significantly affect student performances on standardized achievement tests.

A proxy often used by researchers to measure socioeconomic and demographic influences of local communities on a school’s academic performance is the percent of
students within the school who are eligible for either free or reduced-fee lunch services (Garris & Cohn, 1996; Stringfield & Teddlie, 1991). Another frequently used proxy for the social and economic status of a community is the percentage of families receiving Aid to Families with Disadvantaged Children (Felter, 1989; Vincenzi & Ayrer, 1985). Some researchers have questioned the appropriateness of these proxies to measure the exogenous influences on schools because the error variances of these proxies are not randomly distributed (Witte & Walsh, 1990).

Economic, social and demographic influences used in this study were measured using four indicators similar to those outlined by Kennedy and Crone (1998), but modified to address the unique characteristics of the population. Using data obtained from databases maintained by the LDE, four indicators: (a) % poverty (free/reduced lunch membership), (b) % retesters, (c) community type, and (d) % minority were used to measure the influence of exogenous factors on the dependent variable. The three student-level variables were combined using principle-components analysis. This statistical process generated a factor score for each secondary school in the sample. Community type was a school-level variable entered into the production function after the factor score. These procedures allowed for the variance of exogenous influences to be accounted for prior to the introduction of the treatment variable, human resource expenditures with and without the Level 3 subsidy.

Educational Production Function

For the purpose of this study, the educational production function was generally described as an input-output paradigm (Cooper et al., 1994). The educational production function was conceptually borrowed from the industrial production function
model and is used to determine the specific amounts of land, labor and capital necessary in the production of a good or service (Mankiw, 1992). The shape of the educational production function in this study was assumed to be linear with resource constraints (Cohn & Geske, 1990). The general formula used by economists is \( Q = f(a, x_1, x_2 \ldots x_m) \) with each input \((x_1, x_2 \ldots x_l)\) having a diminishing, but positive affect on the output \((Q)\). Marginal productivity for the expenditure could not be established from the production coefficient. This phenomenon exists because the marginal product input price for the supply-side expenditure necessary to establish a threshold effect on the output has not been determined, thus a priced – marginal product ratio could not be calculated.

Externalities

The term externality is borrowed from the field of economics and is synonymous with spillover effects, diseconomies, and neighborhood effects. For the purpose of this study, externalities are defined as the “benefits or costs of production or consumption of a good “spilling over” onto third parties, that is, to parties other than the immediate buyer or seller” (McConnell & Brue, 1993, p.90). For example, local communities are a third party receiving spillover benefits from having more productive schools. This premise is based on the rationale that more educated persons increase the relative quality of local labor markets and reduce participation in welfare and judicial programs (Cohn & Geske, 1990).

Economists correct for spillover benefits by increasing either the supply or the demand of a particular good. Governmental agencies often provide “subsidies” to producers in an attempt to reduce costs and move the supply curve downward.

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(McConnel & Brue, 1993). Fiscal allocation by Louisiana’s MFP (Level 3 funding) after AY 95-96 targeted instructional salaries throughout the state and was classified as a governmental subsidy. The basis for this rationale was that LEAs did not incur the cost of salary increases mandated by the legislature yet received the benefits of better paid employees. This policy is partly based on the assumption that subsidies for instructional salaries will positively affect academic productivity, thus producing spillover benefits for both the individual and the labor market.

**Human Resource Expenditures**

For the purpose of this study, human resource expenditures are defined as those costs associated with instructional salaries. Expenditures for other human resources were not selected because a direct relationship with student learning has not been suggested in findings from other productivity studies. Human resource expenditures for instructional salaries were calculated for each secondary school using a modification of the School-Site Microfinancial Allocations Model (SMAM) and the guidelines provided by the Louisiana Department of Education’s Bulletin 1929 (Cooper et al., 1994; Griscom, Cooper & Cohen, 1993; LDE, December 1996). The SMAM disaggregates expenditures based on spending location and the primary function of the service (i.e. instructional versus administrative). The SMAM calculates expenditures for those services directly provided to the student, which in turn provided a rationale for selecting expenditures allocated to instructional salaries rather than more general expenditures for indirect services.

General expenditures were typically used in early school productivity studies as fiscal inputs. Empirical studies found no significant relationship between general
expenditures and academic productivity. General expenditures are calculated using direct and indirect costs and often incorporated such peripheral expenditures as debt services, capital outlay, maintenance, equipment, transportation, and food services (Goertz, 1997). These types of aggregated expenditures have provided school personnel with little insight into those inputs that explain differentiated levels of school productivity.

Production Frontier

For the purpose of this study, the production frontier was defined as the attempt by a school to use the best technology in combination with available resources to maximize outputs and reduce input costs (Cohn & Geske, 1990; Geske & Teddlie, 1990). The concept of operating on the production frontier describes (economically) how industry maintains high levels of efficiency. The industrial production function uses specific inputs and their associated costs based on causality with selected outputs. The educational production function model is a version of the industrial production model designed to use school inputs to describe the direction and size of those scarce resources that can be systematically transformed into outputs (Cohn & Geske, 1990; Cohn & Millman, 1975; Geske & Teddlie, 1990; Monk, 1989. Unlike the industrial production function, the educational production function cannot assume that a causal relationship exists between inputs and outputs. This limitation is due in part to the influence non-school factors and students have in the production of learning.

Technical Efficiency

For the purpose of this study, technical efficiency was defined as the best use of available resources by a school’s instructional staff in the production of educational
services. Under this concept, all individuals “with discretion over production [would] seek to produce the maximum possible level of output obtainable for given inputs” (Monk, 1981, p.227). This definition is similar to that of educational efficiency outlined by Geske (1983). Educational efficiency is primarily defined by increases in student learning outputs through the parsimonious use of school resource inputs amenable to economic analysis.

**Limitations of the Study**

This study’s accessible population was limited by pecuniary and time constraints placed upon the researcher to effectively collect data from schools within the sovereign boundaries of Louisiana. Data for each secondary school were acquired from the LDE’s archived databases from AY 95-96 through AY 97-98. This data collection period helped reduce what Mumane (1982) called “snapshots of relationships” (p.8) by investigating the influence of independent variables on the dependent variable across time.

This study’s two-year, cross-sectional design had to estimate the effect of exogenous influences on the sample over a two-year timeframe. Because proxies for socioeconomic status and academic productivity had to be used, errors in the estimated population parameters were inevitable. Proxies were necessary because precise measurements for socioeconomic and demographic factors do not exist; therefore highly correlated indicators (Alexander & Solomon, 1995) must estimate these latent factors. Bridge, Judd and Moock (1979) have suggested “almost all of the variables used in input-output studies are proxies because researchers usually do not have a clear understanding of the process underlying the relationships they uncover” (p.27). This
theoretical limitation was present in this study because a causal model outlining the schooling process (Monk, 1981) currently does not exist. The Educational Production Process under School Conditions (EPPSC) was developed by Rossmiller and Geske (1977) as a framework for organizing inputs involved in the production of educational services. This framework guided the researcher in data collection and analysis in lieu of a causal model.

Summary of the Chapters

In Chapter 2 of this study, selected literature germane to the research question is reviewed to provide information and empirical findings necessary to buttress the selection of the EPPSC outlined by Rossmiller and Geske (1977) and to illuminate areas in need of further inquiry. A review of the industrial and educational production function model is supported by information regarding types of inputs, outputs, externalities, and issues regarding scale economies and technical efficiency. Selected empirical findings and literature reviews provide further detail into the historical findings of early production studies beginning with the Coleman study (1966). Information regarding the relationship between fiscal inputs and student achievement is reviewed with specific emphasis on those expenditures for instructional salaries.

In Chapter 3, the procedures used to conduct this study are discussed in detail. Pertinent information related to the sampling procedures, target population, study design, operational definitions for selected variables and the calculations of instructional salaries for each secondary school is provided. Further information regarding measurement of selected exogenous influences (social, demographic and economic factors) of each secondary school is discussed in detail. The psychometric
properties is provided for the Graduate Exit Examination, including evidence of reliability and validity. Data analysis using associated Statistical Package for the Social Sciences (SPSS) software programs is described to facilitate an understanding of how descriptive and diagnostic analyses will be used with the data. Issues related to multicollinearity are addressed along with the specific tests used with each of the hypotheses.

In Chapter 4 of this study, the quantitative data collected are presented in the context of this study’s research question. The characteristic of the final sample used in the production function once diagnostic analyses are completed is presented. Specific evidence concerning data assumptions associated with using multiple regression techniques is provided to illustrate the appropriateness of this statistical procedure. The findings from bivariate correlation analyses of the first four hypotheses are provided along with those of the four, production function models. Each of the production functions used hierarchical regression analysis to test four additional hypotheses.

In Chapter 5 of this study, the research problem is restated along with a summary of the findings. Conclusions and a brief discussion of the findings are presented to facilitate interpretation of the results. General implications for educational policy are discussed along with the study’s limitations. Suggestions for further research conclude the chapter.
CHAPTER 2
REVIEW OF LITERATURE

A plethora of research has attempted to understand the relationship between school resources and their associated outcomes. Beginning in the early 1960's, researchers have attempted to systematically link a series of school resources with educationally desirable outputs, usually measured by student performances on standardized tests. Considerable analysis has provided limited insight into those specific inputs that are systematically linked with student learning (Hanushek, 1986).

Perhaps out of the mixed results of production function studies and/or political pressures for increased school accountability during the 1980s, researchers shifted their inquiry paradigm. Using an inductive method, researchers attempted to identify those school characteristics present in unusually successful schools (Purkey & Smith, 1983). School effectiveness research has contributed to a greater understanding of the instructional processes needed to facilitate student learning (Goodlad, 1984; Murnane, 1981; Murnane & Phillips, 1981; Teddlie, Kirby & Stringfield, 1989).

Educational researchers, regardless of whether an inductive or deductive paradigm guided the inquiry, have not been able to establish a causal model to describe the relationship between school resources and levels of productivity (Monk, 1997). Recent productivity studies (Cooper et. al, 1994; Fortune & O’Neil, 1994; Hartman, 1994; Hedges & Greenwald, 1996) have suggested that certain school expenditures are directly and systematically associated with student learning. These findings appear to contradict earlier studies (Coleman et al., 1966; Jencks & Brown, 1975; Hanushek, 1981) that suggested no relationship existed between school expenditures and
performances on standardized achievement tests. These mixed findings may be a result of the type of data (Goertz, 1997) and/or the dependency of proxies for most variables (Bridge, Judd & Moock, 1979).

To date, a limited number of empirical studies have used a general systems model, such as the EPPSC, to organize variables associated with the production of educational goods and services. This theoretical framework provides insight into those inputs and outputs amenable to economic analysis using an educational production function. This input-output paradigm allows for the unique variance of the independent variables on the dependent variable to be accounted for after controlling for specific exogenous influences.

Selected Production Function Theories

The industrial production-function model is a mathematical formula used by economists to determine the specific amounts of capital (K) and labor (L) necessary to produce a given output (Y). This model can be expressed as $Y = f(K, L)$, or $zY = f(zK, zL)$ if a constant ($z$) rate of returns to scale can be applied to a specific level of labor and/or capital (Mankiw, 1992). As with the case of public and private education, some industries are labor intensive. According to the marginal production of labor (MPL) axiom, additional increases in the amount of labor will theoretically increase output by a specific unit. The MPL model can be expressed as $MPL = f(K, L + 1) - f(K, L)$.

Mankiw (1992) summaries the MPL model by stating, "the marginal product of labor is the difference between the amount of output produced with $L+1$ units of labor and the amount produced with only $L$ units of labor" (p.48). The MPL is estimated by using the slope of the industrial production function. Assuming capital is held constant, the
The geometric shape of the MPL slope will become curvilinear due to the law of diminishing marginal returns. This phenomenon describes how successive increases of an input will reach a point in which further increases will fail to produce equivalent changes on the targeted output, *ceteris paribus*. Assuming a curvilinear production function, marginal productivity coefficients for multiple inputs can be used to determine the maximum output "such that the last dollar spent on each input should yield the same additional output as obtained by spending a dollar on any other input" (Cohn & Geske, 1990, p.200).

The shape of the production function is also directly influenced by changes in technologies, especially those that directly impact labor. Technological progress can increase the efficiency of labor by maximizing individual skills and knowledge or by reducing the amount of labor necessary. The improvements of the production function resulting from technological progress (A) can be expressed as $Y = Af(K, L)$. According to this model, output will be affected by changes in A when capital and labor are held constant. The change in A is often expressed as a residual in the growth production function referred to by economists as the Solow residual (Mankiw, 1992).

The concept of production efficiency is directly associated with the industrial production-function model. According to this model, the economic relationship among a set of inputs (resources) used to generate the maximum amount of outputs (products) is determined by a production function (Alexander & Salmon, 1995; Monk, 1989; Rossmiller & Geske, 1976). When associated with cost analysis, a production function model can provide industry with decision-making information regarding levels of operating efficiency. Increased efficiency reduces the K and L inputs necessary to
produce a good, thus equating to potentially higher levels of profit by eliminating or substituting costly resources.

Costs in economics include those opportunity costs at the lowest levels necessary to produce a specific level of output. Minimum cost estimations are made by combining inputs at different levels for the same level of output. The general formula for determining cost is \( C = g(Q; P; X) \), with \( Q \) being the vector of outputs, and \( P \) and \( X \) as inputs with associated accounting costs (Cohn & Geske, 1990). The shape of the cost equation is dependent on the shape assumption of the production function.

Determining the average cost of an output by dividing the total costs (\( TC \)) by \( Q \) provides information regarding economies of scale. The AC reaches a minimum point by which any change in \( Q \) will result in a cost change. Scale economies are often used to examine cost functions and utilization rates of selected inputs (Riew, 1986), which provide data for program evaluation.

**Educational Model**

The educational production function is derived from profit seeking industry, which attempts to operate on the “production frontier” by maximizing outputs using the most efficient combination of inputs (Geske & Teddlie, 1990). By operating on the production frontier, industry can maintain high levels of efficiency measured by the industrial model of the production function. The educational model production function has been primarily used to describe the direction and size of those educational inputs that can be systematically transformed into outputs such as increased student learning (Cohn & Geske, 1990; Cohn & Millman, 1975; Geske, 1983; Geske & Teddlie, 1990; Monk, 1989). Student learning as defined by basic skill mastery can be viewed as a
cumulative investment in human capital. The positive correlation among such inputs as levels of education consumption and an individual’s life long labor income, provide a rationale for educators to develop processes to efficiently mix scarce resources into educational services available for student consumption (Card & Krueger, 1992; Jorgenson & Fraumeni, 1989).

One method to measure the effect of resources (inputs) on student learning is to use an educational production function. Production function models in education can be generally divided into four categories based on the assumptions regarding linearity and input constraints (Cohn & Geske, 1990). One category of production function models assumes linearity with no input constraints. Jencks and Brown (1978) noted that the $Q = a + b_1x_1 + b_2x_2 + \ldots + b_mx_m + e$ model has been utilized by numerous school productivity studies. The single output (Q) model is based on selected school-related inputs ($x_1, x_2\ldots$) and their associated beta coefficients ($b_1, b_2\ldots$). When input prices are placed as the denominator for all inputs, the subsequent ratios provide the dollar contribution each input has on Q. Those price-input ratios producing the greatest affect on Q could then be theoretically increased without constraint. Human resource constraints are indicative of the organizational structure of public education and therefore require a model that addresses these constraints.

The second category of educational production models are those which assume linearity using a single Q, but adjust for resource constraints. Resource constraints exist with most educational inputs. Theoretically, resources with the highest price-input ratios could be expanded to the extent authorized by organizational policies and educational law. Cohn and Geske (1990) have suggested that the next highest price-
input ratio could then be increased at the expense of those inputs with lower ratios as a compensatory strategy to address input constraints.

The third and fourth categories of educational production models are those that do not assume linearity using a single $Q$ and differ based on how they address input constraints. The general form for both categories is expressed by the equation $Q = f(a, x_1, x_2 \ldots x_m)$. Similar to the assumption of marginal productivity used in the industrial model, the inputs $(x_1, x_2)$ have a positive but diminishing affect on $Q$. Each inputs' marginal productivity (MP) can be estimated from the production coefficient. Similar to the price-input ratios used in the first two categories, the price for each MP input would be placed as denominators. All price-MP ratios (inputs) are then combined so that the last dollar spent per input would produce equivalent increases in $Q$. When constraints are assumed, those inputs with the highest price-MP ratios are expanded, while subsequently reducing the lowest ratios.

**Inputs.** Inputs for the educational production function can be classified as either school or non-school related variables. School related variables could be further subdivided into either those amenable to manipulation or those unable to be directly influenced by school personnel. Teacher-student ratio, number of courses taught per teacher, curriculum supplies, instructional materials, grade configurations and teacher salaries are school process and organizational variables under the direct control of school officials (Cohn & Geske, 1990). For example, Corcoran and Goertz (1995) have suggested increased instructional time via more efficient utilization of the school day would increase the availability of instructional services to students. The theory being as availability of instructional services students increases so will performance.
Material and human resources in an educational setting are often susceptible to manipulation by school officials and can be easily quantified. School inputs more difficult to manipulate and measure are such things as teacher attitudes towards students, teacher expectations of their students, student motivational levels toward schoolwork, peer influences on campus, and student skill acquisitions from prior schooling. Regardless of the measurement difficulties, teacher quality inputs are of considerable significant in the production function (Bowles & Levin, 1968); however, use of higher salaries to increase teacher quality available to schools may not be an effective strategy (Ballou & Podgursky, 1995).

Some studies have suggested non-school inputs account for a majority of the variance in student achievement levels (Coleman, 1966; Jencks & Brown, 1975). Inputs such as innate student abilities, parental expectations, motivational levels, temperament types, socio-economic levels, parent educational levels, race, gender, languages spoken in the home, community locations and attitudes of local communities toward education are examples of many of the exogenous influences beyond the control of school personnel in the production of student learning (Alexander & Salmon, 1995; Cohn & Geske, 1990; Okagaki & Frensch, 1998). Because proxies must be used for many of the aforementioned inputs, some researchers believe “a true education production function is not available and under present conditions cannot be known” (Alexander & Salmon, 1995, p.353).

**Outputs.** Many of the outputs used in the educational production function derived from proxies. Educational outputs can be classified as cognitive or non-cognitive. The most frequently used cognitive output proxy is student achievement
scores on standardized tests. This phenomenon has continued as expenditures for public education have continued to increase since the 1960s (Odden, 1992). Geske (1983) notes that the emphasis on the use of standardized tests as a measure of student learning outcomes has increased due to increased accountability and competency testing programs in education. Non-cognitive outputs such as self-concept, citizenship, marketability, and participation in government could be used to measures educational productivity; however, non-cognitive variables are often difficult to measure quantitatively and are seldom selected as outputs in productivity studies (Cohn & Geske, 1990; Garris & Cohn, 1996; Geske, 1983).

**Industrial vs. Educational Model**

The industrial production function's ability to establish causality between inputs and outputs differs considerably from that of the educational production function. Geske and Teddlie (1990) report that industry can systematically test the effect of a specific input by holding other inputs constant or by using experimental methodologies; however, educational inputs such as student cognition, developmental readiness, self-concept, motivation, peer influence, and family background are not amenable to manipulation. The aforementioned inputs are constructs, thus requiring the need to measure observable proxies believed to be highly correlated with a particular construct (Alexander & Salmon, 1995; Gall, Borg & Gall, 1996). For those variables that could be manipulated, the uniqueness and ethical limitations of “the school setting does not permit researchers to manipulate variables to determine the relative impact of specific inputs” (Rossmiller & Geske, 1976, p.492). The inability of researchers to manipulate variables has reduced the use of experimental methods in educational settings.
Determining the unit cost of each proxy becomes another problem when using a production function. The unit cost can not be stabilized either between or within schools, thus making efficiency comparisons across schools difficult. For example, no standardized class size has been established (with associated accounting costs) which maximizes student achievement across different schools, curricula, or students. Cohn and Rossmiller (1987) explain how no organizational structure or student-grouping technique has been established as an optimum input in the production of learning.

