This thesis examines indirect institutional discrimination in Ohio’s public schools. Student SES and teaching resources influence student achievement. Federal, state, and local tax revenues purchase institutional resources in America’s public schools. Local property tax revenue is a major source of income in Ohio public schools. Disparity in community property tax revenue results in unequal funds for public schools. Using path analysis I examined the direct and indirect effects of student SES and institutional resources on percentage of students passing the proficiency exams. In this thesis I introduced a label, indirect institutional discrimination, in the examination of property wealth based public school funding systems. Federal revenue, in comparison to state and local revenue, has a significant effect on proficiency test scores. Future research should examine subgroups selected by student SES to further explore the differential effects of federal, state, and local revenue on teaching resource variables and proficiency test scores.
An Examination of the Effects of Student SES, School Funding, and Teaching Resources on Test Scores among Ohio High School Students

A thesis submitted to Kent State University in partial fulfillment of the requirements for the degree of Master of Arts

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Chapter I

INTRODUCTION

In this thesis I examine the effects of student SES, school funding and teaching resources on test scores among Ohio high school students using the 2000 Ohio Report Card District Data. Researchers and policy makers traditionally place the blame of poor student achievement solely on student socioeconomic status (SES) (Baker, 1991). The significance of student SES in student achievement research has been used to justify discriminatory public school funding policies (Baker, 1991). Studies using student SES find that regardless of the total amount spent on education, student SES has the strongest influence on student achievement (Coleman, 1966; Jencks, 1972; Hanushek, 1986; Nyhan and Alkady, 1999). Policy makers conclude that monetary input fails to influence student achievement and increasing spending in public schools is unnecessary (Baker, 1991). With this conclusion, policy makers fail to acknowledge that student achievement has also been found to be significantly influenced by institutional level resources such as, pupil teacher ratio (Greenwald, Hedges, and Laine, 1994; Ferguson and Ladd, 1996; Wenglinsky, 1997), teacher certification (Ferguson, 1991; Darling-Hammond, 2000), and teacher salary (Ferguson, 1991; Greenwald, Hedges, and Laine, 1994; Harter, 1999). I also include school funding in my model to examine the effect of the amount of funding on the ability of school districts to purchase institutional resources.
The amount of school funding invested in schools influences institutional resources (Harter, 1999). Wealthier districts are able to invest more money in their public schools than lower income districts (Hartman, 1994). I will test whether student SES, institutional resources, or their combination influence student achievement.

The Coleman Report (1966) was the first extensive national study to investigate the effects of inequality in U.S. public schools. Coleman and his associates compared schools by averaging students' standardized test scores and evaluating the variance in student achievement. While some of the variance was explained by school characteristics, student SES was found to be the most influential predictor of student achievement. Student SES was measured by student characteristics. Student characteristics included percentage of students with fathers employed in white-collar occupations, average number of student's whose parents had a high school or higher level of education, and average number of students with encyclopedias in the home. This student SES measure did not include income. While Coleman and subsequent researcher used student SES as a measure the aggregate data represents community SES. I will use aggregate data in my study and use the traditional term student SES to represent community SES.

Coleman's influence in this area of research continues today. While Coleman concluded that student SES is the strongest predictor of student achievement, he also found that institutional resources such as teacher quality, influence student achievement. Specifically, institutional resources have the most profound effect on disadvantaged students. While Coleman did not examine the effects of school funding on the
purchasing of valuable institutional resources he did find that disadvantaged students are more likely to attend lower quality schools. The same students he concluded would benefit from higher school quality. The following question persists. Why are disadvantaged students more likely to attend to low quality schools? I propose that in Ohio the reason can be found in the public school funding formula. While not intentionally producing differential effects on student achievement it contributes to negative impact that may be deemed discriminatory.

Discrimination is the process through which dominant group members negatively treat minority group members. Group membership may be based on gender, race/ethnicity, and or social class. In sociological literature, the concept institutional discrimination is used to describe discriminatory practices at the organizational level. Institutional discrimination is differential treatment based on race, gender, or socioeconomic status embedded in practices, policies, and procedures. The negative effects of the embedded inequality may or may not be deliberate. I will be testing Ohio public school data to examine the influence of student SES, public school funding, and institutional resources on student achievement.

There are three funding sources that I will be examining. Public schools receive funding from federal, state, and local revenue. As depicted in the Ohio Public School Foundation Formula (Figure 1.1 p. 4), school funding is most reliant on state and local funding. Because of this, disadvantaged communities may have less to contribute in the purchase of higher school quality.
Step 1: Base Cost = Foundation * ADM * CODBF
Step 2: Local Share = Property Valuation * Charge-off Millage
Step 3: State Share = Cost of Adequate Basic Education - Local Share

Figure 1.1. Ohio Public School Funding Foundation Formula.