The economic concept of “returns to scale” purports that the targeted output will increase proportionally to increases in all inputs (Alexander & Salmon, 1995; Cohn & Geske, 1990). Under this economic concept, increased school inputs should systematically increase educational outputs, yet the product in education (student learning) is also a construct and this latent trait is poorly understood. This construct is often approximated by inferences made from student performances on standardized achievement tests. Some researchers believe no direct relationship exists between school expenditures and student achievement (Coleman et al., 1966; Hanushek, 1981, 1986, 1997; Jencks & Brown, 1975). Under this premise, applying the returns to scale concept in the educational setting would be inappropriate because causality between fiscal inputs and student learning outcomes has not been established.

Assuming influential educational resources could be identified and measured with precision, school officials could theoretically develop an incentive structure to promote schools to operate on the production frontier. Economists could determine the amount of money necessary for each student to maximize their academic productivity potential and the price for each educational input (Odden and Clune, 1999), which
would move the production of learning closer to the production frontier. Because of the number and conflicting philosophies of individuals who have discretionary control over production, Monk (1981) has questioned whether schools can ever operate on the production frontier. Hanushek (1997) noted that the organizational structures of educational bureaucracies and the lack of incentive mechanisms to promote productivity exacerbate the inefficient manner by which scarce resources are mixed to produce services amenable for consumption.

Under the industrial production function model, the cost of more expensive inputs are "substituted" for less expensive inputs without negatively impacting the product (Alexander & Salmon, 1995). Because education remains a labor-intensive industry, the substitution effects of using less expensive labor may not facilitate economic efficiency or increase academic productivity. The use of computer-assisted instruction and paraprofessional teachers to deliver educational services rather than more costly certified instructional personnel has been suggested as possible input substitutions to lower input costs (Monk, 1989; Odden, 1990; Rossmiller & Geske, 1976). These input substitutions could in theory reduce human capital costs but may not appropriately address the dynamic, non-cognitive needs of students.

Efficiency

The educational sector spends over 300 billion dollars per year; however, there exists little evidence that fiscal inputs are being used efficiently (Levin, 1989b). The concept of efficiency in education is derived from the field of economics and is used to describe the allocation of scarce resources to produce consumer goods and services. Rossmiller and Geske (1976) explain that "economic efficiency is measured by the
relationship between inputs and outputs in an enterprise” (p.486). Maximum efficiency is achieved when any change in scarce resources reduces consumer satisfaction in relationship to the product. In other words, resources are allocated at such a point that the influence on the output from the “last dollar expended would be the same for each unit of input” (Geske & Teddlie, 1990, p.192). Because of marginal diminishing returns, districts with extremely high per-pupil expenditures may actually be operating less efficiently than their “average” counterparts. The concept of marginal diminishing returns is based on the assumption of a curvilinear production function. Using this axiom, extremely high spending districts are exceeding the point by which increased fiscal inputs reflect equivalent changes on targeted outputs.

Efficiency can also be described based on the type of outputs. Geske (1983) delineates between social, production, and educational efficiency based upon the outputs being produced through the parsimonious combination of inputs. Educational efficiency is primarily defined by increases in student learning outputs, which are often measured using standardized achievement tests. Social efficiency refers to those outputs considered to be goals of society, such as becoming a productive member of the workforce. Production efficiency is used by organizations to describe how scarce resources are used to produce a given product. Geske (1983) notes that educational and social efficiency can be achieved simultaneously, but this relationship may not exist at all times.

Public schools have historically not attempted to operate on the production frontier and continue to operate less efficiently than private sector industries (Cohn & Geske, 1990; Geske & Teddlie, 1990). Under the concept of technical efficiency, all
"individuals with discretion over production [would] seek to produce the maximum possible level of output obtainable for given inputs" (Monk, 1981, p.227). One possible cause for the inefficiency found in education is in its organizational structure. Because a number of actors at the local, state and federal levels exert discretionary controls over production, efficiency is often sacrificed due to conflicting political, social and individual interests. Further, technical inefficiency is exacerbated by the discretionary controls the dependent variable (students) exerts on the production of learning.

Recent state accountability systems have established high standards for both graduation and grade promotion as one method of manipulating the discretionary control students maintain on the production of learning. These accountability strategies have required students to accept responsibility for their own learning, thus providing an incentive structure without fiscally impacting producers (schools). One equity caveat regarding this type of incentive program is that the opportunity to learn must exist for all students who are being held accountable for academic productivity (Odden, 1994).

Unlike the private sector, the incentive to increase profits by holding or reducing cost and increasing demand is missing in the public sector. The lack of profit incentives designed to maximize student learning outputs has increased the inefficiencies within schools. Some economists have suggested the low levels of student outputs in some schools "represents more the fact that teachers and school personnel are simply reacting to the incentive structure that they currently face, an incentive structure that does not emphasize student performances" (Hanushek, 1997, p.305). Odden and Clune (1999) have suggested incorporating performance incentives in state finance systems by fiscally rewarding schools for increased student academic performances. The cost for
such a program would require the establishment of an ongoing trust fund of approximately 1% of a state’s total education budget. The CCSSO (1999) reports that some performance incentives are embedded within certain state-sponsored accountability programs, but not at the levels suggested by Odden and Clune (1999).

Proposals for improving school efficiency. State finance reform regarding fiscal inputs to local school districts has focused on issues regarding equity, adequacy and efficiency. Green (1996) has suggested that the courts have not addressed issues of efficiency in public schools due “in part to the courts’ belief that they lack the expertise to judge the legislative decision and the doctrine of separation of powers” (p.95). Historically, the courts have addressed equity from a supply-side perspective using per-pupil expenditures across school districts as an indicator of the quality of educational services provided to students. Recent emphasis in school accountability systems has shifted the focus of the court from a supply-side to a demand-side perspective. Mullin (1982) notes that a Maryland court did addressed the issue of efficiency but reverted back to a supply-side perspective in its final judgment. As with numerous equity cases, the Maryland court focused on student expenditures across districts rather the correlation between spending and performance.

Performance-based accountability models have been recently developed in Maryland and several other states including Louisiana (CCSSO, 1999). These state-level accountability models have been designed to evaluate the productivity of their public school systems. In Louisiana’s school and district accountability system, the efficient use of school resources is an area of concern, especially for those schools identified as “Academically Unacceptable School.” Using two-years of data, schools
receive one of six performance labels (Academic Excellence, Academic Distinction, Academic Achievement, Academically Above Average, Academically Below Average, Academically Unacceptable) based upon the value of their School Performance Score.

A School Performance Score (SPS) is a value computed from either three or four-weighted indicators: criterion-referenced test scores (60%), norm-reference test scores (30%), attendance rates (10% or 5%) and dropout rates (5%) based upon a school’s grade configuration. The SPS is computed using two-years of data to establish a baseline necessary to calculate a Growth Target for the school. A Growth Target is the amount a school must improve by the next accountability cycle in an effort to reach the state’s 10-year goal. An accountability cycle is a two-year period by which a school improves the performances of students on either the three or four indices that comprise the SPS. Schools in Louisiana whose SPS is equal to or less than thirty are labeled as an Academically Unacceptable Schools and placed in Corrective Actions I for one accountability cycle (LDE, 1999).

The LDE developed a process for local District Assistance Teams to investigate how human and material resources are being used by low performing schools and to refocus resource allocations in an effort to increase the school’s level of academic productivity. The School Analysis Model is the LDE’s analytic process specifically developed to provide low-performing schools with information regarding how to increase productivity, while holding fiscal inputs constant. According to economic theory, efficiency will be improved when the process of mixing scarce resources is improved (inputs are held constant) and the output increases (Mankiw, 1992). This economic axiom is based on the assumption increasing efficiency is a system goal.
Prior to Louisiana’s school and district accountability system, the state began the implementation of the MFP’s Level 3 subsidy to LEAs for instructional expenditures in hopes of increasing school productivity. The mixed results of productivity studies have not established a causal relationship between instructional expenditures and academic productivity. Because causality in the aforementioned relationship has not been established, no evidence exists that the policy of using the Level 3 subsidy will positively influence levels of academic productivity. Marginal diminishing returns on human resource expenditures may reduce both productivity and efficiency levels as further expenditures are not having an equivalent influence on the output (academic productivity).

Concerns regarding efficiency and equal educational opportunity may exist concurrently if state officials developed performance-based, school funding formulas. Using an educational production function model with classroom level data (Monk, 1992, 1997), schools would be provided fiscal incentives to increase educational outputs using a per unit cost index. Murnane (1981) suggested further research on “the responses of human resources to incentives provided by institutional rules” (p.31) should be undertaken, which is supported by other researchers (Hanushek, 1997). Limitations of using an educational production function within an incentive program to increase school productivity and efficiency range from the types of data collected to resource availability.

Production Function Studies

The most publicized investigation into the relationship between school resources and student achievement was the Equality of Educational Opportunity (EEO) study.
conducted in 1966 by James Coleman and associates. This study was mandated by the Civil Rights Act of 1964 to review the distribution of educational resources by race throughout the nation. Sample data from over half a million students encompassing over 3,000 schools were used for analysis. Using a production function model, the data revealed that non-school factors, such as family background and socioeconomic factors of students, accounted for approximately 90% of the between school variance found in student achievement test scores (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld & York, 1966). School related inputs were found to contribute little to the overall between-school variance. The researchers deduced from the findings that non-school inputs accounted for a majority of the variance found in students' test scores, thus suggesting schools had little influence on student learning.

The EEO study had numerous methodological problems such as deviations from linearity assumptions and the presence of multicollinearity among inputs (Bowles & Levin, 1968). Multicollinearity amongst those input variables selected by Coleman reduced the unique variance explained by each input on the dependent variable. Regardless of methodological limitations, the overall findings of the EEO study have been supported by many other studies using the educational production model. For example, Jencks and Brown's (1975) study corroborated the Coleman's findings that suggested educational inputs had inconsistent effects on student performances on standardized tests. The researchers used a stratified sampling technique to select (n = 98) public high schools participating in Project Talent. Using a production function model similar to the one used in the EEO study, the researchers applied regression analysis with selected school inputs on standardized test performances of students. The
results found "few relationships between high-school characteristics and any measure of high-school effectiveness" (Jencks & Brown, 1975, p.273). This study found non-school factors had the greatest influence on student performances on standardized achievement tests.

Similar to the findings of the Coleman study, an empirical study of New York State's school districts (n = 1,400) found a weak relationship between per-pupil expenditures and student performances on standardized tests (Kiesling, 1967). The findings suggested students from low socioeconomic backgrounds residing in districts with high per-pupil expenditure levels performed significantly lower than their counterparts residing in low spending districts. Further, Garms (1967) provided evidence that expenditures were related to wealth and demand for education in large urban school districts across the nation. Hickrod (1967) suggested wealth disparity in urban areas had increased since the 1950s and the quality of educational services to students was contingent on the wealth of the district.

Empirical studies suggesting a positive relationship between wealth and spending were further supported by Owens' (1972) analysis of nine urban areas. Results of this study suggested that instructional expenditures "were distributed unequally and that school systems spend less on non-white and poor children than on other children in large American cities" (Owens, 1972, p.37). Non-white students in the sample attending schools in less wealthy districts received educational services subordinate to their wealthy counterparts, thus suggesting these students were a "suspect class" being discriminated against due to factors beyond their control. The findings of Dye (1967) indicated wealth measured by median household incomes could
explain over 70% of the total variance in per-pupil expenditures throughout the United States. Chambers (1978) suggested wealthier districts simply “outbid” poorer districts for higher quality teachers based on experience and verbal ability. As the market demand for quality educational services increased, wealthier districts were able to purchase services at a premium market rate often resulting in poorer districts inability to provide quality educational services to students.

Some studies not using a production function method found evidence that fiscal neutrality did not exist across state or districts boundaries. Fiscal neutrality occurs when no relationship between a district’s wealth and expenditures for educational services exists. During most equity cases, the courts have primarily investigated the relationship between per-pupil expenditures for educational services and the property wealth of local school districts. Numerous plaintiffs in equity lawsuits against state finance systems have used the argument that the wealth of a local school district should not dictate the educational opportunity of a child.

The issue of fiscal neutrality across districts within a state was first addressed in a lawsuit filed in California (Serrano, 1971) then later in Texas (Rodriguez, 1973). The judge in the Serrano case ruled fiscal neutrality must exist across all districts in California, thus requiring increased financial aid by the state to less wealthy districts. Because the federal government has limited authority with educational issues, the U.S. Supreme court determined in the Rodriguez case that cases regarding school finance are state matters and the federal government does not provide the statutory power necessary to require inter or intra-state fiscal neutrality. The Serrano and Rodriguez cases are considered “landmark cases” because they established precedence for most of the
current litigation involving state finance systems throughout the nation (Alexander & Alexander, 1992).

The issue of equity has been addressed in numerous state finance cases, even though litigation regarding the efficient use of resources by school districts has only recently come before the judiciary. Empirical evidence has existed since the late 1960s that school systems were operating in a highly inefficient manner. Kiesling (1967) found that districts with low, per-pupil expenditures appeared to exhibit higher rates of returns per dollar than those districts with high, per-pupil expenditures. This phenomenon suggested that the poorer districts were operating with greater efficiency than their high spending counterparts. Empirical evidence also suggested that scale economies, which were used to examine a cost function and utilization rate of selected inputs (Riew, 1986), were not present when relating school district size with academic productivity.

Studies by Summers and Wolfe (1977) and later by Murnane and Phillips (1981) attempted to overcome some of the methodological problems of earlier production function studies. Summers and Wolfe (1977) attempted to disaggregate data regarding individual student's innate cognitive ability and socioeconomic status, teacher quality, peer group characteristics and school quality. The rationale for this methodology was that aggregated data provided spurious results because all students do not consume school resources equally. A random sample of 103 elementary, 42 junior high and 5 high schools was extricated from the Philadelphia School District. Individual student data over a three-year period were collected to determine the increase in student achievement (dependent variable). This "value-added measure is consistent with the
usual choice in estimating production functions” (Summers & Wolfe, 1977, p.641) and also controlled for initial achievement levels. The production function model used was assumed to be curvilinear with no constraints on a single output (Cohn & Geske, 1990). The findings of the study suggested underachieving students from low socioeconomic home backgrounds were positively affected by specific school inputs. Additionally, findings suggested when data are disaggregated; the positive impact of school inputs on student learning is revealed.

These findings were partially supported in a study investigating the classroom behaviors and background characteristics of teachers (Murnane & Phillips, 1981). The four production function models used in the study assumed linearity with no constraints on a single output. The researchers tested four hypotheses on a sample of elementary students and found evidence suggesting teacher characteristics and their classroom behaviors accounted for significant variations in student achievement across grade levels. Wendling and Cohen (1981) also found in their study that teacher quality was positively related to student performances on standardized achievement tests.

Limitations of the Murnane and Phillips study (1981) were based on the presence of multicollinearity in their multivariate model and high levels of measurement error because of the small sample size. The presence of multicollinearity amongst the inputs of a regression model reduces the unique variance being explained by the inputs on the dependent variable. The multicollinearity among inputs, as was the case in the Coleman study, significantly reduced the amount of unique variance explained by subsequent inputs. Along with the issue of multicollinearity, other methodological limitations of the study contributed to the “lack of consistent
relationships across all four grade levels, between any individual teacher behaviors, and student achievement" (Murnane & Phillips, 1981, p.92).

The findings of the Murnane and Phillip study (1981) were partially supported by Thompson and Correa's (1989) investigation of selected teacher characteristics (master’s degree and verbal fluency) and levels of academic productivity from a sample of third grade students. Their sample was drawn from students attending Catholic schools in Hawaii using an ex post facto, four-way analysis of variance (ANOVA) design. The four-way ANOVA was used to investigate the influence of school and student characteristics on academic performances in reading and mathematics. Six stepwise regression analyses were also used to determine the amount of variance accounted for by teacher, school and student inputs on a single dependent variable (reading or mathematical achievement test scores).

The results of their findings continued to support previous research, which suggested teacher and school inputs accounted for only 7% of the total variance in student achievement scores. This study did not report any limitation; however, the purposeful sampling procedure reported by the authors is a sampling technique often associated with qualitative methods. Patton (1990) described this sampling technique as one based on “the selecting [of] information-rich cases for study in depth” (p.169). Because of limitations in their sampling technique, the use of inferential statistics with the selected variables reduced the generalizability of their findings.

Fowler and Walberg (1991) investigated the influence of school size on multiple school outputs from a sample (n = 239) of secondary schools. Multiple backward, stepwise regression equations were used with 18 independent variables and 23
dependent variables to retain those inputs that significantly \((p < .05)\) contributed to the overall variance. Their findings suggested a "consistent relationship between schooling outcomes and per-pupil expenditures, teacher salaries, teacher degree status, and teacher experience" (Fowler & Walberg, 1991, p.200) did not exist. The school size input was the only system control input associated with student performances on standardized achievement tests. School size was negatively associated with six of the dependent variables, although Baum (1986) found no relationship between test scores and district size. A positive relationship was found to exist among district expenditures, the conditions at a school, and standardized test scores; however, non-school influences had the strongest association with the dependent variables.

In the Fowler and Walberg (1991) study, exploratory analysis was conducted to address the possibility that a curvilinear relationship among variables may exist. The findings suggested the predictive power of their linear model did not improve when the curvilinear model was used. Limitations of this study were not provided by the researchers, even though the use of aggregated, district level expenditure data with production function models can often obfuscate the unique variance within and between schools (Summers & Wolf, 1977). Some researchers (Raudenbush & Bryk, 1986) have also questioned the appropriateness of using multilevel, hierarchical data with traditional inferential statistics, similar to those used in this study.

Recent empirical studies have provided evidence that once expenditure data are disaggregated to the school, a positive relationship exists between certain expenditures and student achievement. Ferguson (1992) used a statewide sample from Texas and found a positive relationship between teacher quality and student achievement. The
findings from this study suggested expenditure variables accounted for approximately one-third of the variance in student achievement scores. Other non-fiscal, inputs such as teacher performances on Texas’ recertification examination, years of teaching experience, and level of formal education were positively associated with test performances of students.

The findings in Texas by the Ferguson (1992) study were supported by Harter’s (1999) comprehensive review of (n = 2,800) elementary schools throughout Texas. The study disaggregated fiscal data at the school level using a cross-sectional design. The researcher applied regression analytic methods to control for exogenous influences, such as academic potential and socioeconomic factors.

The study found “a significant and positive relationship between spending for teachers’ career ladder supplement and achievement in both math and reading” (Harter, 1999, p.293). Instructional salaries were not positively related to academic performances, but expenditures for substitute teacher salaries were negatively associated with student test results. This finding indicates the amount of time a teacher spends in class, rather than the amount of money received through direct salary, has positive effect on student performances.

Literature Reviews

Glasman and Biniaminov (1981) summarized the empirical findings of studies (n = 33) conducted after 1959 in one of the first comprehensive literature reviews. Their literature review was focused on school productivity research investigating the relationship between educational resources and their associated school related outputs. A majority of the reviewed studies used cognitive outputs measured by norm-referenced
standardized tests. Inputs were classified into two major groups: student-level or school-level. Of the student inputs, all studies included some measure of student socioeconomic background. Most of the studies (n = 25) used regression analysis to determine the influence of the inputs on the selected output. The authors organized their review based upon how samples were selected and the representativeness of those samples to the target population. Aggregated data obtained from mixed levels of data from state, district, school, and students limited the findings from at least half of the early productivity studies reviewed. Similar to the caveats posited later by Raudenbush and Bryk (1986), studies using “mixed data aggregation levels should be treated with caution because the effect of any input may be underestimated” (Glasman & Biniaminov, 1981, p.532).

A majority of the studies reviewed by Glasman and Biniaminov (1981) used regression analytic techniques, such as (a) ordinary least squares, (b) two-stage least squares, (c) stepwise multiple regression, (d) variance partitioning, or (e) commonality analysis to interpret their data. Only one study utilized path analysis, which was used to establish evidence of causal links between variables. The authors concluded their literature review with a proposed structural model. This model illustrated hypothetical relationships between inputs and outputs.

Hanushek (1981) conducted a literature review (n=130) to examine the relationship between school expenditures and student performance. Similar to Glasman & Biniaminov (1981), a majority of the studies measured student performance on standardized tests as a proxy for cognitive ability. Hanushek (1981) summarized the findings concerning student test performances and stated (a) student performances were
widely distributed, (b) non-school factors heavily influenced student test performances, (c) teacher performance characteristics were widely distributed and complex, and (d) per-pupil expenditures were not associated with student test performances. This last statement has caused considerable debate in the research community because higher per-pupil expenditures were believed to be associated with greater resources, subsequently increasing student learning.

Hanushek's (1986) literature review, which included 17 more studies, resulted in findings similar to those previously reported. Schools appeared to spend fiscal resources on inputs that were not directly associated with student achievement and subsequently operated inefficiently. One hypothesis for the high level of inefficiency found in public education posits a lack of understanding by school officials concerning the production function and a lack of incentive to operate schools on the production frontier (Hanushek, 1997).

A number of researchers have questioned the vote counting method Hanushek (1981, 1986) used in his analysis (Baker, 1991; Hedges, Laine, & Greenwald, 1994). Vote counting is a method of analyzing empirical studies based on the sign of the coefficient and the level of statistical significance. This procedure is susceptible to Type II errors (accepting the null hypothesis when it should have been rejected) and cannot identify the magnitude or direction of relationships. Baker (1991) suggested the results of Hanushek's (1981, 1986) vote counting analysis underestimated the relationship between per-pupil expenditures and student achievement.

Using meta-analysis, Hedges, Laine and Greenwald (1994) determined “systematic positive relations [exist] between resource inputs and school outcomes”
(p.5) and that the regression coefficients were large enough to be of concern for educational researchers. A meta-analytical method allows researchers to review the results of numerous empirical studies (secondary sources) and to convert the findings of these studies into an effect-size statistic. This statistic provides information concerning the magnitude of each study (Best & Kahn, 1993; Gall, Borg, & Gall, 1996). Factors limiting the use of effect-size statistics are based on (a) the age of the data, (b) the social and economic measures utilized to control for non-school factors, and (c) the use of cross-sectional designs. These limitations appear to have reduced the validity of Hanushek's conclusion that no systematic relationship exists between per-pupil expenditures and student achievement (Greenwald, Hedges, & Laine, 1994).

MacPhail-Wilcox and King (1986) reviewed many of the studies previously discussed in the literature reviews conducted by both Glasman & Biniaminov (1981) and Hanushek (1981, 1986). These researchers reviewed and subdivided the productivity studies into categories based upon teacher characteristics, district policies, administrative arrangements, fiscal characteristics, and the condition of facilities. The authors found teacher verbal achievement, experience, and salary significantly influenced student achievement. The social and economic backgrounds of teachers were found to be associated with student test performances. One rationale presented for this phenomenon was that "education units may be more likely to employ teachers with socioeconomic backgrounds most like their own" (MacPhail-Wilcox & King, 1986, p.207).

Elements of the instructional organization (classified in this study as policy and administrative arrangements), such as median class size and teacher-pupil ratios were
found to be significant. When compared to their white counterparts, the authors noted that ability grouping and student peer groups negatively influenced black students. Additionally, reduced class size and increased teacher-student verbal interactions during instructional periods positively influenced disadvantaged students. The relationship between facilities and per-pupil expenditures provided mixed results, which may indicate a more indirect influence on student achievement. Similar to findings by earlier researchers (Coleman, 1966; Jencks & Brown, 1975), the authors concluded that "characteristics of students themselves--and of their parents, communities, peers, and so on--may contribute more to the learning process than any purchased resource" (MacPhail-Wilcox & King, 1986, p. 220).

Limitations

Research on school productivity has relied primarily on ex post facto research designs using correlational, causal-comparative, or case study methods rather than experimentation. This phenomenon exists primarily because of the ethical and judicial limitations placed upon research conducted in school settings. The empirical studies outlined in the literature reviews selected in this section suggests the relationship between fiscal inputs and academic productivity has had mixed results. Fiscal inputs have been frequently aggregated at the district-level although numerous costs not directly associated with the production of educational services have been taken into consideration during analysis.

Methodological problems associated with using a production model in educational settings results from the inability of researchers to obtain discrete, observable inputs rather than having to rely on proxies. As a result, quantifiable units
of educational resources cannot readily be obtained to establish those levels needed to affect school productivity. The use of proxies to measure latent variables (Alexander & Solomon, 1995), the influence of non-school factors, and the discretionary control of students in the production of learning have reduced the utility of the production function model in educational settings. Other commonly identified limitations associated with productivity studies include: (a) replication of the findings, (b) size and selection of the sample, and (c) multi-level units used during the analysis (Cohn & Rossmiller, 1987; Geske & Teddlie, 1990; Hanushek, 1997; Ralph & Fennessey, 1983).

Cohn and Rossmiller (1987) reported statistical shortcomings of the educational production function were based upon (a) the instability of regression coefficients, (b) the inability to establish causality with significant coefficients, and (c) the increased statistical bias incumbent of a single output research designs. These statistical shortcomings have reduced the explanatory power of empirical studies using a production function model with district-level data. Bowles and Levin (1968) addressed the limitations of the Coleman study resulting from multicollinearity among inputs used in the study. Multicollinearity among inputs in an educational production function reduces the unique variance accounted for by subsequent inputs into the equation (Spencer & Wiley, 1981).

Inputs

Public schools are similar to many other social programs funded through a mixture of federal, state, and local revenues because they address social wants. Social wants are generally defined as those goods and services to which the exclusionary principle cannot be applied (Musgrave & Musgrave, 1989). As a result, some
individuals who do not directly contribute to the revenues collected for the purchase of a particular good or service are still able to enjoy its consumption. Some individuals who enjoy the consumption of educational services have not contributed to the costs for these services because the exclusionary principle does not operate in public education. Each state in the nation must provide educational services to its citizens regardless of their contribution to the revenues needed to provide the public service.

In Louisiana, a majority of the revenues for public education are produced through the taxation of goods and personal income. Unlike most states, Louisiana does not use the taxation of property as the primary mechanism for generating revenues to pay for educational costs. As outlined in The Constitution of Louisiana of 1974, any homestead whose assessed property value is less than $75,000 is exempted from property taxation. Because most residential property values in the state qualify for the homestead exemption, the state must generate revenues using other mechanism of taxation.

The difficulties associated with generating revenues through the taxation of goods and personal income have been illustrated in Louisiana’s low per-pupil expenditures for education. Recent efforts by the governor and state superintendent of education have increased the expenditures for K-12 education from $1.9 billion in AY 1997 to $2.2 billion in AY 1999 (Picard, 1997, 1999). These expenditure increases have paralleled those across the country; however, the academic performances of students in Louisiana have remained behind the nation (NCES, 1998a).

Per-pupil expenditures throughout the nation have increased approximately 67% from 1967 to 1991 (Rothstein & Miles, 1996), yet some estimates have suggested
educational expenditures have increased 205% since 1960 (Levin, 1989b). In light of the significant increases in expenditures for educational services, academic performances of American students on international achievement tests have lagged behind several industrialized nations (NCES, November 1996). Experts have suggested the increased expenditures have not been significant enough to reach the "threshold" necessary for significant increases in academic productivity to occur, yet many researchers agree with Hanushek (1997) and Monk (1989) that schools have used these increased fiscal inputs in an inefficient manner.

Historically, administrators have lacked those incentives needed to move schools closer to the production frontier. In Louisiana, as in other states, a school and district accountability system based upon rewards and consequences for academic productivity has provided a rudimentary incentive mechanism to increase the student learning throughout the state. Accountability systems in Texas and Maryland have increased the academic productivity of numerous schools; however, how efficiently educational resources are being utilized to produce student learning is still unclear.

Most educational economists agree public schools will never operate as efficiently as their private market counterparts. System controls (Rossmiller & Geske, 1977), lack of econometric training for administrators (Hanushek, 1997), and educational wastage (Loxely, 1987) are causes for inefficiencies found in public education. The reliance on human capital to produce educational services rather than less costly technologies continues to prevent schools from operating closer to the production frontier, assuming its existence (Monk, 1989). The labor intensive nature of educating children results in an overall labor cost impact ranging anywhere from 60%
to 90% of an entire school’s budget (Geske, 1979; Picus & Fazal, 1995), thus limiting other inputs amenable to manipulation by administrators.

Scale economies for reduced teacher-pupil ratios has increased the costs to districts, although research has provided limited support that this policy has a positive impact on student learning (Bloom, 1983; Odden, 1990). Reductions in teacher-pupil ratios, combined with an increase in expenditures for instructional salaries because of greater experience and more advanced credentials held by instructional personnel, (Rothstein & Miles, 1996) have significantly increased the costs for educational services. Calculating the unit costs for education (COE) has become a more arduous task due to differences in the cost of living in particular geographic areas between and within states. McMahon (1994) used a cost of living indicator as a method of “exploring equity in expenditures per-pupil” (p.19). Regardless of how COE are calculated, increased costs for more qualified, experienced instructional personnel and lower teacher-pupil ratios will burden less affluent districts. Wealthier districts with a greater tax base will simply increase taxation necessary to generate revenues needed to pay for increased educational costs, as was the case in Pennsylvania (Hartman, 1994).

Supply-Side Subsidies

In theory, state educational finance systems could use supply-side subsidies to correct for the underallocation of fiscal resources required to purchase high quality instructional labor in less affluent districts. By providing revenues to producers in this manner, state officials would be attempting to shift the supply curve downward. This action would move the consumers’ demand for educational services to an “optimum” level, thereby increasing demand without increasing costs to producers.
In Louisiana, state officials have utilized this type of intervention through the MFP, Level 3 funding. The demand on LEAs for instructional labor needed to produce high quality educational services for student consumption is partially achieved by shifting some of those costs to the state. This shift of costs subsequently moves the supply curve downward and allows for local revenues to be directed to other expenditure areas. Simply, the LEAs receive the benefit of higher paid teachers without having to incur the expense because state government subsidizes those costs through Level 3 funding.

Pennsylvania’s educational finance formula utilized a supply-side subsidy for several low-wealth districts; however, the formula failed to significantly reduce the per-pupil expenditure variations across the state. The failed policy in Pennsylvania appears to have little influence in Louisiana’s decision to utilize the Level 3 subsidy. Current policy to reduced expenditure inequalities and promote academic productivity in the state’s public schools includes the use of fiscal inputs in the form of a supply-side subsidy.

**Exogenous/Endogenous Influences**

Non-school factors have been found to account for a majority of the variance found among student performances on standardized achievement tests (Coleman, 1966; Jencks & Brown, 1975; Klitgaard & Hall, 1975; Okagaki & Frensch, 1998; Stringfield & Teddlie, 1988; Vincenzi & Ayrer, 1985). Most non-school factors cannot be the manipulated by educators but have a significant influence on students’ ability to be successful in school. As outlined in the antecedent with mediated effects model (Bossert et al., 1982), external characteristics of students, such as SES, affects the
mediating variables (school climate and instructional organization) and student achievement. Principals' leadership behaviors have been established as indirectly associated with student achievement; however, principals directly influence the aforementioned mediating variables.

A positive school climate has been associated with increased levels of student achievement and decreased levels of academic futility (Brookover et al., 1978). Organizational modification in the allocation of fiscal and human resources based on time, class size, and student characteristics have been associated with improved student achievement (Goodlad, 1984; Fowler & Walberg, 1991; MacPhail-Wilcox & King, 1986; Murnane, 1981). The basic logic behind modifying resource allocations is to increase output by increasing the efficiency of the production process, while holding expenditures constant. From a cost-benefit perspective, increased levels of student achievement (basic skill mastery) will provide both monetary and non-monetary benefits to both the individual and society.

Organizational characteristics such as school size and the principal's leadership behaviors are important influences on the academic productivity of schools. Increased school size was developed under the movement to increase school efficiency by concentrating on increased scale economies (Fowler & Walberg, 1991; Verstegen, 1990; Thompson, 1994). Although scale economies are increased through centralization, larger schools may not be beneficial to low SES students and may be more difficult for principals to operate.

Principals in larger schools spend approximately 80% of their day on management duties unrelated to instruction (Mann, 1989). For urban principals with
high levels of at-risk students, the instructional organization (school size and location) is often used as a rationale for low levels of student achievement. Reyes and Capper (1991) investigated the leadership behaviors of urban principals toward at-risk students on their campuses. Using a modified version of the antecedent model (Bossert et al., 1982) as their theoretical framework, the study showed a paucity of school intervention programs designed to address cultural sensitivity and diversity on their campuses. None of the principals in the sample reported that they believed school size contributed to students leaving school or that their leadership behaviors influenced student achievement. These findings provide support for Cuban's (1989) comments that reform efforts have not reached urban schools.

The relationship between school size and student achievement in California was investigated in a study conducted by Felter (1989). After controlling for SES, it was found that higher student achievement was directly associated with lower dropout rates and student achievement was inversely associated with school size. As noted by Levin (1989a) and Hergert (1991), academic failure is one major school related variable influencing a student's decision to prematurely leave school. These findings were collaborated by Fowler and Walberg (1991) in a study investigating school size and academic achievement. Based on New Jersey's Minimum Basic Skills Test (MBS) and the High School Proficiency Test (HSPT) results, school size was significantly associated with lower test results. The findings from these studies suggest increased school sizes have negative effects on academic productivity.

Organizational characteristics such as classroom size and teachers' instructional behaviors are important influences on the at-risk student. Similar to the scale economies
rationale used to justify increased school size, increased numbers of students per classroom provides more efficient use of scarce resources. Cost-effectiveness research in support of class size reduction positively affecting student performances is limited to extremes. Conversely, Sizer (1984) has suggested high schools can reduce the number of students per teacher without increasing per-pupil expenditures by manipulating the organizational structure of schools.

Odden (1990) reports that research "on class size and student achievement primarily supports individual or very small group tutoring at the elementary level" (p.217). Research on the effects of class size reduction has not provided findings establishing a causal association with student learning outcomes at the secondary level (Hanushek, 1981, 1986, 1997; Witte & Walsh, 1990). Reduced class size may have questionable association with student achievement; however, it may have a positive impact on teachers' attitudes and behaviors. Odden (1990) reports that teachers in smaller classes exhibit increased (a) questioning behaviors, (b) individualization of instruction, (c) interaction with students, and (d) management of student behaviors. This research suggests a systemic association between reduced class size and teachers' behaviors and attitudes towards students, which may indirectly impacting the quality of educational services being available for consumption.

Teacher behaviors within the classroom may vary based on the composition of the students in the classroom, regardless of class size. Research has suggested interschool classroom differences in time allocation, instructional methods, and curriculum content were associated with the teacher's perception of their students' academic ability (Goodlad, 1984). Murnane (1981) reports that research has shown a "systematic
relationship between time use and student learning” (p.25). With this relationship understood, teacher behaviors in selecting instructional methods, associated curricula modifications, and the utilization of class time were different for at-risk students. Additionally, the time students were actively engaged in learning activities was lower for the remedial classrooms than in classrooms for advanced coursework. Preliminary findings from the School Analysis Model pilot program suggest the expectations of students and parents differ significantly than those held by faculty members. Using a comparative case study method (Tashakkori & Teddlie, 1998) of the pilot school, student expectations were more dependent on the socioeconomic characteristics of the students, rather than class size.

Outputs

One measurement of a school’s effectiveness in turning fiscal and human resources into student outputs is the level of academic achievement obtained by the student. Most productivity and school effectiveness studies have used standardized achievement tests as proxies for cognition of the curricula. Following this research trend, this study also selected an achievement test to measure student learning.

Traditionally measured using standardized assessment batteries, academic mastery of basic skills is believed to provide the individual student with the opportunity to be competitive in the job market and/or seek post-secondary education. Standardized tests scores used as proxies for cognitive development have been criticized because most tests assess “knowledge of discrete facts” (Taylor & Teddlie, 1992, p.19), rather than higher level cognitive skills outlined by Bloom (1964). The use of standardized achievement tests to measure student learning, indicative to the framework of
Louisiana's School and District Accountability Program, may continue a pedagogy focused on the mastery of discrete facts (Marcoulides & Heck, 1994; Taylor & Teddlie, 1992) rather than more complex, higher-order thinking skills.

**Externalities**

Empirical evidence exists that externalities are being created from differentiated levels of academic productivity. Externalities are those unintentional spillover benefits or costs associated with the production of a good or service. Academic productivity, school completion and life-long earnings are positively correlated. Individuals who leave school have significantly lower lifetime incomes. Levin (1989a) used a cost-benefit analysis methodology and determined that life-long earnings of dropouts were approximately 25% less than their counterparts who complete twelve years of school. He estimated costs to society in the form of increased levels of social services and decreased revenues from taxation are in the billions of dollars. This study provides some evidence regarding the influence of student retention rates in producing a spillover cost to the local communities in the form of higher costs for public assistance programs.

In a recent study, Miller (1998) found that academic performance, as reported by earned grades in high school, was significantly related long-term earnings. Using a cohort from the High Schools and Beyond (HSB) data, the grades students earned in school were significantly correlated to earnings nine years after graduation. Conversely, dropout earnings were significantly associated with lower lifetime earnings (p<.01) for both men and women, which supported previous research associating earning with years of education. From this perspective, students dropping out of school prior to graduation are incurring an individual spillover cost in the form of lower lifetime earnings.
Beyond measuring the pecuniary differences between school completers and dropouts, there are numerous non-monetary benefits associated with the consumption of educational services at high levels. Cohn and Geske (1990) note the non-monetary benefits to the individual's who consume education services can be reflected in the quality of life and a perception of an internal, rather than an external, locus of control. This locus of control can be characterized through the benefits education consumption bestows on the person to include (a) greater choice of occupations, (b) increased productivity in non-market activities, (c) reduced health problems, (d) reduced work disability, (e) increased life-span, and (e) increased social mobility (Cohn & Geske, 1990; Wehlage, 1991).

Summary

This chapter provided a comprehensive review of the literature associated with issues related to the research question in this study. The production function was originally developed by economists to measure the amount of land, labor, and capital necessary to maximize productivity. Educational researchers using the production function model have attempted to investigate those specific inputs that are associated with high levels of academic productivity. Regardless of numerous limitations, early productivity studies revealed how non-school factors have a significant influence on the production of learning.

The influence of fiscal inputs to improve academic productivity has been supported by several studies; however, an numerous studies have provided empirical evidence that increased expenditures for educational services does not ensure increased productivity. Hanushek (1981, 1997) has suggested to systematic relationship between
per-pupil expenditures and the performance of students on standardized tests. Hedges, Laine, and Greenwald (1994) have challenged Hanushek's position by purporting a positive relationship exists between per-pupil expenditures for educational services and student test performances. Regardless of the debate, researchers and economists agree schools are operating inefficiently (Monk, 1981) as "the goal of efficiency has played third fiddle to the dually prominent goals of equity and adequacy" (Dunn, 1999, p.102).
CHAPTER 3

METHOD

Educational researchers, using an educational production function model, have investigated the relationship between educational resources and academic productivity for the past 40 years. Academic productivity has primarily been measured by student performances on standardized tests acting as a proxy for cognitive development. Unfortunately, findings from production function studies have been unable to establish a causal model to guide further research (Monk, 1997). Frustrated by the mixed results of research attempts to locate a systematic relationship between school resources and academic productivity, some researchers have deduced that fiscal expenditures have had an inconsequential effect on student learning (Fowler & Walberg, 1991; Hanushek, 1981, 1986, 1987). Hanushek (1997) has purported that the failure to establish a relationship between expenditures and student learning may be a result of the technical inefficiency of schools exacerbated by the lack of profit incentive structures of the market.