The school funding formula used in Ohio to determine the State’s contribution to public school districts is computed in the following manner (Stabile, 2001). First, the Foundation amount, or base cost for adequate basic education per pupil, is multiplied by the average daily membership multiplied by the cost of doing business factor (Foundation * ADM * CODBF). The Foundation base cost per pupil is the amount of money the state guarantees for each student to ensure an adequate basic education. For the 1998 fiscal year the Foundation amount was $3,851 (Zahn and Newman, 1999). The 2005 foundation amount is $5,169. The average daily membership is based on the number of students attending school in the district. Students are weighted differently according to specific categories. Kindergarteners weighted as 0.5, first through twelfth graders equal one, and vocational students are weighted as 0.25. Students with disabilities are provided additional weights ranging from 0.22-3.01. The cost of doing business factor is used to account for regional expenditure differences. It is calculated by the state every two years based on the weekly wage of hourly workers for each county. The next step in calculating the state contribution to public school districts involves calculating the local share by multiplying the community's property valuation by the charge-off millage (Property Valuation * Charge-off Millage). The property valuation represents the value of real estate property in the school district. The charge off is the amount local districts
must contribute. This amount is raised by school levies. The final step is the calculation of the state's contribution to public school districts. This is done by subtracting the local share from the total base cost of adequate basic education (State Share = Cost of Adequate Basic Education - Local Share).

The local share portion of the formula represents community ability to invest in public schools. An inter-district disparity exists in Ohio. This disparity is observable in the different funding amounts each school district receives. During 1998, the school district with the highest median income was Ottawa Hills ($61,222) (Ohio Department of Taxation, 1998). New Boston had the lowest median income ($15,820). Ottawa Hills received $56 revenue, $1,463 state revenue, and $6,662 local revenue, totaling $8,182 per pupil. New Boston received $963 federal revenue, $3,399 state revenue, and $1,861 local revenue, totaling $6,224 per pupil. Proficiency test performance varied between these two school districts. Of the Ottawa Hills 9th graders 97.5% passed the citizens proficiency, 97.5% passed the math proficiency, 98.5% passed the reading proficiency, and 98.5% passed the writing proficiency. Of the New Boston 9th graders 76.4% passed the citizen proficiency, 75.7% passed the math proficiency, 84.1% passed the reading proficiency, and 78.9% passed the writing proficiency.

The increasing importance in high-stakes testing threatens resources and rewards as well. New policies threaten to cut off federal and state funds to schools that fail to raise standardized test scores. Given the increasing demands on students to achieve, it is necessary to search for the most effective factors that have an impact on student achievement.
Funding

Federal, state and local tax dollars fund America's public schools. Local property taxation is the main source of public school funds in every state but Hawaii. In Ohio, a Foundation plan is in effect to monitor the funding of the public school system. Foundation plans are the most widely used funding program in the U.S. and causes inequality in the funding of public schools (Stabile, 2001). In states that use a Foundation plan, the state legislature determines the minimum dollar amount of per pupil expenditure required for an adequate education. The community is expected to meet this minimum by taxing local real estate property. The state provides additional funds to communities that are unable to meet the minimum requirement. Ohio legislation that determines type and amount of public school funding focuses on equity and adequacy. Equity is the fair allocation of funds. Adequacy is the appropriate amount of spending per student. Equity and adequacy are political decisions based on the state budget (Stabile, 2001).

The federal government provides funds for vocational and special needs students (Stabile, 2001). Funds are distributed based on needs for special education in the school district. Title 1 funds are intended for disadvantaged students from low income families. Additional federal funds may be distributed to schools with students with disabilities. The federal government funds nutritional needs as well. In Ohio, school lunches are subsidized by federal funds. Low income students may receive free breakfast and lunch paid for with federal funds. During the 1998-99 school year, federal government
contributions made up about 7 percent of school budgets across the nation (Johnson, 2001). In Ohio, the federal contribution was 5.8% (Johnson, 2001).

State funds are used to meet the minimum amount specified in the Foundation plan when local real estate property taxes fall short. This failure to meet the minimum amount is generally not due to lack of effort, but low real estate property values. Low SES communities may pay more proportionally to school property taxes but still be unable to meet the minimum state per pupil spending requirements. Compared to higher income communities, levy support is greater in low income communities (Bachelor, 2001).