Early researchers (Cubberley, 1905; Elliot, 1905; Strayer, 1905; Wise, 1968) have advocated adequate and equitable financial support for public schools, yet little empirical evidence exists showing that schools are attempting to operate on the production frontier. For example, high dropout rates by minority children and stagnated performances by all groups of students on standardized achievement tests might suggest that school productivity levels cannot be increased simply by increasing educational expenditures. Recent empirical studies by Cooper et al. (1994), Fortune and O’Neil (1994) and MacPhail-Wilcox and King (1986) have provided evidence that those
expenditures directly allocated for instructional services are positively associated with increased levels of academic productivity. Laine, Greenwald and Hedges (1994) buttressed these findings by completing a meta-analysis of 60 early production studies reported by Hanushek (1986) and found a significant and positive relationship between expenditures and academic productivity. Although these findings may appear sanguine to educational policy makers seeking a causal, educational production function, the limited focus on only a short-term, cognitive output (student achievement test scores) has ignored other important outputs of the schooling process (Verstegen & King, 1998).

School retention rates have received national attention as evident in state-sponsored programs designed to increase this non-cognitive school output. Felter (1989) has suggested that higher academic productivity is positively associated with higher levels of student retention. This finding provides support for the axiom that students will exit school if they are unable to meet the academic rigors of high school. Research has suggested that high school dropouts are less successful in the labor market (Catterall, 1987; Levin, 1972) and have lower wages over time (Blakemore & Low, 1984; Stern, Paik, Catterall & Nakata, 1989). These findings suggest that increased levels of academic productivity may provide both private and social spillover benefits. Spillover benefits to the individual may be in the form of higher wages and greater competitiveness in labor markets. Spillover benefits to the public may be expressed in monetary terms by reduced demand for public assistance programs.

Research has investigated the influence of human resource expenditures for instructional salaries on levels of academic productivity; however, little information exists as to how the use of the Level 3 subsidy would influence the aforementioned
relationship. Typically, governmental agencies use supply-side subsidies to correct for the underallocation of resources by providing revenues to producers in an attempt to shift the supply curve downward. For example, in higher education, the federal government "subsidizes" student loans in an effort to move the consumers' demand for educational services to an "optimum" level. One externality created from this federal subsidy is a nationally educated labor market able to successfully compete in a global economy (Reich, 1992).

The policy of using a state-sponsored, Level 3-type subsidy allocated to human resource expenditures for K-12 instructional salaries has not been investigated. This study will use selected components of the Educational Productivity Process under School Conditions outlined by Rossmiller and Geske (1977) as a framework to organize data for use with an educational production function. The use of an educational production function model allows for the influence of selected inputs on a targeted output to be analyzed while controlling for exogenous influences. Once the variance accounted for by exogenous influences has been controlled, the effect of the treatment input on the dependent variable can be ascertained.

Sampling Procedures

The State of Louisiana has 64 parish school districts and two city-school districts. School districts' geographic boundaries exist coterminously with those of the 64 parishes. In the state, the organizational structure of public schools and the basic educational rights of its citizenry are outlined in Chapter 7 of the Constitution of the State of Louisiana of 1974. According to the Preamble, the goal of the public education system is to provide services at all stages of life necessary to develop the potential of
each individual. This state educational goal is partially accomplished through the activities of over 1,500 public schools having a yearly adjusted student membership of approximately 760,000 students (LDE, May 1998) since AY 95-96.

Study Population

Within the 66 parish/city school districts in Louisiana, 348 public schools had a grade configuration designed to provide direct educational services for 10th grade students (LDE, 1997) during AY 95-96. Data revealed that the target population of secondary schools had a net increase of three schools by October 1 of AY 97-98 (LDE, 1999). Gall, Borg, and Gall (1996) have defined a target population as the “larger group of individuals to whom the research findings are generalized” (p. 474). Data analysis was conducted at the school-level, which required student-level data to be aggregate to the unit of analysis.

Student-level data was solicited from all schools comprising the target population. Using student-level data, the sample and target population of test-takers were approximately equal as summarized by Table 1. According to Gravetter and Wallnau (1996), the “law of large numbers states that the larger the sample size (n), the more probable it is that the sample mean will approximate the population mean” (p. 207). Because of research design, only 313 secondary schools from the target population could be included for analysis, yet student-level data suggested only 2% of all test-takers were excluded.

The sample of schools used in this study did not include information from 660 students during AY 95-96 and 1,539 students during AY 97-98. The exclusion of these test-takers was based on the knowledge that they were receiving educational services.
from either private schools or unique programs operating beyond the jurisdictional controls of LEAs. The increase in test-takers in the sample was comparable to that of the target population. The lack of change in the number of schools in the sample reflected the constraints of the research design. The following table provides a comparative summary of the preliminary sample size and the target population using student-level and school-level data.

Table 1

Sample Size versus Target Population

<table>
<thead>
<tr>
<th></th>
<th>Students</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample (AY 95-96)</td>
<td>54,548</td>
<td>313</td>
</tr>
<tr>
<td>Sample (AY 97-98)</td>
<td>56,154</td>
<td>313</td>
</tr>
<tr>
<td>Net Sample Change</td>
<td>+ 1,606</td>
<td>0</td>
</tr>
<tr>
<td>Population (AY 95-96)</td>
<td>55,208</td>
<td>348</td>
</tr>
<tr>
<td>Population (AY 97-98)</td>
<td>57,693</td>
<td>351</td>
</tr>
<tr>
<td>Net Population Change</td>
<td>+ 2,485</td>
<td>+ 3</td>
</tr>
</tbody>
</table>

In order to establish a baseline of schools for cross-year comparison, data from 35 schools during AY 95-96 were excluded because the schools provided educational services to specific subpopulations such as “alternative” students. These schools serviced less than 2% of all secondary students in the targeted population. The rationale for exclusion was based on the dissimilarity in the student body and instructional organization of alternative/non-standard schools. In general, these schools are specifically designed to address a unique subpopulation of students, exhibit high levels
of student mobility, and disproportional per-pupil expenditures. Louisiana School for
the Deaf, Special School District #1 and the Florida Parishes Juvenile Detention Center
are examples of schools excluded from this study’s sample.

Selected Exogenous Inputs

The EPPSC provides a comprehensive framework for research focused on
current problems associated with the utilization of scarce resources in the
production of educational goods and services, which can be used to measure academic
productivity. Because of the limitations of the researcher and the nature of the research
question, this study utilized only a portion of the EPPSC framework. As Rossmiller
(1982) states, “The model follows the various resources which are provided to the
formal educational system from the community in which it is embedded through the
process which occurs within the school to the outcomes of schooling” (p.87).

Data obtained from the LDE were used to calculate those inputs related to the
economic, social and demographic characteristics of students at each school in the
sample. Research has provided strong empirical evidence that home and community
background significantly influence student performances on standardized achievement
tests (Coleman et al., 1966; Fowler & Walberg, 1991; Jencks & Brown, 1975; MacPail-
Wilcox & King, 1986). The social and demographic inputs into the schooling process
provided some insight into those social contexts impacting the academic productivity of
schools. Demographic information about the type of communities in which schools are
embedded and students “grow-up” in was based on data from the National Center for
Education Statistics, which examines population density and other census-type data.
Social information regarding the presence of minority students was calculated from the
percentage of non-Caucasian students in the 10th grade. Prior to taking the Graduation Exit Examination (GEE), students provide data regarding their ethnicity on the testing protocol. In addition to ethnicity, students who had previous exposure (retesters) to the GEE were controlled for statistically because they had been “socialized” to the test.

Beyond the social and demographic influences on schools, economic factors of the community (wealth) impact schools. Economic proxies are used to measure the impact of poverty on schools. Poverty ratios for a school can be estimated using the number of students eligible to receive either free or reduced lunch services. The data in this study used to calculate the percentage of children in poverty was determined using free/reduced lunch information.

**Economic Input**

The economic input for each school was based on self-reported household incomes used to determine a student’s eligibility to receive either free or reduced lunch/breakfast at school. Similar to the Aid to Families with Dependent Children (AFDC) variable used by Felter (1989), information regarding household incomes versus the number of minors in the domicile provides an economic indicator of household wealth. By using a household income proxy, the percent of students at each school in the sample whom come from impoverished households can be estimated. Students from low-income families have been negatively associated with measures of academic productivity (Fowler & Walberg, 1991).

**% Poverty.** Data for this variable were obtained from the LDE’s Student Information System (SIS) database and were reported at the ratio level. Poverty was inferred from the percent of students at a school who are eligible to receive either free
or reduced lunch services. As a requirement to receive this service, household incomes and number of minors in the domicile are reported on the application.

Social and Demographic Inputs

Data aggregated by the Louisiana Department of Education were used to explore input proxies associated with the social and demographic characteristics of the secondary schools in the sample. The final selection of social and demographic inputs used for the study were partially based on the guidelines outlined by Kennedy and Crone (1998) that suggested several inputs are highly correlated to each other and to the performance of students on standardized achievement tests. The social and demographic inputs for this study were (a) the percentage of minorities, (b) the percentage of retesters, and (c) community type surrounding each school in the sample.

% Minority. Data for this variable were obtained from the LDE’s Division of Student Standards and Assessment and were reported at the ratio level. All ethnicity information was based upon the self-reported data from the GEE protocol. Persons in the category of “white” were individuals who reported their primary ethnic category as “Caucasian”. All other persons were collapsed into a second category of “minority”, which was primarily comprised of individuals who reported their primary ethnic category as “African American”, “Native American”, “Hispanic” or “Asian/Pacific Islanders”. The percentage of minority test-takers was computed by dividing the second ethnicity category by the total number of test-takers.

% Retesters. Data for this variable were obtained from the LDE’s Division of Student Standards and Assessment and were reported at the ratio level. A “retester” is an individual who has had previous experience or “socialization” with the testing
materials of the GEE. The socialization bias assumes students who have been exposed
to testing materials will perform differently than those individuals having no exposure.

% Exceptional students. Data for this variable were obtained from the LDE’s
LANSER database and were reported at the ratio level. The percentage of exceptional
students at each school was calculated by dividing the aggregate exceptional student
membership by the adjusted student membership. Exceptional students were
operationally defined as those individuals protected under the provisions of the
Individuals with Disabilities Education Act and have been identified under the
guidelines set in the LDE’s Bulletin 1508. A student classified as “exceptional” had a
current Individual Education Plan that outlined the educational services and setting
most appropriate to meet the needs of the handicapped student (Alexander &
Alexander, 1992). Students identified as “gifted and talented” and those individuals
receiving instructional and proximal modification under the guidelines of Section 504
of the Vocational Rehabilitation Act of 1973 were excluded. This variable was
excluded from the factor solution because no positive correlation coefficients with any
other exogenous variables were evident in the data. Subsequently, this variable was
extricated from the production function because no relationship with the dependent
variable could be ascertained from the data.

Community type. Data for this variable were obtained from the LDE’s Student
Information System (SIS) database and were reported at the ordinal level. Each school
in the sample was allocated a school locale code based on the population density and
geographic location. The Louisiana Department of Education’s Division of Planning,
Analysis, and Information Management has arranged its database similar to the
guidelines established by the NCES, which uses seven classification schemes to
differentiate school locale types. The school locale types used by the NCES (1996) are
(a) large central city, (b) mid-size central city, (c) urban fringe of a large city, (d) urban
fringe of a mid-size city, (e) large town, (f) small town, and (g) rural.

Selected System Control and Process Inputs

The EPPSC provided a framework for this study to focus on the use of the Level
3 subsidy allocated to human resource expenditures for instructional salaries and to
view such a subsidy as a system control factor. Instructional salaries can be considered
fiscal inputs into the process of student learning under the axiom that those personnel
requiring salaries commensurate with the supply and demand of the market provide
quality instructional services available for consumption by students. Research has
suggested this input is associated with differentiated levels of academic productivity
(Cooper et al., 1994). This empirical study suggests levels of instructional salaries,
inclusive of the Level 3 subsidy are positively associated with differentiated levels of
academic productivity in Louisiana’s secondary schools, ceteris paribus.

Academic productivity is classified by the EPPSC as a short-term, cognitive
output of the schooling process and is the primary focus of the selected input
(instruction salaries). Rossmiller and Geske (1977) specifically define short-term,
cognitive outputs as those attempting to ascertain the “possession of basic knowledge”
(p.500) and are typically measured using standardized achievement tests. The use of
standardized achievement tests as a measure of the cognitive development of children
has been a major focus of productivity studies since the 1950s, although Rossmiller
(1982) has advocated for the utilization of other outputs to adequately measure the
Because of the recent emphasis on test scores within state-sponsored accountability models and the logical relationship between human resource expenditures and student performance, this study based a school’s academic productivity on the mean score obtained by students on Louisiana’s minimum competency test.

The EPPSC framework delineates the influence of political and judicial decisions that influence the process of providing instructional services available for student consumption. These “system controls” place procedural mandates on local boards of education in the form of minimum content standards, graduation requirements, hiring policies, student attendance, and teacher certification. For example, one system control from the LDE includes the use of local wealth factors within the MFP to determine how much fiscal effort each LEA must provide for students within its jurisdiction. The MFP establishes a predetermined, per-pupil expenditure level for the entire state each fiscal year, then requires LEAs to contribute for a proportional amount (relative to fiscal capacity) of those costs using locally generated revenues. Since AY 95-96, the MFP has allocated a supply-side subsidy (Level 3 funding) to specifically increase human resource expenditures for instructional salaries without requiring matching funds from LEAs. This system control is a fiscal intervention by the state in an effort to correct for the underallocation of resources by producers (LEAs).

**Process Factor (Human Resource Expenditures)**

The investment in the human capital of a school’s professional staff is a costly endeavor, especially due to the labor intense nature of the schooling process. Because the costs associated with staff salaries and benefits account from between 60% to 90%
of the per-pupil expenditures of an entire school (Hartman & Rivenburg, 1985; Picus & Fazal, 1995), expenditure analyses of schools in this area are appropriate (Geske, 1979).

The selection of instructional salaries for full-time teachers was based on 'a priori knowledge that these individuals provide the direct instructional services within the general curricula currently being measured by the criterion-referenced test used by the Louisiana Department of Education.

The human resource inputs for each school in the sample were obtained from the expenditure codes used for instructional salaries, exclusive of benefits. As outlined by Bulletin 1929 (LDE, December 1996), only expenditures with object codes lxx (salaries) and function codes lxxx (instruction) were used to compute instructional salaries. These data were aggregated for each secondary school in the sample during AY 95-96 and AY 97-98. Hartman and Rivenburg's (1985) study of school districts in Oregon provided evidence that regardless of budgetary constraints, expenditures for instructional costs remained constant or increased over time.

Human resource inputs in the process of student learning are not uniquely limited to those of the instructional staff. The human capital and resources of the students themselves directly influence the degree to which each individual obtains the academic skills outlined within the general curricula. Because school personnel (Rossmiller & Geske, 1977) cannot directly manipulate most human resources of students, such as innate endowment and motivational level, they were not investigated in this study.

Per-Pupil: Instructional salaries. Data for this variable were obtained from the Annual School Level Report: Current Expenditures for Instruction, Instruction Support

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and School Administration (LDE, 1997, 1999) and the State Superintendent of
Education’s Budget Letter (Arveson, 1996, Picard, 1998). All data were reported at the
ratio level. This variable was an estimate of the salaries of instructional personnel at
each secondary school in the sample, excluding expenditures for benefits. Instructional
personnel are operationally defined as those employees whose salaries were allocated
expenditure codes of 1xxx (LDE, December 1996). These employees included regular
and special education teachers and long-term substitutes. Human resource information
from each school was obtained from the LDE’s Profile of Educational Personnel (PEP)
database.

System Control Factor (Level 3 Subsidy)

The EPPSC describes system controls as those specific policy parameters by
which educational services must be delivered based on “constitutional requirements,
judicial mandates, statutory directives and administrative rules” (Rossmiller & Geske,
1977, p. 56). These system control factors directly influence how fiscal resources are
allocated to LEAs by Louisiana’s Minimum Foundation Program (MFP). According to
the MFP framework, local educational agencies with low wealth receive greater
amounts of state support for the costs associated with educational services than their
wealthier counterparts. This differentiated treatment of unequals is described by
educational economists as vertical equity (Alexander & Salmon, 1995) and is a system
control used by state finance programs to promote fiscal neutrality. As outlined in
Serrano, the concept of fiscal neutrality suggests that per-pupil expenditures for
educational services are not based on the relative wealth of the district by which
students reside.
Within the framework of the MFP, Louisiana has recently implemented a supply-side subsidy (Level 3 funding) allocated to human resource expenditures for instructional salaries. This system control factor exhibits vertical equity characteristics similar to other components of the MFP. Allocations for this subsidy are based on local wealth factors and have a minimum and maximum distribution range. Unlike those Level 1 expenditures requiring LEAs to provide a portion of the revenues used to pay for educational services, Level 3 funds are allocated in addition to other funding levels and require no local effort.

Economic theory suggests this type of funding is an attempt by state officials to shift the supply curve downward in order to correct for an underallocation of resources (McConnell & Brue, 1993), thus reducing the impact on locally generated revenues. Similar to other state-sponsored subsidies, costs to the producers (LEAs) for educational services are shifted to a governmental agency, which subsequently moves the supply curve downward to an "optimum" level.

**Per-Pupil: Level 3 expenditures.** Data for this variable were obtained from the *Annual School Level Report: Current Expenditures for Instruction, Instruction Support and School Administration* (LDE, 1997, 1999) and the State Superintendent of Education's Budget Letter (Arveson, 1996; Picard, 1998). All data were reported at the ratio level. This variable was calculated by including those expenditures for full-time instructional salaries at each secondary school in the sample, while excluding expenditures for benefits and part-time instructional salaries. Instructional personnel were operationally defined as those employees whose salaries are allocated expenditure code of lxxx (LDE, December 1996) who provided direct instructional services to
students. Instructional personnel information for AY 95-96 and AY 97-98 was obtained from the Profile of Educational Personnel (PEP) database managed by the Division of Planning, Analysis, and Information Resources of the LDE.

Selected Output Factor

This study measured academic productivity (dependent variable) based upon student performances on the English-language arts and mathematics tests of the GEE, which was a proxy for student learning. A logical relationship has been found to exist between student learning and effective instructional methods delivered by high quality instructional personnel (Bloom, 1983; Goodlad, 1984; Teddlie, Kirby & Stringfield, 1989). Because investments into the human capital of instructional personnel increases their market demand when the supply remains constant, expenditures by local boards of education must be increased as a method of recruiting and maintaining high quality instructional personnel. Through their investment in instructional capital, school districts attempt to maximize the academic productivity of schools by providing students with high quality, instructional services for consumption.

This study suggests one measure of academic productivity in Louisiana's secondary schools can be based upon how successful students are in passing the state's minimum competency test (GEE). The GEE is technically classified as a battery of five tests designed to measure the skill mastery of secondary students within the general curricula. The recent emphasis on standardized test scores to identify low and high performing schools in state-sponsored accountability models supports the use of the GEE to measure academic productivity. Further, the GEE is a "high stakes" test requiring students to successfully complete all five tests prior to receiving a high school
diploma. This phenomenon provides a reasonable assurance that students will attempt to maximize their performance on the battery.

Graduate Exit Examination

Data for this variable were reported at the ratio level from an archived database maintained by the Division of Student Standards and Assessment located at the Louisiana Department of Education. A measure of each school’s academic productivity was estimated by calculating the mean standard score of all test-takers on the English-language arts and mathematics tests of the GEE. Students receiving no score due to eraser-analysis, cheating, or failing to complete the tests were allocated the lowest standard score on the scale (1000).

The GEE is a standardized, criterion-referenced test measuring basic skill mastery in five content areas: English-language arts, written expression, mathematics, social studies and science. Successful completion of this standardized assessment battery is required for all secondary students in the State of Louisiana to receive a high school diploma. Successful completion of the GEE is in addition to “a state mandated course of study and the 23 Carnegie unit requirement” (LDE, August 1998, p.7) outlined by the Board of Elementary and Secondary Education necessary for a secondary student to graduate from high school. Students who do not pass any content area of the GEE must retake the battery and receive a passing score to be eligible for a high school diploma.

The GEE was administered in April of AY 95-96 and AY 97-98 to students in the 10th and 11th grade in addition to 12th grade retesters. Retesters were defined as those students who failed to reach the performance standard score on one of the five
tests and had to retake one or all of the tests. According to the LDE's *Criterion-Referenced Testing Program: Technical Manual* (August 1998), the performance scores on the GEE are set at such a level as to facilitate 80% of the test-takers successful completion of the battery without needing to retest. All students classified as 10th graders are required to complete the English-language arts, mathematics and written composition tests of the GEE. Students classified as 11th grader are required complete the science and social studies tests of the GEE. All students classified as 12th graders complete any test either not passed or not taken in previous testing years.

**Instrumentation**

This study utilized the Graduate Exit Examination (GEE) to obtain a proxy measurement of cognitive development for the students in the sample. Because the learning construct cannot be directly observed, data from standardized achievement tests are often used under the assumption that they are highly correlated with the latent, unmeasurable construct (Alexander & Solmon, 1995). Unlike norm-reference tests, criterion-reference tests (CRTs) attempt to measure specifically those skills mastered by the student within a conceptual domain (Cohen, Swerdlik & Phillips, 1996). Scores on CRTs often provide greater diagnostic information to school personnel regarding mastery of the general curricula.

An advantage of using a CRT to measure academic productivity was that the results were not based on a comparative norming group. Frequently norm group comparisons are not available for specific subpopulations such as special education students and low incident, minority students. Use of a CRT eliminated the chance that the comparative norm tables could have become outdated as a result of test score pollution. Test score pollution is a phenomenon that exists when test-takers continue to
increase their performance over time, thus making the norm tables of the NRT useless as a reference point (Gall, Borg & Gall, 1996).

Test Development

The test development process for the GEE generally followed the five stages outlined by Cohen, Swerdlik and Phillips (1996): (a) conceptualization, (b) construction, (c) tryout, (d) analysis, and (e) revision. The objective of the GEE was to develop a criterion-reference test to measure the mastery of basic academic skills. The Louisiana State Board of Elementary and Secondary Education (SBSE) established the GEE and the accumulation of 23 Carnegie units from the state’s curriculum as a minimum requirement for a student to receive a high school diploma (LDE, August 1998). The GEE is administered to all secondary students from grades 10 through 12 in the spring of each academic year, with additional test dates for individuals who must retest.

Test blueprints were developed by IOX Assessment Associates, Measurement Dimensions and ex-officio representatives of the LDE, who outlined the construction of all tests being administered as part of the Louisiana Educational Assessment Program (LEAP). Test blueprints were used to indicate the quantity of items used to assess skills within a specific content domain. An instrument such as the GEE is classified as a domain-referenced measurement according to Gall, Borg and Gall (1996) because the items are randomly sampled from an “item pool” taken from a well-defined content area. Each curricula domain emerged through the content standards developed by teachers, curriculum experts and LDE personnel in 1984. Since this time, the GEE has been designated as the minimum competency test required for all public students.
The item pool for the GEE was developed in the spring of 1987 to measure new content standards being implemented throughout Louisiana. An ad hoc committee assisted content experts in developing the item pools used for the initial pilot project within each of the four content domains: (a) English-language arts, (b) mathematics, (c) social studies, and (d) science (LDE, August 1998). Field-testing was conducted in 1988 and a final item pool was completed and used to develop the initial battery.

Performance standards were established from the initial administration of the completed battery in 1989 using a modified contrasting-group method. According to the LDE (August 1998), this method “statistically contrasts teachers’ perceptions of whether their students would pass or fail the test against the students’ actual tests scores in order to determine the appropriate cut score for the pass/fail decision” (p.5). A sample of 5,000 teachers was selected using a stratified random sampling technique (Best & Kahn, 1993) to provide information regarding teachers’ perception of students having those academic skills necessary to pass the battery.

Chi-square (χ) tests were used to investigate test-item bias by contrasting the observed number of correct items (by subgroups) with the expected number of correct items. Test-item bias was defined as items that systematically assisted or hindered the performance of a particular subgroup of examinees (Harris & Kolen, 1989). The use of the chi-square statistic, a non-parametric test, was appropriate because the data do not satisfy the assumptions (such as normality) necessary for use with parametric tests (Gravetter & Wallnau, 1996). An ad hoc committee reviewed items statistically “flagged” from the chi-square tests and removed those items deemed unfair from the
item pool. Differential item functioning analyses using the Mantel-Haenszel and logistic regression analysis are now used to identify bias items (LDE, August 1998).

**Reliability Evidence**

Beyond item-bias detection, the ability of items to address the criterion was of paramount importance when developing this criterion-referenced test; however, item discrimination was also a necessary secondary function. Item discrimination on the GEE used logit values to label the range of difficulty for each item. Because the length of the GEE was fixed and the responses were scored dichotomously for each item on the test, the point-biserial index was used to correlate item difficulty with a student’s performance on the entire battery. The point-biserial index was deemed appropriate because one variable was measured at the interval level (overall tests score) and the other variable was dichotomous (Gravetter & Wallnau, 1996). Items with a point-biserial index of .20 and logit ranges of +/- 2.5 were dropped from the battery.

The selection of items on the GEE was the primary method used to increase the reliability characteristics of the instrument without increasing the length of the test. Traditional techniques for estimating reliability such as test-retest, alternative form or split-half reliability were inappropriate with the GEE because the proportion of total variance (true plus error variance) was reduced across individuals (Cohen, Swerdlik & Phillips, 1996). The GEE performance score classified individuals into two categories (those who pass or fail), thus facilitating the use of the kappa coefficient as a proxy for a test-retest situation. Kappa coefficients for the GEE tests during the timeframe of this study ranged from .63 to .76 (LDE, August 1998), which provided evidence that the GEE consistently differentiated between the two groups of test-takers.
Classical test reliability is defined as the squared correlation between an observed score and the true score of the individual. Reliability was considered an important theoretical consideration for the LDE’s decision to use the Kuder-Richardson (KR) 20 formula. The KR20 was used to ascertain internal consistency of test items scored dichotomously by using a method of rational equivalence estimating (Richardson & Kuder, 1939). All KR20 coefficients for the GEE between AY 95-96 and AY 97-98 were above .85, which suggests a high level of internal consistency existed within each test.

In addition to classical test theory, generalizability theory (Cronbach, 1976) was used to address reliability issues related to the GEE’s use of cut scores with each test. Generalizability theory suggests many exogenous factors contribute to measurement error (Van der Kamp, 1976) and can be analyzed using inferential techniques, such as analysis of variance (ANOVA). Generalizability coefficients for the entire battery ranged from .866 to .943, suggesting high levels of reliability existed at the cut score and throughout the test. Results from test analysis indicated lower levels of reliability existed with generalizability coefficients ranging from a low of .396 to .755 (LDE, August 1998). The low generalizability coefficient in the test purporting to measure study skills suggests those items selected were not able to consistently and accurately measuring this construct.

Validity Evidence

Validity issues surrounding the GEE referred to the appropriateness of inferences drawn from test scores to each academic domain. Validity evidence is often placed in a three-category taxonomy: (a) content validity, (b) criterion-related validity,
and (c) construct validity. As outlined by Cohen, Swerdlik and Phillips (1996), these three validity categories should not be viewed as mutually exclusive, but rather as contributing to the validity judgments of the test in an interdependent manner.

Content validity refers to those judgments made regarding how adequately the scores on the test represent the content domain they purport to measure (Gall, Borg & Gall, 1996). Criterion related validity evidence was gathered using the California Achievement Test (CAT). Criterion-related validity refers to how adequately “a test score can be used to infer an individual’s most probable standing on some measure of interest” (Cohen, Swerdlik & Phillips, 1996, p.179). The correlation coefficients for the English-language arts and mathematics tests ranged from .70 to .80, which suggested a high level of prediction exists from one test to another (LDE, August 1998). Discriminant function analysis was also used with the CAT results and provided evidence supporting the GEE’s cut scores. The results of the CAT’s cut scores when compared to those of the GEE provided high levels of agreement in differentiating those individuals who passed or failed the English-language arts and mathematics tests. Criterion-related validity evidence on the social studies and science tests was not provided by the LDE.

Construct validity evidence is defined as the “extent to which a particular test can be shown to assess the construct that it purports to measure” (Gall, Borg & Gall, 1996, p.249). According to the LDE (August, 1998), evidence of construct validity was provided by the two studies correlating results from the GEE with their equivalent levels on the CAT. Bivariate correlational analyses between the two tests of mathematics and English-language arts produced coefficients of correlation between .70
and .80. Robust statistical procedures such as factor analytic techniques (Gorsuch, 1983; Harmon, 1976) or multitrait-multimethod matrix methods (Campbell & Fiske, 1959) were not presented in the technical manual to provide additional evidence of construct validity.

Research Design

A methodological problem inherent to research in education has been the necessity to rely on ex post facto designs because the school setting rarely facilitates the use of experimental designs. Although Hanushek (1997) has advocated greater use of experimentation in educational research, Rossmiller and Geske (1977) have suggested educational research can rarely control or manipulate variables within a school setting, a necessary requirement when using an experimental research design. School effectiveness and productivity studies using quantitative designs are typically limited to descriptive, correlational or causal-comparative methods. Although causal-comparative methods are used in numerous research studies and provide insight into cause and effect, only experimental studies can establish causality (Gall, Borg, Gall, 1996). Experimental designs using an educational production model are not feasible because of the necessity to provide fiscal resources to educational systems, thus eliminating the ability to have the control group needed for comparison.

This study’s use of hierarchical, regression analysis within the greater framework of an educational production function model was not designed to seek causality, but rather to test hypotheses. These hypotheses were based on the belief that a positive relationship existed between human resource expenditures for instructional salaries and academic productivity. Further, this study investigated the relationship
between human resource expenditures for instructional salaries, inclusive of the Level 3 subsidy and academic productivity, *ceteris paribus*.

The use of multivariate regression techniques (Gorsuch, 1983) allowed the researcher to investigate the amount of variance accounted for by independent variables on the dependent variable and to control for exogenous influences. Exogenous influences that significantly impact student performances on standardized achievement tests were selected based upon an exhaustive review of school productivity research since 1960.

The use of a quasi-longitudinal design allowed the research to investigate the impact of the treatment on the dependent variable across time. This research designed was based on the assumption that the impact of increased expenditures for human resources inclusive of the Level 3 subsidy would take at least two-years impact academic productivity of secondary schools. The use of a supply-side subsidy for instructional salaries (Level 3 funding) by the MFP did not exist until after AY 95-96. Collecting baseline data on secondary schools prior to the introduction of Level 3 funding facilitated the study’s ability to measure its influence on the dependent variable. Four educational production function models were designed using regression analysis to measure impact of increases in human resource expenditures with and without the Level 3 subsidy on academic productivity once exogenous factors are controlled for.

**Data Analysis**

**Descriptive Statistics**

Prior to hypothesis testing, descriptive statistics were used to collect information about how the data were distributed (Gall, Borg & Gall, 1996; Gravetter & Wallnau).
The "Explore" command of SPSS 8.0 facilitated the screening of data necessary to identify not only extreme cases, but to locate missing and unusual information often resulting from human error during data entry. Missing data found in the database was replaced with the arithmetic mean, a procedure outlined by Norusis (1990).

Descriptive statistics provided additional evidence regarding the assumption that the data were obtained from a normal population. Histograms and Stem-n-Leaf plots provided a cursory analysis of the aforementioned normality assumption. Because the sample in this study closely approximated the target population, the discrepancy between the sample mean and population mean on the selected variables, known as sampling error, was significantly reduced. Means and standard deviations were calculated for those inputs used in calculating the factor score and community type, which represented the impact of exogenous influences on the academic productivity of schools. Means and standard deviations were also calculated for the system control, process, and output factors for both AY 95-96 and AY 97-98.

Diagnostic Analysis

The basic objective of multiple regression analysis within an educational production model is to provide predictive information with an estimated margin of error (Liu, 1981) while controlling for the effects of exogenous influences. One assumption associated with the use of inferential statistics is that findings from the sample can be generalized to the population from which it was obtained. The population in this study was determined as normally distributed, but the presence of extreme cases in the sample could reduce the accuracy of any findings. As Bates (1997) states, "The purpose of a diagnostic analysis is to identify influential observations (e.g. those which have a
disproportionate impact on the regression results) and to determine whether those observations should be excluded from the final analysis” (p.118).

Because extreme cases in the data may influence estimates of the population parameters and are inconsistent with the regression model fitted for a majority of the cases, a casewise analysis of the selected input values was conducted. Mahalanobis' distance and Cook’s D were used to identify cases having large values from the mean and their influence on all residuals when the selected cases were deleted from the regression model (Norusis, 1990). For all cases in the sample, the DFBETA was computed and used to investigate the influence of extreme cases on the coefficient of determination. The coefficient of determination ($R^2$) is a statistical estimation of how much variance is shared by two variables and can be calculated by squaring the correlation coefficient, then multiplying the resultant by 100 (Cohen, Swerdlik & Phillips, 1996). Cases identified by diagnostic procedures outlined in the next section were deleted from the final regression models, thus ensuring the regression models used in the study “fit” the data.

Multicollinearity limits the effectiveness of using multivariate regression techniques with a production function model by obfuscating the unique variance accounted for by subsequent inputs. Multicollinearity occurs when the predictor (independent) variables are highly correlated with each other. This intercorrelation among inputs reduces the unique variance explained by each input on the dependent variable, which was considered a serious limitation of the Coleman study (Bowles & Levin, 1968). Because the absence of multicollinearity is considered extremely rare in educational research (Liu, 1981), the inevitable presence of this phenomenon must be
addressed when using multiple regression analysis. The presence of multicollinearity can limit the coefficient of determination and “make it more difficult to increase unique explanatory prediction from additional variables” (Bates, 1997, p.117). When using an educational production function, the influence of each input on the selected output can be distorted by the presence of multicollinearity, thus limiting the researcher’s ability in obtaining a precise estimation of the regression coefficient.

The procedures for detecting multicollinearity in this study followed the methods developed by Belsley, Kuh and Welsch (1980). An exploratory factor analytic technique using the principal-components method (Harman, 1976) was used with this study’s targeted inputs to produce direct eigenvalues. These eigenvalues were subsequently used to produce condition indices that represented the degree of collinearity between inputs. Condition indices of 10 or less represent moderate to low collinearity among inputs, while indices greater than 30 represented severe collinearity (Morrow-Howell, 1994). Any two inputs with a condition index above 30 and that could account for a substantial proportion (.90 or greater) of the variance on the dependent variable were considered to exhibit high levels of multicollinearity (Bates, 1997).

Factor Analysis

Factor analytic techniques can be used to address problems of multicollinearity by identifying a variable “which embraces many highly interrelated variables” (Liu, 1981, p.183). The use of confirmatory factor analytic procedures with the three exogenous inputs was based on à priori knowledge that these data were highly intercorrelated within the population of 10th Grade test-takers. All factor analytic

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procedures used the SPSS 8.0 software and followed the guidelines presented by Gorsuch (1983) and Norusis (1990).

Confirmatory factor analysis is often used to identify a small number of factors that explain a majority of the variance found in large samples, which was also the case in this study. Descriptive statistics were calculated for each exogenous input and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy provided support for using factor analytic procedures with the selected data. According to Kaiser (1974), sample adequacy coefficients of less than .50 suggest that factor analytic techniques are not appropriate for the data in the sample. In addition to the KMO coefficient, Bartlett's Test of Sphericity was used to investigate whether or not the correlation matrix derived from the data was an identity matrix, which would have suggested factor analytic techniques were not appropriate with the data. According to Norusis (1990) when the approximate chi-square is large and the significance level is small, the hypothesis that the population matrix is an identity matrix can be rejected, thus providing support for the use of factor analytic techniques with the selected data.

The extraction method used in this study was the principal-components method using an oblique rotation. Principal-components analysis uses linear combinations of highly correlated variables to form factors (Norusis, 1990). The oblique rotation allows for correlation among the obtained factors to be accounted for, a frequent phenomenon in educational research. Although other factors may have eigenvalues greater than 1, a single factor was believed to exist that would account for a majority of the variance in the data. A Scree plot was used to visually review the distribution of factors by their associated eigenvalues. A single factor score for each school in the sample was
calculated using the regression method outlined by Norusis (1990). This method provided exact scores for each case in the sample because a single factor was extracted using the principal-components method.

Tests of Hypotheses

Hypothesis 1 was assessed through the use of bivariate correlation analysis of the relationship between exogenous influences and a school’s level of academic productivity (mean standard score on the Graduate Exit Examination) during academic year AY 95-96 and AY 97-98.

Hypothesis 2 was assessed through the use of bivariate correlation analysis of the relationship between community type and a school’s level of academic productivity during AY 95-96 and AY 97-98.

Hypothesis 3 was assessed through the use of bivariate correlation analysis of the relationship between human resource expenditures (per-pupil) for instructional salaries exclusive of the Level 3 subsidy and academic productivity levels during AY 95-96 and AY 97-98.

Hypothesis 4 was assessed through the use of bivariate correlation analysis of the relationship between the human resource expenditures (per-pupil) for instructional salaries inclusive of the Level 3 subsidy and academic productivity levels during AY 97-98.

Hypotheses 5 through 8 were assessed using hierarchical, multiple regression analysis on the data for AY 95-96 and AY 97-98. Four educational production function models were designed to facilitate hypothesis testing of the two measures of academic productivity, mean standard scores on the English-language arts and mathematics tests.
of the GEE. This procedure entered the exogenous influence factor first, community
type second, and lastly the treatment input into each production function. This order of
entry was based on the EPPSC framework and findings from productivity studies
conducted during the past several decades.

The sequencing of each variable into the production model provided information
regarding the unique variance accounted for by subsequent inputs on the dependent
variable. Comparisons of the coefficient of determination for the instructional salary
exclusive of the Level 3 subsidy in AY 95-96 versus its inclusion in AY 97-98
specifically addressed Hypothesis 8. Table 2 provides a summary of the order each
variable will be entered into each production function model necessary to conduct
regression analysis on both measures of academic productivity.