Additional state funds may be distributed to public schools in the form of categorical aid (Stabile, 2001). Special, vocational and gifted education, transportation, disadvantaged pupil impact aid (DPIA) and parity aid are examples of categorical aid. Parity aid provides additional funds to public schools in low income communities. Various formulas are used to calculate the state contribution in categorical aid. For example, as the severity of a student's disability increases the weight of this student in the special education formula increases. Therefore, while a district may receive a larger state contribution of special education funds this does not always mean that this district has a larger population of students with disabilities. Categorical aid is restricted. It must be spent on the specific programs for which it is designated. During the 1998-99 school year, the national average for state contributions to primary and secondary public schools was 49%. In Ohio, the state contribution was 42.1% (Johnson, 2001).
Local property taxes are the major source of income for Ohio public schools. The local property tax enables local control of public schools. Operating levies, permanent improvement levies and bond issues are types of local funding. The spending of these types of funds are restricted. Operating levies pay for the day to day operations of schools (Stabile, 2001). This includes personnel salaries, teaching supplies, books, building repair, buses, and other costs associated with the daily operation of schools. Permanent improvement levies can only be spent on school construction, building, and school property repair. Bond issues can be used to pay additional costs of school construction and renovations. Fifty-two percent of Ohio's public primary and secondary revenue came from local and intermediate sources in 1998-99 (Johnson, 2001). The national average that local and intermediate sources contributed was 49%.

Local public schools collect funds based on a millage rate. A mill is equal to one-tenth of a cent. School districts receive one dollar for each one thousand dollars of property tax paid by community member. Voters in local school districts determine the amount of mills a school receives from the local property tax. In Ohio, school districts are required to have a twenty-mill floor minimum levy to qualify for state funding.

There are three types of mills (Stabile, 2001). The first is the inside mill. The inside millage rate is determined by the local government. Up to ten inside mills can be divided between schools and other local government agencies. The inside millage rate is not voted upon by the community members.

The second type of millage rate is the outside mill. The outside mill is proposed by the local school district and voted upon by the community members. If the
community members fail to pass the proposed outside millage rate the school is denied additional funding from the local property tax. Ohio uses outside mills in the foundation formula.

Effective mills are the final type of millage rate. Effective mills determine the actual amount of property tax collected by the local school district. The effective millage rate is the outside mill reduced by H.B. 920. H.B. 920, enacted in 1976, specifies that although property increases in value, the previously voted millage rate will not. The local public school district will receive the same amount of revenue from the year the levy was approved.

The amount of property tax an individual pays is based on the assessed valuation of his/her home (Stabile, 2001). The assessed valuation in Ohio is equal to 35% of the fair market valuation of the home. It is the county auditor's responsibility to reassess taxable property in his/her presiding county every three years. This new assessment is used to adjust the school tax rate (Wulff, 2001). During the time between reappraisals, the effective millage stays the same. While inflation and home values increase, the income to the public school system remains stagnant. After the reappraisal, if the property value has increased, the tax rate to schools is adjusted so that the revenue stays the same (Wulff, 2001). This problem, called phantom revenue, occurs when the increased value of homes does not equal the taxable value of the homes (Stabile, 2001). The state ignores the difference between outside mills and effective mills. Phantom revenue is the absence of revenue for the school district that is the result of the difference.
The property tax is stable in times of a poor economy. Incomes may be lost, but the property tax stays the same, or increases with property value. The property tax is steady income to the local public schools, but legislation decreases the benefits of this tax. Public school funding relies on community members voting in favor of school levies. It is unfortunate that so much of the burden of financing public schools is placed on the local property tax. Community members must decide between providing the students with a better education, or saving money.

The Education Tax Policy Institute (Levin & Driscoll, 2002) recently released its ten-year study of school property taxes in Ohio. It concluded that Ohio legislation has increased the role of real estate property taxation in the financing of public schools. The funding inequality in Ohio public schools persists and is increasing because the gap in property wealth between rich and poor districts is increasing. Public school funding reform is necessary to eliminate this disparity.

Legal History

The quest for equal protection, set forth by the 14th amendment of the United States Constitution, represents the struggle for equality in public schools. The Plessy v. Ferguson 1896 Supreme Court decision reinforced the acceptance of inequality in the U.S. public schools. This ruling, which established the "separate but equal principal" blatantly ignored the fact that the public schools African-Americans attended were inferior to the public schools whites attended. The 1954 Brown v. Board of Education
(U.S. Supreme Court) decision confirmed that these schools were not equal. The U.S. Supreme court finally recognized the detrimental effect of segregation.

While race was at the center of these past rulings, today social class is the main cause of inequality in education. The inequality has shifted from quality of education based on race to that of one based on class. It was declared in the 1971 Serrano v. Priest ruling by the California Supreme Court that "education may not be a function of wealth, except the wealth of the state as a whole" (Stabile, 2001 p. 68). This ruling encouraged other school finance litigation across the country. It seemed that school finance lawsuits would result in rulings in favor of equality until Rodriguez v. San Antonio Independent School District in 1973. However, the U.S. Supreme Court concluded that the financing of public schools was not covered by the equal protection clause of the 14th amendment. While discrimination in school funding is wealth-based, the U.S. Constitution does not give the federal government the power to override state and local control of the nation's public schools. Lacking the support from the federal government equal education had to be won at the state level.

The legal history of the fight for equal education in Ohio public schools began in 1979 with Cincinnati Board of Education v. Walter (Stabile, 2001). This lawsuit was filed against the state superintendent of public instruction. The Cincinnati Board of Education claimed that the public school finance system in Ohio failed to provide "thorough and efficient" funding for all Ohio schools. The Ohio State Supreme Court ruled that the inequity of the property tax based funding system did not violate the Ohio
Constitution. In Ohio, it was determined that free equal education is not a fundamental right.

Since 1991 the Ohio Coalition for Equity and Adequacy of School Funding has challenged the Ohio State Supreme Court. The courts have repeatedly ruled that the funding system for Ohio public schools is unconstitutional. DeRolph v. State of Ohio was originally filed in 1991. The first ruling in 1997 overturned the Cincinnati Board of Education v. Walter decision that the Ohio public school funding system was constitutional (The Ohio Coalition for Equity and Adequacy of School Funding, 2002). The court declared that the excessive reliance on real estate property tax and phantom revenue caused by H.B. 920 causes inter-district inequity in Ohio public schools and is, therefore, unconstitutional (Stabile, 2001). While the Coalition persists in demanding equality for all Ohio public schools, legislators appealed the 1997 decision. In 1998, legislators changed the Foundation level to $4,063 per pupil to be increased at 2.8% each year for five years. That same year voters were asked to vote for Issue 2, a 1-cent sales tax increase for public schools. Issue 2 was rejected by 80% of the voters. Voters did pass Issue 1 in 1999. Issue 1 authorizes the state to issue bonds for public school construction.

Regardless of state efforts, the inequality persists. Issues 1 and 2 failed to address the effects of the Foundation formula on per pupil revenue. The reliance on property taxes and the passage of local school levies maintained an unequal funding system. The Coalition fought for DeRolph and won again in 2000 and 2001. These rulings confirmed
that the Ohio public school funding system is unconstitutional. The Ohio Supreme Court gave the state the deadline of June 15, 2001 to resolve the funding inequity. The legislators appealed. Approaching the summer of the year 2002 Ohio public school students were still waiting for equality. On December 11th 2002 the Ohio Supreme Court ruled again that the Ohio public school funding system was in violation of the state constitution. In 2003, Governor Bob Taft formed the Blue Ribbon Task Force for Financing Student Success. The Task Force of legislators, educators, business representatives, and others met over an eighteen month period. The public school funding reform recommendations include eliminating phantom revenue and reducing the over reliance of public school funding on local property taxes (Blue Ribbon Task Force on Financing Student Success, 2005).

The Ohio State Supreme Court ruled that the current funding system does not provide a "thorough and efficient" education for all Ohio public school students. The opposition to these rulings appears to be justified on the surface. The state determines the minimum amount of per pupil expenditure. Local property tax is collected by the local public schools based on the amount each community is willing and capable of contributing. This allows for the tradition of local control of public schools to continue. Communities that are capable and willing to contribute more to the local public schools may exceed the minimum amount of per pupil expenditure. State assistance is available to communities that are unable to raise the minimum amount of per pupil expenditure. Although the court has come to recognize the resulting disparity as unfair, the legislature fails to address this institutional discrimination. The recommendations of the Blue
Ribbon Task Force indicate progress. However, it appears that more time will pass before the implementation of actual school funding reform. The Blue Ribbon Task Force recommended the formation of another committee, a School Funding Advisory Council, to address the issues reported by the Task Force.