### Table 2

<table>
<thead>
<tr>
<th>Input #1</th>
<th>Input #2</th>
<th>Input #3</th>
<th>Output</th>
</tr>
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<tbody>
<tr>
<td>(Control)</td>
<td>(Control)</td>
<td>(Treatment)</td>
<td>(Dependent)</td>
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<td>Model 1</td>
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<td>Community</td>
<td>Instructional</td>
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<td>Score</td>
<td>Type</td>
<td>Standard</td>
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<td>Community</td>
<td>Instructional</td>
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<tr>
<td>AY 95-96</td>
<td>Score</td>
<td>Type</td>
<td>Salaries + Subsidy</td>
</tr>
<tr>
<td>Model 3</td>
<td>Factor</td>
<td>Community</td>
<td>Instructional</td>
</tr>
<tr>
<td>AY 97-98</td>
<td>Score</td>
<td>Type</td>
<td>Salaries + Subsidy</td>
</tr>
<tr>
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<td>AY 97-98</td>
<td>Score</td>
<td>Type</td>
<td>Salaries + Subsidy</td>
</tr>
</tbody>
</table>

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The final hypothesis primarily focused on whether or not a state-level, supply-side subsidy combined with increased human resource expenditures has had a significant and positive effect on academic productivity of the sample schools, *ceteris paribus*. Alternative schools, schools/programs for non-diploma bound students, and schools with extreme values (e.g. per-pupil expenditures) will be extricated from the target population during the diagnostic analysis procedures outlined previously in this chapter.
CHAPTER 4

RESULTS

This study investigated the impact of a state-sponsored, supply-side subsidy on the academic productivity of secondary schools in Louisiana. Using a modified version of the Educational Production Process under School Conditions (EPPSC) originally conceptualized by Rossmiller and Geske (1977), this study first selected and investigated several exogenous influences. These independent variables were household incomes (% poverty), community type, ethnicity (% minority), exceptional students, and retested students (% retesters). The impact of the system control and process inputs (treatment variables) on the academic productivity of secondary schools (dependent variable) was investigated across a two-year period. The dependent variable was measured by the performance of students on specific tests that comprise the state-administered, minimum competency exam. Bivariate correlation and hierarchial regression analysis were the analytical procedures used to investigate the relationship between the selected inputs and the dependent variable. A factor analytical procedure was also used to control for multicollinearity among several exogenous inputs.

Characteristics of the Final Sample

A review was performed of the student-level data for several inputs and the dependent variable before aggregating the “nested” data (Purkey & Smith, 1983) to the unit of analysis (school). Performance data and student characteristics reported on the Graduate Exit Examination from 10th grade students were obtained for both AY 95-96 and AY 97-98. These two data files were extracted from the Louisiana Department of Education’s database maintained by the Division of Planning, Analysis, and

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Information Resources. These student-level data files contained 55,208 cases during AY 95-96 and 57,693 cases during AY 97-98. Using the Explore command found in SPSS 8.0, these files were reviewed electronically to locate missing data and to investigate the characteristics of the population. The standard scores for all 10th grade test-takers of the GEE were found to be normally distributed, with the exception of Written Expression.

Standard scores from non-public school students and those test-takers who had previously passed the exam were identified and excluded from both data files. Students attending non-public schools were beyond the parameters of this study. Additionally, test-takers who previously passed the 10th grade tests were assumed not to be motivated by the same circumstances as those who had not taken any portion of the GEE. These two groups of excluded students accounted for less than 3% of all test-takers in the population and did not significantly change the normality of the standard score distribution for either the English-language arts or mathematics scores.

A histogram was produced for the Written Expression test scores using SPSS for AY 95-96 and AY 97-98 with a normal curve superimposed to judge the distribution of scores. Additionally, a Normal Q-Q Plot was used to investigate how the student-level, standard scores from the Written Expression test were distributed. A Normal Q-Q Plot compared the observed values from the Written Expression variable and plotted them against those expected values if the sample data had been from a normal distribution. When observed values are normally distributed, they produce a linear pattern with the expected values (Norusis, 1990); however, a non-linear pattern provides evidence that the assumption of normality has been violated.
A review of the histogram and Normal Q-Q Plot provided evidence that the scores on the Written Expression test were skewed left and not normally distributed. Because the Guassian (normality) assumption is required for populations when using inferential statistics, the skewness in the population violated an important assumption needed to conduct hierarchical, regression analysis. The skewness among the population of Written Expression standard scores in conjunction with the limited evidence of construct validity and internal reliability of the instrument facilitated this test’s exclusion as a measure of academic productivity. Table 3 provides a summary of the student-level population receiving a standard score for each selected test of the GEE used in this study.

Table 3

<table>
<thead>
<tr>
<th>Test-Takers (Population)</th>
<th>Test-Takers (Excluded)</th>
<th>Test-Takers (Sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Exit Examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics (AY 95-96)</td>
<td>55,208</td>
<td>660</td>
</tr>
<tr>
<td>Graduate Exit Examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English-language arts (AY 95-96)</td>
<td>55,208</td>
<td>660</td>
</tr>
<tr>
<td>Graduate Exit Examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics (AY 97-98)</td>
<td>57,693</td>
<td>1,539</td>
</tr>
<tr>
<td>Graduate Exit Examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English-language arts (AY 97-98)</td>
<td>57,693</td>
<td>1,539</td>
</tr>
</tbody>
</table>
After examining the parameters of the selected dependent variables using student-level data and excluding approximately 2,000 cases from both years, the remaining student-level standard scores were aggregated to the unit of analysis (school) originally outlined in Chapter 1. During AY 95-96, 348 public schools reported having both grade configurations inclusive of the 10th grade and educational programs for these 10th graders on their campuses. A net increase of three schools was observed in the number of schools having a 10th grade in their grade configuration by AY 97-98.

The result of aggregating student-level data to the unit of analysis was a population of public schools in AY 95-96 and AY 97-98 that provided only a testing location for students, rather than direct educational services. Using data obtained from queries conducted with those data maintained in the Student Information System of the LDE, several schools were identified as having tested students but did not have a grade configuration that included the 10th grade.

A number of alternative schools included at least one level of 10th grade test-takers, but were excluded from the sample. The rationale for this exclusion was based on the examination of the targeted inputs using the Explore command found in SPSS 8.0 and the a priori knowledge that membership to these schools was based on unique criteria, thus introducing unwanted selection bias into the sample. Review of the results from several Boxplots and Stem-and-Leaf Plots identified 35 cases with extreme values. Inclusion of these data were not believed to increase the generalizability of any findings because extreme values among the variables under consideration in this study have little similarity to the “typical” secondary school in Louisiana. According to Teddlie and Tashakkori (1998), “Generalizability is not enhanced by adding individuals and/or
observations that are not “typical” of the group of situations of importance to your research” (p.72).

The sample of schools was also limited by the quasi-longitudinal research design used in this study. According to this design, a specific baseline of schools was used to examine the influence of the treatment input on the dependent variable after a two-year period. The timeframe allowed for two-years of treatment implementation prior to measuring the dependent variable. The rationale for the quasi-longitudinal design was based on the assumption that fiscal inputs into the process of producing educational services would require a “gestation period.” Based on school reform research, efforts require a period of time for changes in pedagogy (Murphy, 1991).

Subject attrition in the form of schools closing and the introduction of new subjects into the target population required the number of cases across time to remain constant. This criterion eliminated several schools (n = 3) in addition to those cases with extreme values that closed or opened between AY 95-96 and AY 97-98. The sample of schools for AY 95-96 was matched electronically with the data from AY 97-98 to identify schools having a NCES sitecode in only one file. The cumulative results from reviewing the population eliminated 38 schools that were (a) closed after AY 95-96, (b) classified as alternative schools/programs with extreme values, or (c) received an initial sitecode after AY 95-96. As outlined in the following section of this chapter, data from a targeted input (% exceptional students) was subsequently eliminated from the study. Diagnostic analysis further eliminated several non-representative schools (n = 17) from the sample. Descriptive statistics for the final sample of schools used for hypothesis testing are provided in Tables 4 and 5.
Table 4

**Descriptive Statistics for AY 95-96**

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Poverty</td>
<td>44.295</td>
<td>20.435</td>
<td>296</td>
</tr>
<tr>
<td>% Minority</td>
<td>40.905</td>
<td>30.820</td>
<td>296</td>
</tr>
<tr>
<td>% Retesters</td>
<td>11.916</td>
<td>9.378</td>
<td>296</td>
</tr>
<tr>
<td>Community type</td>
<td>5.090</td>
<td>2.070</td>
<td>295</td>
</tr>
<tr>
<td>Instructional salaries (per-pupil)</td>
<td>$2,318.194</td>
<td>$444.019</td>
<td>296</td>
</tr>
<tr>
<td>Standard Score – ELA</td>
<td>1060.537</td>
<td>4.208</td>
<td>296</td>
</tr>
<tr>
<td>Standard Score – Math</td>
<td>1055.158</td>
<td>5.628</td>
<td>296</td>
</tr>
</tbody>
</table>

Table 5

**Descriptive Statistics for AY 97-98**

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Poverty</td>
<td>44.298</td>
<td>20.567</td>
<td>296</td>
</tr>
<tr>
<td>% Minority</td>
<td>41.453</td>
<td>31.279</td>
<td>296</td>
</tr>
<tr>
<td>% Retesters</td>
<td>14.203</td>
<td>9.534</td>
<td>296</td>
</tr>
<tr>
<td>Community type</td>
<td>5.090</td>
<td>2.070</td>
<td>295</td>
</tr>
<tr>
<td>Instructional salaries (per-pupil)</td>
<td>$2,680.978</td>
<td>$499.928</td>
<td>296</td>
</tr>
<tr>
<td>Instructional salaries w/subsidy</td>
<td>$2,758.876</td>
<td>$510.160</td>
<td>296</td>
</tr>
<tr>
<td>Standard Score – ELA</td>
<td>1061.026</td>
<td>4.011</td>
<td>296</td>
</tr>
<tr>
<td>Standard Score – Math</td>
<td>1055.607</td>
<td>5.903</td>
<td>296</td>
</tr>
</tbody>
</table>

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Diagnostic Analysis

Multicollinearity

The objective of multiple regression within an educational production model is to test hypotheses associated with the impact of treatment variables on selected dependent variables after controlling for exogenous influences. Descriptive statistics were computed for each of the exogenous variables. A preliminary correlation matrix using a four-variable solution suggested a significant (p < .01) and positive relationship among three variables (% minority, % retesters, and % poverty). The fifth variable, the percentage of exceptional students per school, did not exhibit a significant or a positive relationship with any of the other four variables. Further investigation of this phenomenon using Pearson Product Moment correlation analysis revealed that no significant relationship existed between the fifth variable and the dependent variable. Consequently, this variable was excluded from the study.

Table 6

Intercorrelations Between Exogenous Inputs for AY 95-96

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. % Poverty</td>
<td>--</td>
<td>.751**</td>
<td>.648**</td>
<td>-.029</td>
<td>-.106*</td>
</tr>
<tr>
<td>2. % Minority</td>
<td></td>
<td>--</td>
<td>.432**</td>
<td>-.365**</td>
<td>-.057</td>
</tr>
<tr>
<td>3. % Retesters</td>
<td></td>
<td></td>
<td>--</td>
<td>-.356**</td>
<td>-.033</td>
</tr>
<tr>
<td>4. Community type</td>
<td></td>
<td></td>
<td></td>
<td>--</td>
<td>-.609</td>
</tr>
<tr>
<td>5. % Exceptional students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

* p < .05 (one-tailed). ** p < .01 (one-tailed).
Table 7

Intercorrelations Between Exogenous Inputs for AY 97-98

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. % Poverty</td>
<td>--</td>
<td>.764*</td>
<td>.655*</td>
<td>-.029</td>
<td>-.131*</td>
</tr>
<tr>
<td>2. % Minority</td>
<td>--</td>
<td>.432**</td>
<td>-.365**</td>
<td>-.111*</td>
<td></td>
</tr>
<tr>
<td>3. % Retesters</td>
<td>--</td>
<td>-.264**</td>
<td>.040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Community type</td>
<td>--</td>
<td>.013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. % Exceptional students</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .05 (one-tailed). ** p < .01 (one-tailed).

The final correlation matrix used three exogenous variables—% poverty, % minority, and % retesters—whose correlation coefficients were significantly positive at the p < .01 level. The final correlation matrix exhibited a Kaiser-Meyer-Olkin (KMO) measure of at least .60 for the data collected during AY 95-96 and AY 97-98. According to Kaiser (1974), KMO coefficients of .60 or higher suggests that the use of factor analytic procedures are appropriate with the data. In addition to the KMO coefficients, Bartlett's Test of Sphericity provided evidence that the correlation matrix for AY 95-96 and AY 97-98 were not identity matrices. This test was appropriate because the assumption of normality, as described in the next section, was established for the population. The hypothesis that the correlation matrices were identity matrices was rejected because the chi-square value was proportionally large while the significance (p < .01) value was small. Tables 8 and 9 provide a summary of the results of Bartlett's Test of Sphericity, and KMO measure of sample adequacy for the data.
Table 8

Factor Analysis: Component Matrix and Adequacy Measures for AY 95-96

<table>
<thead>
<tr>
<th>Component</th>
<th>KMO Coefficient</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. % Poverty</td>
<td>.937</td>
<td></td>
</tr>
<tr>
<td>2. % Minority</td>
<td>.851</td>
<td></td>
</tr>
<tr>
<td>3. % Retesters</td>
<td>.793</td>
<td></td>
</tr>
<tr>
<td>Kaiser-Meyer-Olkin (KMO)</td>
<td>.602</td>
<td></td>
</tr>
<tr>
<td>Bartlett’s Test of Sphericity</td>
<td>406.041*</td>
<td></td>
</tr>
</tbody>
</table>

* p < .01 (one-tailed)

Table 9

Factor Analysis: Component Matrix and Adequacy Measures for AY 97-98

<table>
<thead>
<tr>
<th>Component</th>
<th>KMO Coefficient</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. % Poverty</td>
<td>.924</td>
<td></td>
</tr>
<tr>
<td>2. % Minority</td>
<td>.881</td>
<td></td>
</tr>
<tr>
<td>4. % Retesters</td>
<td>.828</td>
<td></td>
</tr>
<tr>
<td>Kaiser-Meyer-Olkin (KMO)</td>
<td>.682</td>
<td></td>
</tr>
<tr>
<td>Bartlett’s Test of Sphericity</td>
<td>424.243*</td>
<td></td>
</tr>
</tbody>
</table>

* p < .01 (one-tailed)

Once the appropriateness of the correlation matrices was established a factor extraction procedure using an oblique rotation was attempted; however, this rotation could not be performed because no additional factors could be extricated from the data.
A single, exogenous factor for the AY 95-96 data was extracted with an eigenvalue of 2.230, which accounted for 74.328% of the variance among the three inputs. A factor score was obtained for each school in the sample's baseline using the regression method outlined by Norusis (1990). The extracted factor from the AY 97-98 data had an eigenvalue of 2.316 that accounted for 77.192% of the variance among the selected inputs. A factor score for each school in the AY 97-98 data was also obtained using the regression method. The regression method computes factor scores by multiplying the factor score coefficients from the coefficient matrix with the standardized values for each case (Harman, 1976). The correlation between the extracted factor for each year and three selected inputs can be found in Tables 8 and 9.

The factor analytic procedures produced a factor score for each case in the sample; however, a fourth exogenous input (community type) was not included in the factor solution. The community-type variable exhibited a significantly positive association (p < .01) with the dependent variable during AY 95-96 and AY 97-98. This additional exogenous input was included in the initial production function model to investigate the presence of multicollinearity between inputs. The presence of substantial correlations between independent variables would have distorted the influence of the selected inputs (Morrow-Howell, 1994).

Collinearity diagnostic procedures outlined by Belsely, Kuh, and Welsch (1980) were used to investigate the four production function models used in this study. Diagnostic procedures were used to ensure the unique variance accounted for by each input on the dependent variable was not obfuscated by the presence of other inputs. Collinearity diagnostic results suggested that no two sets of inputs in any of the
production models exhibited a condition index above 30 while concomitantly accounting for a majority (.90) of the variance in the dependent variable. Production function Model 1 measured academic productivity during AY 95-96 using student performance data on the English-language arts (ELA) test of the GEE. Production function Model 2 measured academic productivity during AY 95-96 using student performance data on the Mathematics (Math) test of the GEE. Production function Models 3 and 4 followed the same methodology as that used during AY 95-96 but with AY 97-98 data. Table 10 provides specific data from the collinearity diagnostic analysis of each production function model regarding the condition index score and variance proportions for each targeted input.

Table 10

Production Function Models: Collinearity Diagnostics

<table>
<thead>
<tr>
<th>Condition Index</th>
<th>Variance Proportions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor score</td>
</tr>
<tr>
<td>Models 1 &amp; 2</td>
<td>1.692</td>
</tr>
<tr>
<td></td>
<td>5.570</td>
</tr>
<tr>
<td></td>
<td>13.095</td>
</tr>
<tr>
<td>Models 3 &amp; 4</td>
<td>1.697</td>
</tr>
<tr>
<td></td>
<td>5.537</td>
</tr>
<tr>
<td></td>
<td>13.435</td>
</tr>
</tbody>
</table>
**Extreme Cases**

Cases having extreme values may influence estimates of the population parameters and are inconsistent with the production function model that fits for a majority of the cases. Extreme cases are often present in populations, and information from initial descriptive statistics with the data suggested the presence of several cases with extreme values. Therefore, a casewise analysis was conducted with each of the four production function models to identify those residuals that were both influential and far from the mean. Mahalanobis' distance and Cook’s D were calculated for each case. Mahalanobis’s distance provided information regarding 18 to 20 cases in each production function model having standardized residuals far from the mean.

Standardized residuals for each case in the sample were calculated by dividing the residual by the standard deviation of the residuals as outlined by Norusis (1990) using SPSS 8.0. Subsequently, standardized residuals have a mean of zero and a standard deviation of one.

Diagnostic analysis of the sample using Cook’s D provided information regarding the influence of cases in each production function model. Cook’s D accounts for the change in the residuals of all remaining cases once an extreme case has been eliminated from the regression equation. The DFBETA statistic was used to examine the change in the regression coefficient by observing changes in the regression line once the selected case was eliminated from the model. Because the normality assumption was supported by the data, the t-statistic provided an indication that the targeted case had a significance influence on the regression line (Belsely, Kuh & Welsch, 1980). A review of the DFBETA and the DFBETA Intercept in conjunction with Cook’s D and
Mahalanobis's distance suggested ten cases had extreme values and were significantly influencing all four production function models.

Beginning with production function Model 1, an F-statistic was calculated to verify that the procedures used to eliminate extreme cases significantly improved the model's fit with the data. As outlined by Bates (1997), an improvement in the production function model’s fit with the data will be expressed when a significant decrease in the residual sum of squares occurs after the extreme cases are deleted from the full model. Deletion of extreme cases (n = 10) produced a residual sum of squares of 2415.475 and produced a significant improvement (p < .01) in the model’s fit with the data. Further analysis suggested three additional extreme cases were present in both Models 1 and 2. Using the procedures outlined by Bates (1997) to locate each model’s maximum fit with the data, each extreme case was sequentially deleted from the baseline models. The subsequent change in the residual sum of squares was determined and divided by the Mean Squares (MS) for the full model, which produced an F-statistic. The progressive exclusion of each extreme case that significantly (p < .01) improved the fit of the baseline models continued until further deletion of extreme cases did not produce a significant F-statistic.

The quasi-longitudinal research design required that the same cases be used in AY 95-96 and AY 97-98. Subsequently, the final models had to fit both sets of data to evaluate appropriately the treatment's impact on the dependent variable. The presence of new cases and/or extreme cases in the AY 97-98 data would have introduced unwanted error and reduced the validity of any findings. As a result, all extreme cases eliminated in AY 95-96 were also eliminated in AY 97-98 once Cook's D and
DFBETA had been calculated. The findings suggested all 13 extreme cases in AY 95-96 exhibited extreme standardized residuals and influenced the AY 97-98 models. The full model's residual sum of squares was significantly (p < .01) reduced once the 13 extreme cases were deleted from the AY 97-98 data.

Analyses further revealed the presence of four additional cases having large Cook's D and DFBETA values not identified in the AY 95-96 data. A case by case elimination produced significant (p < .01) F-statistics for each subsequent case deleted from the AY 97-98 models. All four cases were deleted from the AY 95-96 models, which reduced the residual sum of squares but did not produce a significant F-statistic (p < .01) in Model 1.

Table 11

<table>
<thead>
<tr>
<th></th>
<th>Residual sos</th>
<th>Residual MS</th>
<th>Δ F 3.310</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Model 1</td>
<td>3,133.973</td>
<td>9.851</td>
<td>--</td>
</tr>
<tr>
<td>Full Model 1 less 17 Cases</td>
<td>1,610.961</td>
<td>9.851</td>
<td>154.605*</td>
</tr>
<tr>
<td>Full Model 2</td>
<td>6,454.857</td>
<td>20.951</td>
<td>--</td>
</tr>
<tr>
<td>Full Model 2 less 17 Cases</td>
<td>4,141.009</td>
<td>20.951</td>
<td>110.441*</td>
</tr>
<tr>
<td>Full Model 3</td>
<td>3,081.501</td>
<td>9.752</td>
<td>--</td>
</tr>
<tr>
<td>Full Model 3 less 17 Cases</td>
<td>1,687.813</td>
<td>9.752</td>
<td>142.913*</td>
</tr>
<tr>
<td>Full Model 4</td>
<td>7,164.788</td>
<td>22.673</td>
<td>--</td>
</tr>
<tr>
<td>Full Model 4 less 17 Cases</td>
<td>5,131.545</td>
<td>22.673</td>
<td>89.677*</td>
</tr>
</tbody>
</table>

*p < .01 (one-tailed)
The results from the diagnostic analysis of extreme cases suggested the elimination of 17 cases lowered the residual sum of squares value and increased the regression line’s fit in each model. The maximum regression sum of squares (SOS) for each of the four-production function models was based upon those parameters set by this study’s design. Table 11 provides a summary of the change in the F-statistic for each model through subsequent deletion of extreme cases.

Tests of Assumptions

The multiple regression analysis used with the production function models in this study provided evidence that a specific treatment affected the dependent variable once the influence of exogenous factors were addressed. As with numerous inferential statistics, a number of assumptions about the input-output relationship must be addressed to ensure that the analytical techniques are appropriate for the data. This study addresses four specific assumptions about the relationship between the inputs and the targeted output.

The normality assumption is that the data was obtained from a normal population. Histograms of standardized residuals for each of the four production models were juxtaposed with a normal distribution curve. The result of this analysis suggested the residuals were normally distributed around the mean and that 95% of the residuals fell between +/- 2 standard deviations of the mean. A Normal Q-Q Plot produced by SPSS 8.0 provided further evidence that the standardized residuals were located on the diagonal line.

The second assumption is based on the requirement that error values from a single input are not influenced by other inputs. A sequencing effect occurs as the error
term from a single input "carries" to another input, thus producing residuals with a consistent and discernable pattern. A test for the independence of error assumption was conducted by plotting the standardized residuals against the standardized predicted value for each model. The results indicated the residuals for all models were independent with no discernable patterns observed in any of the four plots. As noted by Norusis (1990), a discernable pattern in the standardized residuals would have suggested that the assumption had been violated.

The third assumption requires homoscedasticity of the data. Homoscedasticity between the output and those selected inputs should not be limited to the restricted range of the inputs. The assumption of equal variance in the output values across the selected inputs was investigated by plotting the standardized predictor value against the studentized residuals. Similar to standardized residuals, studentized residuals are computed by dividing the residual by the estimated standard deviation from each case to the regression line. Studentized residuals are more precise than standardized residuals and are a more accurate way of examining each case's residual value (Belsely, Kuh & Welsch, 1980). The studentized residuals in each production function model did not exhibit any discernable, systematic pattern that would have suggested the homoscedasticity assumption had been violated.

The final assumption is based on the premise that the inputs have a linear relationship with the output. Linearity assumes that as the magnitude of input values increases so does the magnitude of the output. The output of each model was plotted against the studentized residuals. A linear relationship was observed for all scatterplots and provided evidence that a linear relationship existed between all selected inputs and
output for each model. Partial plots were used to determine whether a linear relationship existed between each selected input and targeted output. In all models, the per-pupil expenditure input exhibited marginal linearity as the relationship between increased expenditures and academic productivity appeared to be weak. This phenomenon was expected since numerous productivity studies have suggested either a weak or insignificant relationship exists between per-pupil expenditures and academic productivity (Coleman, 1966; Glasman & Biniaminov, 1981; Hanushek, 1996; Jencks & Brown, 1975).

In conclusion, none of the four assumptions provided evidence of being seriously violated, thus suggesting the use of multiple regression analysis within each production function model was appropriate. Violations of the four data assumptions outlined in this section would have required either data transformation procedures or a decision to abandon the use of regression analysis. The instructional salary input with and without the inclusion of the Level 3 subsidy exhibited a weak, linear relationship with the academic productivity variable. This phenomenon provided the first insight into the effects that per-pupil expenditures have had on the academic productivity of Louisiana’s secondary schools.

Examination of Specific Hypotheses

The first four hypotheses suggest relationships exist between the selected inputs and academic productivity. Bivariate correlation analysis was conducted on each measure of academic productivity for both years. This analytic technique was necessary as this study measures academic productivity based upon students’ standard scores on the GEE aggregated at the school level across time. The 10th grade GEE tests
in English-language arts and mathematics were specifically used as measures of academic productivity. The Written Expression test was eliminated as a measure of academic productivity because of psychometric anomalies.

The bivariate correlation analysis was conducted using the Pearson product-moment correlation (r). This statistic provides information about the magnitude and direction of two variables under the assumption that the relationship is linear (Cohen, Swerdlik & Phillips, 1996). The linearity assumption between those targeted variables examined through the use of the Pearson product-moment correlation was established earlier in this chapter. Another consideration when using bivariate analysis to hypothesis test is the presence of outliers in the data, which can have a “dramatic effect on the value of a correlation” (Gravetter & Wallnau, 1996, p.510). As described earlier, unrepresentative cases (outliers) were extricated from the sample.

The second four hypotheses were investigated using hierarchical, multiple regression analysis across each measure of academic productivity. Hierarchical, multiple regression analysis allowed for the unique influence of each input on the dependent variable to be measured in a systematic manner. The standard scores on the English-language arts and mathematics tests of the GEE were the measures of academic productivity used in each production function model. These models attempted to control for the influence of the exogenous factor and community type in order to determine the impact of increased human resource expenditures with and without the inclusion of the Level 3 subsidy. Human resource expenditures were targeted specifically at those costs associated with instructional salaries. All expenditure data was reported by calculating per-pupil estimates to control for the effects of school size.
Bivariate Correlation Analyses

Hypothesis 1: Exogenous influences will be negatively correlated with academic productivity levels (Graduate Exit Examination scores) during AY 95-96 and AY 97-98. Pearson product-moment correlation coefficients were significantly negative (p < .01, one-tailed) across both academic years in the study and across both dependent variables. The exogenous factor during AY 95-96 produced negative correlation values (r) of -.793 for English-language arts and -.725 for mathematics. This relationship continued to exist in AY 97-98 as the exogenous factor produced a negative r value of -.787 for English-language arts and -.694 for mathematics. These data provide evidence in support of Hypothesis 1.

Hypothesis 2: Community type will be positively correlated with academic productivity levels during AY 95-96 and AY 97-98. Pearson product-moment correlation coefficients were significantly positive (p < .01, one-tailed) across both academic years in the study and across both dependent variables. During AY 95-96, community type produced positive correlation values of .468 for English-language arts and .372 for mathematics. This relationship continued to exist in AY 97-98 as the community-type input produced a positive r value of .335 for English-language arts and .289 for mathematics. Although the level of significance did not reach that of the exogenous factor, these data do provide evidence in support of Hypothesis 2.

Hypothesis 3: Human resource expenditures (per-pupil) for instructional salaries exclusive of the Level 3 subsidy will be positively correlated with academic productivity levels during AY 95-96 and AY 97-98. Pearson product-moment correlation coefficients were not significantly positive (p < .01, one-tailed) across the
dependent variables for either AY 95-96 or AY 97-98. During AY 95-96, human resource expenditures produced positive correlation values of .041 for English-language arts and .064 for mathematics. This relationship continued to exist in AY 97-98 as the human resource expenditure input produced positive r values of .050 for English-language arts and .075 for mathematics. These data did not provide evidence in support of Hypothesis 3.

Hypothesis 4: Human resource expenditures (per-pupil) for instructional salaries inclusive of the Level 3 subsidy will be positively correlated with academic productivity levels during AY 97-98. Pearson product-moment correlation coefficients were not significantly positive (p < .01, one-tailed) across the dependent variables for AY 97-98. During AY 97-98, human resource expenditures inclusive of the Level 3 subsidy produced positive correlation values of .054 for English-language arts and .078 for mathematics for those selected 10th grade test-takers. These data did not provide evidence in support of Hypothesis 4.

Hierarchical Regression Analyses

Hypothesis 5: Exogenous influences will explain a significant proportion of the variance in academic productivity during AY 95-96 and AY 97-98. Regression analysis suggests that the exogenous factor produced significant (p < .01) Beta values and accounted for the largest portion of the variance across the dependent variables. Tables 12 through 15 summarize the findings from these data. The exogenous factor accounted for 62.9% (R² = .629) of the variance in English-language arts scores and 52.6% (R² = .526) of the variance in mathematics scores of those selected 10th grade test-takers during AY 95-96. During AY 97-98, the exogenous factor accounted for 62.0% (R² =
of the variance in English-language arts scores and 48.1% ($R^2 = .481$) of the variance in mathematics scores of those selected 10th grade test-takers. These data provide evidence in support of Hypothesis 5.

**Hypothesis 6:** Community type will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences has been accounted for during AY 95-96 and AY 97-98. Regression analysis suggests that the community-type input produced significant ($p < .01$) Beta values and accounted for a significant portion of the variance across the dependent variables once the variance accounted for by the exogenous factor had been taken into consideration. Tables 12 through 15 summarize the findings from these data. The community-type input accounted for 6.20% ($R^2 = .062$) of the variance in English-language arts scores and 2.90% ($R^2 = .029$) of the variance in mathematics scores of those selected 10th grade test-takers during AY 95-96. During AY 97-98, the community-type input accounted for 2.50% ($R^2 = .025$) of the variance in English-language arts scores and 1.70% ($R^2 = .017$) of the variance in mathematics score of those selected 10th grade test-takers. These data provide evidence in support of Hypothesis 6.

**Hypothesis 7:** Human resource expenditures (per-pupil) exclusive of the Level 3 subsidy for instructional salaries will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences and community type have been accounted for during AY 95-96 and AY 97-98. Regression analysis suggests that human resource expenditures (per-pupil) exclusive of the Level 3 subsidy for instructional salaries did not produce either significant ($p < .01$) Beta values or account for a significant portion of the variance across the dependent variables.
Tables 12 through 15 summarize the findings from these data. After variance for exogenous influences and community type were accounted for, the human resource expenditure input accounted for only .20% ($R^2 = .002$) of the variance in English-language arts scores and .50% ($R^2 = .005$) of the variance in mathematics scores during AY 95-96. During AY 97-98, the human resource input accounted for only .10% ($R^2 = .001$) of the variance in English-language arts scores and .30% ($R^2 = .003$) of the variance in mathematics scores of those selected 10th grade test-takers. These data do not provide evidence in support of Hypothesis 7.

**Hypothesis 8:** Human resource expenditures (per-pupil) inclusive of the Level 3 subsidy for instructional salaries will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences and community type have been accounted for during AY 97-98. Regression analysis suggests that human resource expenditures (per-pupil) inclusive of the Level 3 subsidy for instructional salaries did not produce either significant ($p < .01$) Beta values or account for a significant portion of the variance across the dependent variables. After the variance for exogenous influences and community type were accounted for, the human resource expenditure inclusive of the Level 3 subsidy accounted for only .20% ($R^2 = .002$) of the variance in English-language arts scores and .30% ($R^2 = .003$) of the variance in mathematics scores of those selected 10th grade test-takers during AY 97-98. These data did not provide evidence in support of Hypothesis 8. Tables 12 through 15 summarize the findings from these data. These tables provide information regarding the standardized beta values (β), coefficient of determination ($R^2$), change in the coefficient of determination ($\Delta R^2$), and the F-statistic (F) associated with each input.
Table 12

Summary of Hierarchical Regression Analysis for Production Function Model 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>R²</th>
<th>ΔR²</th>
<th>E (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Exogenous Factor</td>
<td>-.793</td>
<td>.629</td>
<td>--</td>
<td>498.770 (1, 294)</td>
</tr>
<tr>
<td>Step 2. Exogenous Factor</td>
<td>-.718</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community type</td>
<td>.260</td>
<td>.691</td>
<td>.062*</td>
<td>58.966 (1, 293)</td>
</tr>
<tr>
<td>Step 3. Exogenous Factor</td>
<td>-.719</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community type</td>
<td>.259</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructional salaries (per-pupil)</td>
<td>.044</td>
<td>.693</td>
<td>.002</td>
<td>1.840 (1, 292)</td>
</tr>
</tbody>
</table>

* p < .01 (one-tailed)

Table 13

Summary of Hierarchical Regression Analysis for Production Function Model 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>R²</th>
<th>ΔR²</th>
<th>E (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Exogenous Factor</td>
<td>-.725</td>
<td>.529</td>
<td>--</td>
<td>325.832 (1, 294)</td>
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<tr>
<td>Step 2. Exogenous Factor</td>
<td>-.672</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community type</td>
<td>.177</td>
<td>.554</td>
<td>.029*</td>
<td>18.825 (1, 293)</td>
</tr>
<tr>
<td>Step 3. Exogenous Factor</td>
<td>-.675</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community type</td>
<td>.175</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructional salaries (per-pupil)</td>
<td>.069</td>
<td>.559</td>
<td>.005</td>
<td>3.124 (1, 292)</td>
</tr>
</tbody>
</table>

* p < .01 (one-tailed)
Table 14

Summary of Hierarchical Regression Analysis for Production Function Model 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$F$ (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Exogenous Factor</td>
<td>-.787</td>
<td>.620</td>
<td>--</td>
<td>478.970 (1, 294)</td>
</tr>
<tr>
<td>Step 2. Exogenous Factor</td>
<td>-.750</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Community type</td>
<td>.161</td>
<td>.644</td>
<td>.025*</td>
<td>20.331 (1, 293)</td>
</tr>
<tr>
<td>Instructional salaries</td>
<td>.023</td>
<td>.645</td>
<td>.001</td>
<td>.442 (1, 292)</td>
</tr>
<tr>
<td>Instructional salaries w/ subsidy</td>
<td>.024</td>
<td>.646</td>
<td>.002</td>
<td>.459 (1, 292)</td>
</tr>
</tbody>
</table>

* $p < .01$ (one-tailed)

Table 15

Summary of Hierarchical Regression Analysis for Production Function Model 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$F$ (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Exogenous Factor</td>
<td>-.694</td>
<td>.481</td>
<td>--</td>
<td>272.899 (1, 294)</td>
</tr>
<tr>
<td>Step 2. Exogenous Factor</td>
<td>-.662</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Community type</td>
<td>.135</td>
<td>.499</td>
<td>.017*</td>
<td>10.114 (1, 293)</td>
</tr>
<tr>
<td>Instructional salaries</td>
<td>.052</td>
<td>.501</td>
<td>.003</td>
<td>1.549 (1, 292)</td>
</tr>
<tr>
<td>Instructional salaries w/ subsidy</td>
<td>.051</td>
<td>.501</td>
<td>.003</td>
<td>1.523 (1, 292)</td>
</tr>
</tbody>
</table>

* $p < .01$ (one-tailed)
Summary

This chapter provided information about the final sample and those statistical procedures used to test eight hypotheses. Bivariate correlation analyses were used with four hypotheses producing mixed results. Hypotheses 1 and 2 were confirmed, while Hypotheses 3 and 4 could not be supported. Exogenous influences and community type were significantly (p < .01, one-tailed) correlated with the dependent variable in all production function models. Human resource expenditures measured using per-pupil costs for instructional salaries with and without the presence of the Level 3 subsidy were not positively correlated with the dependent variable in any of the production function models. When the results from the bivariate analyses were compared across years, positive correlation coefficients for the expenditure input increased but did not reach a level of significance.

The production function models used hierarchical, regression analysis to control for exogenous influences and community type, then measured the impact of human resource expenditures, with and without the Level 3 subsidy, on academic productivity. Academic productivity was the dependent variable measured using the standard scores of students on the English-language arts and mathematics tests of the GEE. All student-level data was aggregated at the school-level, which was the unit of analysis for this study.

The results from the four production functions (Models 1-4) provided no evidence that per-pupil expenditures for instructional salaries, with and without the addition of the Level 3 subsidy, influenced the academic productivity of secondary schools. The exogenous factor produced significant (p < .01) Beta values and
accounted for a majority of the variance in all models. These data provided support for Hypothesis 5. Community type produced significant (p < .01) Beta values with $R^2$ values ranging from .017 to .062 after the variance accounted for by the exogenous factor was considered. These data provided support for Hypothesis 6. Human resource expenditures exclusive of the Level 3 subsidy did not produce significant Beta values and did not account for a significant portion of the variance in any of the models. These data provided no support for Hypothesis 7. Human resource expenditures inclusive of the Level 3 subsidy did not produce significant Beta values for AY 97-98. The $R^2$ values did not change for the human resources expenditures input with the addition of the Level 3 subsidy in either Model 3 or Model 4, thus Hypothesis 8 could not be supported.
CHAPTER 5
RESTATEMENT OF THE RESEARCH PROBLEM

This study questions whether or not the current finance policy of using a supply-side subsidy for human resource expenditures has had a positive effect on the academic productivity of secondary schools in Louisiana. Beginning in AY 1997, Louisiana's MFP has included a state-sponsored subsidy for instructional salaries known as Level 3 funding. This funding is categorized as a subsidy because local educational agencies are not required to provide revenues using locally generated funds to support the increased salary costs. In general, governmental agencies have used supply-side subsidies to correct for the underallocation of resources by providing revenues to producers. As revenues are allocated through the subsidy, economy theory states that the supply curve will shift downward. This action moves the consumers' demand for goods and services to an optimum level without increasing those associated costs to producers.

One rationale for the state to use a subsidy-based policy stems from the assumption that those investments will increase the overall quality of the instructional labor market, thus improving the academic productivity of schools. Spillover effects from the use of subsidies in education can be expressed by those social and private benefits assumed to be resulting from students' consuming quality educational services (McConnell & Brue, 1993; Solmon, 1987). For example, private benefits can be measured by higher lifetime incomes (Ribich & Murphy, 1975) while social benefits can be expressed by less participation in welfare and unemployment-type programs (Cohn & Geske, 1990).
From a cost-effectiveness perspective, the use of the Level 3 subsidies could be argued as an economically viable policy if the state's objective is to increase academic productivity once other alternatives have been investigated. Geske (1979) states "The purpose of cost-effectiveness analysis is to aid the decision-maker in choosing among feasible alternatives on a basis of least cost and greatest effectiveness" (p.453). The question arises whether or not the Level 3 subsidies or other alternative methods of increasing instructional salaries should be used in decision-making activities focused on improving academic productivity.

Historically, productivity studies have provided limited information regarding the impact of state-sponsored subsidies for instructional salaries. Educational researchers continue to debate the impact per-pupil expenditures have on the academic productivity of schools. Most studies using a production function model have found increased per-pupil expenditures have had no positive, systematic impact on the academic productivity of schools (Hanushek, 1981; Levin, 1974). Regardless of these findings, human resource expenditures (per-pupil) for instructional salaries in this study increased from $2,318 in AY 95-96 to $2,680 in AY 97-98. The inclusion of the Level 3 subsidy increased the over-all per-pupil instructional expenditures to $2,758 by AY 97-98, an increase of 16% from AY 95-96. This increased spending for instructional salaries appears to follow a national trend, which has seen significant increases in per-pupil expenditures since the 1970s (Levin, 1989b; Walberg, 1994).

Summary of Methods

This study investigates the impact of the Level 3 subsidy for instructional salaries on the academic productivity of secondary schools in Louisiana. Using the
Education Production Process under School Conditions as a framework (Rossmiller & Geske, 1977), inputs and the targeted output were organized for use with an educational production function. Three exogenous inputs exhibited high levels of intercorrelation. A factor analytic technique controlled this intercorrelation among inputs by combining these variables into one representative factor. Prior to using hierarchical, regression analysis within the production function models, bivariate correlation analyses tested the first four hypotheses. The results of these analyses provided useful insight into how selected inputs would affect the dependent variable.

Four production function models using hierarchical, regression analyses tested the four hypotheses outlined in Chapter 1. This analytical technique systematically accounted for the unique variance of the exogenous factor and community type inputs on the dependent variable. Once the variance from the aforementioned inputs was accounted for, the impact of the treatment on the dependent variable could be ascertained. The results of these analyses provided strong evidence suggesting the treatment had no significant impact on the dependent variable.

Summary of Findings

The exogenous factor combined three variables (% poverty, % retesters, % minority) to produce a factor regression score for each school in the sample. Bivariate correlation analyses using the exogenous factor produced significant (p < .01) coefficients of correlation (r) for both measures of academic productivity (English-language arts and mathematics standard scores). The four r values had coefficients ranging between -.694 and -.793, suggesting a significantly negative relationship with the dependent variable. Once placed in each production function model, the exogenous
factor produced significant (p < .01) Beta values ranging between -.662 to -.793 and accounted for a majority of the variance in the dependent variable.

Community type was a proxy developed by the National Center for Educational Statistics to classify the population density of local communities where schools are geographically located. Bivariate correlation analyses using the community-type input produced significant (p < .01) coefficients of correlation for both measures of academic productivity. The four r values had coefficients between .289 to .468, suggesting a significantly positive relationship with the dependent variable. Placed in each production function model after the exogenous factor input, this input produced significant (p < .01) Beta values ranging from .033 to .260. Additionally, this input accounted for a significant portion of the variance in the dependent variable after the exclusion of variance accounted for by the exogenous factor.

The human resource expenditures input focused exclusively on those allocated expenditures for instructional salaries with and without the addition of a Level 3 subsidy. These instructional expenditures were divided by the adjusted student membership of each school as a method of controlling for school size. During AY 97-98, the instructional salaries input was computed with and without the inclusion of the Level 3 subsidy. Bivariate correlation analyses using the human resource expenditure input did not produce significant (p < .01) coefficients of correlation for either measure of academic productivity. The four r values were between .041 and .075, suggesting this input had no significantly positive relationship with the dependent variable. Bivariate correlation analyses using the human resource expenditure input inclusive of the Level 3 subsidy did not produce significant (p < .01) coefficients of correlation with
either measure of academic productivity. In AY 97-98, the two r values had coefficients of .054 and .078 suggesting the human resource expenditure input inclusive of the Level 3 subsidy had no significantly positive relationship with the dependent variable.

Entered into each production function model after the exogenous factor and community-type inputs, the human resource expenditure input exclusive of the Level 3 subsidy did not produce significant (p < .01) Beta values. These Beta values ranged from .023 to .069 and did not produce significant coefficients of determination (R²). The human resource expenditure input inclusive of the Level 3 subsidy was entered into production function Models 3 and 4 to test Hypothesis 8. This hypothesis states that human resource expenditures (per-pupil) inclusive of the Level 3 subsidy for instructional salaries will explain a significant proportion of the variance in academic productivity after the variance explained by exogenous influences and community type have been accounted for during AY 97-98.

After the variance accounted for by the exogenous factor and community-type inputs was addressed, the human resource expenditure input inclusive of the Level 3 subsidy was entered into Models 3 and 4, which subsequently produced Beta values of .024 and .051. These Beta values were not significant at p < .01 and did not support Hypothesis 8. No significant change was observed in the R² values from the inclusion of the Level 3 subsidy with the human resource expenditure input.

Conclusions and Discussion

Results from the birivariate and regression analyses suggest that social, economic and demographic inputs significantly impacted the dependent variable. These findings
appear consistent with those of earlier productivity studies (Coleman et al., 1966; Jencks & Brown, 1975; Summers & Wofle, 1977). As outlined by the EPPSC framework (Rossmiller & Geske, 1977), these non-school influences are, for the most part, beyond the reasonable control of school personnel; however, they significantly influence the performance of students on standardized achievement tests (Fowler & Walberg, 1991; Harter, 1999; MacPhail-Wilcox & King, 1986; Okagaki & Frensch, 197-98). In each of the four production function models, the $R^2$ values for the exogenous factor and community-type inputs accounted for at least 50% of the variance in the dependent variable. These findings continue to provide evidence that non-school influences significantly impact the academic productivity of schools.

These data suggest that the increases in human resource expenditures from AY 95-96 to AY 97-98 have not significantly improved the academic productivity of secondary schools in the sample, ceteris paribus. The instructional salary input, exclusive of the Level 3 subsidy, did not account for more than .5% of the variance in each production function model. In Models 3 and 4, the inclusion of the Level 3 subsidy with the instructional salary input did not increase the variance that could be explained in the dependent variable. This finding appears to support Hanushek’s (1981) statement that no systematic pattern exists between per-pupil expenditures and students’ performances on standardized achievement tests. Further, these data suggest the Level 3 subsidy has had no systematic, positive impact on the academic productivity of secondary schools in Louisiana, ceteris paribus.

In summary, the findings from this study provide continuing evidence that non-school factors significantly impact the academic productivity of schools. The increases
in human resource expenditures for instructional salaries have not improved the
academic productivity of secondary schools. Based on the data, the state’s use of the
Level 3 subsidy to shift the supply curve downward has been unsuccessful. No
evidence suggests the benefits schools receive from instructional costs shifting to a third
party (the State) has positively affected their ability to increase academic productivity.

Discussion

This study suggests that in terms of academic productivity: (a) no significant
relationship exists with human resource expenditures for instructional salaries, (b)
increases in human resources expenditures for instructional salaries have had no
significant impact on the sample, and (c) the Level 3 subsidy has had no significant
impact on Louisiana’s secondary schools. The educational finance policy in Louisiana
continues to increase expenditures for instructional salaries, with a small portion being
subsidized directly by the State. This policy of increased expenditures for education
continues to be a national trend, although academic productivity of schools has
remained relatively constant. For example, the average standard score on the
mathematics test of the GEE for a majority of secondary schools (n = 296) in Louisiana
was 1055.16 in AY 95-96 and 1055.61 in AY 97-98. This change represents a positive
increase of .04%. The average standard score on the English-language arts test of the
GEE was 1060.54 in AY 95-96 and 1061.03 in AY 97-98, which represents a positive
increase of .05%. These findings suggest academic productivity has remained relatively
constant from AY 95-96 to AY 97-98.

The small changes in mean standard scores as compared to the 16% increase in
human resource expenditures are representative of the entire state because the large
sample (n =296) approximated the target population. Although some of the increased costs for instructional salaries were subsidized through Level 3 funding, these data suggest the supply-curve may be shifted downward but without a positive impact in the producer's ability to increase productivity. The lack of change in productivity may be a result of threshold effects. Bridge, Judd and Moock (1979) define a threshold effect as the input levels necessary for a change to appear on a targeted output. Assuming a direct scalar relationship exists between the per-pupil costs for instructional salaries inclusive of the Level 3 subsidy and academic productivity, an increase of one standard score point in the state's mean level of academic productivity would cost approximately $880 per-pupil. This estimate is based on data that suggests a half point increase in the average standard score was associated with a $440 increase in per-pupil expenditures for instructional salaries from AY 95-96 to AY 97-98. The prohibitive costs associated with attempting to reach a threshold point necessary for a significant change in the state's level of academic productivity may be beyond the capacity and willingness of the taxpayers.

The threshold effect rationale in educational settings should not be applied because a causal relationship between fiscal inputs and measures of academic productivity has not been established. The marginal-production-of-labor (MPL) axiom posits that additional increases in the amount of labor should positively affect the output; however, the Law of Diminishing Marginal Returns implies a threshold will be reached by which increased inputs fail to produce equivalent changes on the targeted output, ceteris paribus. A counter-hypothesis to the threshold effect rationale would be that a point of diminishing returns has been reached in regards to expenditures for

140
instructional salaries. This counter-hypothesis suggests the point at which the last dollar spent can produce equivalent amounts of output (Cohn & Geske, 1990) has been reached and further expenditures will yield diminishing returns. Hanushek (1997) has suggested school administrators are not motivated to operate their schools in the most efficient manner, thus operating far from the production frontier. Because of the lack of efficiency and incentives to operate schools from an econometric perspective, the possibility of locating an expenditure threshold for human resources is diminished.

The lack of efficiency in mixing human and material resources in the production of educational services may be a result of the system controls placed upon administrators. Rossmiller & Geske (1977) describe system controls as those regulations and restrictions dictated to school personnel by state departments of education, the judiciary, and other governmental agencies that reduce the efficiency levels of schools. For example, the Level 3 subsidy mandates that local educational agencies spend these state funds on instructional salaries. This requirement reduces the ability of administrators to select other inputs that may have a greater impact on academic productivity such as reducing a school's size (Felter, 1989) or increasing the academic day, thus increasing the time (Mumane, 1981) students are engaged with the curricula. Unfortunately, the lack of econometric training (Hanushek, 1997) and an unwillingness to develop school intervention programs to reduce educational wastage (Loxely, 1987; Reyes & Capper, 1991) combined with system controls stagnates efforts to increase academic productivity.

The discretionary control students have in the production of learning directly impacts the level of technical efficiency possible by schools. Efficiency levels at
schools are worsened as students experience academic failure (Brookover et al., 1978; Levin, 1989a) and become disenfranchised with the production of learning. Although larger schools sizes should increase efficiency as scale economies are improved, some research suggests this practice is negatively correlated with student learning (Felter, 1991; Fowler & Walberg, 1991). The increase of school size through centralization of production increases scale economies (Verstegen, 1990), yet this procedure is also subject to the law of diminishing returns. Scale economies will improve throughout centralization until such a point that academic productivity begins to regress.

Data from community type input suggests schools in large and mid-size urban areas have schools with large (n > 750) student memberships. Large urban areas have the lowest levels of academic productivity and by AY 97-98 the lowest per-pupil expenditures for instructional salaries inclusive of the Level 3 subsidy. Schools located on the fringe of large urban areas spent more for instructional salaries than other communities by at least $300 per-pupil during AY 95-96 and AY 97-98.

These spending increases did not result in higher levels of academic productivity, because the data showed the average school in rural communities outperformed all others on each measure of academic productivity. A Means Plot produced by SPSS 8.0 revealed that on average, academic productivity of schools increased systematically as community type moved from urban to rural. Additionally, expenditure data from wealthy communities did not suggest higher levels of academic productivity were being attained than those communities with lower per-pupil expenditures for instructional salaries, which may be a direct result of diminishing returns due to a curvilinear production function (Kiesling, 1967).
Policy Implications

The use of the Level 3 subsidy with increased expenditures for instructional salaries to positively effect the academic productivity of secondary schools in Louisiana has simply not worked. The supply-curve has been slightly shifted downward as producers have benefited from the Level 3 subsidy by not having to utilize local revenues to pay for increased instructional salaries. No evidence was found to suggest the benefits received by producers has improved the academic productivity of secondary schools. Schools continue to be adversely impacted by non-school influences; however, human resource expenditure increases have not improved the level of academic productivity in secondary schools.

The low-levels of academic productivity in Louisiana may be generating unwanted externalities to local communities in the form of having fewer educated persons able to competitively enter the labor market. Unwanted externalities, also known as spillover costs, result when the costs of production are foisted upon a third party (McConnell & Brue, 1993). Schools shift the market demand curve downward as the costs associated with providing educational services (production) become lowered through decreased attendance rates and increased dropout rates. Empirical studies have shown that lifelong earnings are positively associated with consumption of educational services (Jorgenson & Fraumani, 1989; Levin, 1989a; Miller, 1998; Murphy & Welch, 1989). The inability to compete actively in the labor market can result in increased levels of crime, welfare, and unemployment. This “cycle of poverty” is most likely having adverse intergenerational effects on efforts to increase academic productivity. These intergenerational effects can be inferred from the findings of this study, as the
most influential factors on all measures of academic productivity were external school-related inputs.

The spending policies of Louisiana continue to be based upon politics and pseudo-research rather than evidence from cost-effectiveness studies. The continued emphasis on reducing teacher-pupil ratios is one example of policy driven by politics rather than research. Scale economies for state mandated reductions in class size has increased instructional costs to local educational agencies although little empirical evidence has found this policy to have a positive impact on student learning (Bloom, 1983; Odden, 1990; Hanushek, 1986; Witte & Walsh, 1990).

Recently, Louisiana has invested significant fiscal and human resources in the development and implementation of a statewide, accountability program for schools and districts. This accountability program is primarily designed to measure the academic productivity of schools using testing data from standardized achievement tests. Schools are allocated performance labels within the program based mostly upon the academic productivity of each school. Specific growth targets are assigned based upon the state’s 10 and 20-year goals. Recent findings from other states have documented increased academic productivity of schools participating in accountability programs (CCSSO, 1999) suggesting fiscal investments in these type of program are positively impacting schools.

In summary, Louisiana’s policy of increased expenditures for instructional salaries has had no significant impact on the academic productivity of schools. The use of the Level 3 subsidy to shift the supply-curve downward has also not significantly affected the academic productivity of schools. The findings from this study collaborate
those of numerous productivity studies, which suggest a systematic relationship between expenditures and academic productivity does not exist. More specifically, the continued educational finance policy of using the Level 3 subsidy outlined in Louisiana's Minimum Foundation Program to positively impact the academic productivity of secondary schools is ineffective. The recent implementation of a school and district accountability program to measure academic productivity and establish improvement goals may be the incentive mechanism needed to move schools closer to the production frontier.

Study Limitations

One methodological problem inherent to research in education has been the reliance on *ex post facto* designs, as this study has done. Typically, theoretical models guide economists in research with well-defined, causal relationships established between variables. The EPPSC framework (Rossmiller & Geske, 1977) organized and guided the research process, but causal relationships between inputs and those targeted outputs were not suggested. Because a causal model concerning the production of student learning does not exist and the lack of experimental methods used in this study, causal relationships between the inputs and measures of academic productivity can only be suggested, rather than empirically supported. The use of experimental procedures necessary to establish causal relationship is rare in education. This phenomenon exists because the educational finance variables cannot be made amenable to the manipulation needed to establish a control and treatment group.

Similar to trend studies (Gall, Borg & Gall, 1996), the research design for this study established a baseline of schools during AY 95-96. The schools selected during
this baseline year remained constant across the two-year period; however, the
population of student-level test data increased. Trend study designs are used with
populations whose members do not remain constant, as is the case with student
membership rates in secondary schools. Once the data was aggregated to the unit of
analysis (school), the issue of population change across time was addressed.
Subject attrition is a phenomenon indicative to longitudinal designs as members of the
baseline sample leave prior to conducting subsequent measurements. Extensive subject
attrition can be a limiting factor in the quality of inferences made from the sample to the
target population (Tashakkori & Teddlie, 1998). Subject attrition occurred in two cases
present during AY 95-96 but not during AY 97-98 suggesting no significant threat
existed to the internal validity of this study’s findings.

The use of multivariate regression techniques allowed the researcher to control
for the effects of two inputs (exogenous factor and community type) on the dependent
variable. These inputs were proxies for the social, economic and demographic
influences effecting students and schools. Bridge, Judd and Moock (1979) have
suggested that most variables used in productivity studies are proxies because precise
measures do not exist, therefore, highly correlated indicators (Alexander & Solomon,
1995) are used to estimate latent factors. The dependent variable (academic
productivity) was measured using student performances on two tests of the GEE.
Student performances on the GEE were proxy measures of student learning. As with all
proxies used in educational research, measurement precision was reduced and error
variance increased for both variables in this study.
In summary, a number of limiting factors have increased unwanted error into the findings due to (a) the research design, (b) the use of proxies, and (c) the lack of experimentation to establish causal relationships between variables. The selection and measurement of each proxy was consistent with productivity studies conducted over the past 30 years. In light of these limitations, the internal validity of the study has not been compromised as to render spurious findings.

Future Research

The results of this study failed to provide supportive evidence that increases in human resource expenditures for instructional salaries with and without the inclusion of the Level 3 subsidy has increased the academic productivity of secondary schools. Educational finance researchers (Berne, Moser, Stiefel & Goertz, 1997; Busch & Odden, 1997; Kazal-Thresher, 1993; Monk, 1997) have advocated the use of student-level performance data aggregated to the school-level. Moving the unit of analysis away from more complex units (e.g. district or state) increases the pragmatics of a study’s findings. The ability to electronically manage large, complex databases by state departments of education and moving the unit of analysis closer to the student-level (Picus, 1997) will reduce confounding influences and improve the quality of research findings.

Research using inputs from classroom-level data in an educational production function may provide a less ambiguous understanding of how human and material resources are mixed to produce educational services. Cost-effectiveness studies using the classroom as the unit of analysis could provide detailed information on those expenditures required to impact identified outputs. This based on the fact that the
classroom is the area where a majority of all educational services are produced for student consumption and has the greatest potential for improving efficiency levels. Research investigating how technical efficiencies (Monk, 1981) in classrooms can be improved has the potential to move schools closer to the production frontier (Geske & Teddlie, 1990; Monk, 1989). Most economists and educational researchers agree schools are not operating in an efficient manner and few are attempting to move closer to the production frontier. This phenomenon may exist because school personnel (a) do not understand how the demand curve operates (Katzman, 1971), (b) do not have adequate incentives (Hanushek, 1997), or (c) do not receive feedback regarding the production process (Rossmiller & Geske, 1977).

The focus of the judiciary regarding educational finance has been on issues of equity and adequacy rather than efficiency (Dunn, 1999; Mullin, 1982). Further, educational research has provided little empirical insight in those practices that are reducing the academic productivity of schools. Research in the future should focus on improving how scarce resources are mixed in the classroom, thus reducing inefficient and unproductive practices. As accountability programs become more prevalent throughout the nation, research into establishing accountability programs at the classroom-level should be explored.
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VITA

John Paul Beaudoin is currently an Educational Specialist in the Division of School Standards, Accountability, and Assistance at the Louisiana Department of Education. He served in the United States Air Force in Europe during the Cold War, followed by the United States Army and the Louisiana Army National Guard. After receiving a bachelor of science degree from Louisiana State University with a major in special education, Mr. Beaudoin taught at Jordan High School in Long Beach, California. Concurrently, Mr. Beaudoin opened a tutoring company in Baton Rouge, Louisiana, known as Research in Action, Inc. In 1993, Mr. Beaudoin return to Louisiana to operate Research in Action and subsequently completed his master of education degree at the University of Southwest Louisiana in Educational Administration and Supervision. As an employee of the Lafayette Parish School Board, Mr. Beaudoin taught at the W. D. Smith Career Center in a program for emotional and behavioral disordered high school students. Mr. Beaudoin was admitted to the doctoral program at Louisiana State University in December of 1996 and subsequently completed the course requirements three years later. During a majority of his tenure as a doctoral candidate, Mr. Beaudoin taught 4th and 5th Grade at Walker Elementary School under the auspices of the Livingston Parish School Board. Mr. Beaudoin’s professional memberships include the American Educational Research Association and the Council for Exceptional Children.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate:    John Paul Beaudoin

Major Field: Educational Administration

Title of Dissertation: The Impact of Human Resource Expenditures and the Minimum Foundation Program's Level 3 Subsidy on Academic Productivity in Louisiana

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

December 6, 1999