As we have just seen, variation in type and amount of funding in Ohio that is property-tax based has been deemed unconstitutional because of the inequality that results. As such, the current system represents institutional discrimination in the distribution of resources to Ohio's public school students. The purpose of this thesis is to study the impact of SES on amount of funding by type of revenue and the resultant investment in teaching resources on the proficiency exam results of Ohio public school students. Most school finance research examines the effects of total per pupil expenditure on student achievement. I propose that the disparity in student proficiency test scores is the result of district-to-district variation in student SES. I will examine both the direct effects of student SES as well as the indirect effects of student SES mediated through state and local revenue and subsequently through pupil teacher ratio, teacher certification, and teacher salary. By examining type and amount of revenue as an alternative to total expenditure, I hope to contribute to the literature.
Institutional Discrimination

Discrimination is differential treatment based on race, gender or socioeconomic status. Harris and Bentzen (1977, p.7) described discrimination as "behaviors which disadvantage others consistently and with pervasive and often dramatic effects."

Discrimination involves defending group privileges at the expense of another group (Feagin & Feagin, 1978). Institutional discrimination is embedded in practices, policies and procedures. Certain policies, while not deliberately designed to discriminate, still have detrimental effects. Although intent to discriminate is difficult to detect it is possible to define and measure the harmful effects of differential treatment.

Early theories explained prejudice as the cause of discrimination. It was later determined that discrimination found in institutional settings may, or may not, be motivated by prejudice. As the definition of discrimination developed it began to include structural, unintended acts that produce inequality. In the 1978 book Discrimination American Style Feagin and Feagin (1978) described the "institutionalization and bureaucratization of discrimination"(p. 30). According to Feagin and Feagin it is possible to identify two types of institutional discrimination. Direct institutional discrimination is the intentional differential treatment of minorities. This differential
treatment may be blatant or subtle. Prejudiced attitudes and beliefs, or political principles to protect the dominant groups interests at the expense of minority groups, motivate direct institutional discrimination. Regardless of motivation, intent to harm is difficult to identify and measure. In more recent literature, Pincus (1996; 1999) uses the term institutional discrimination to identify direct institutional discrimination.

On the other hand, indirect institutional discrimination is unintended. This discrimination is measured by the impact of embedded discriminatory practices, policies and procedures. Although the intent to harm is missing, harmful effects exist. Pincus (1996; 1999) uses the term structural discrimination to identify indirect institutional discrimination. "The key element in structural discrimination is not the intent but the effect of keeping minority groups in a subordinate position" (Pincus, 1999, p. 122).

Although Pincus uses structural discrimination, a search of the term failed to identify any cases of it in education research. While institutional discrimination is used frequently in education research, the use of institutional discrimination in public elementary and secondary school education research is limited. Race, ethnicity and gender are the main foci of this literature (Fernandez, 1975; Guttierrez, Asato and Baquedano-Lopez, 2000; St. Charles and Constantino, 2000; Torres, 2001). St. Charles and Constantino (2000) and Guttierrez, Asato, and Baquedano-Lopez (2000) found that English speaking only policies produce institutionalized conditions for the poor academic achievement of non-English speaking students. Fernandez (1975) found that when teachers had low expectations of Latino students they failed to challenge them intellectually. This practice perpetuated the institutional discrimination of Latino students.
that reinforced their low academic achievement maintaining a structure of inequality. While Torres (2001) recommends increasing school funding and investing in teaching resources to address the low academic achievement of Latino students, his main foci is race/ethnicity. Groups differentiated by socioeconomic status are not specifically examined.

Although the specific reference to institutional discrimination in elementary and secondary public school research is limited, differential treatment and their effects on student achievement have been studied as indicated in the literature review of this thesis. The specific use of institutional discrimination was found in an article by Van Laar and Sidanius (2001). The authors discuss direct and indirect institutional discrimination in public schools. Direct (personal) discrimination includes tracking and teacher expectations based on the group membership of the students. Indirect institutional discrimination is defined as the "differential quality of schools attended by children from subordinate and dominant groups" (Van Laar and Sidanius, 2001, p. 239). Differential quality of schools exists when, for example, pupil teacher ratio, and teacher salaries vary between those schools attended predominantly by students from low income families compared to students from high income families. Students from high income families are more likely to attend schools with lower pupil teacher ratios and higher teacher salaries compared to students from low income families. While institutional discrimination is discussed in this article, it is a social psychology review. Furthermore, while a theoretical path model is presented, the emphasis rests heavily on psychological factors.
If access to educational resources at the individual level is associated with access to educational resources at the institutional level then individual and student SES are related. If the individual has little to invest in educational materials in the home it is likely that the community in which the individual lives will have little to invest in its public schools. However, research fails to emphasize the relationship of community and institutional resources and their subsequently related effects on student academic achievement. Furthermore, failing to ground this related research in a conceptual model results in findings yet falls short of labeling the cause. Linking these findings to a strong structural concept, such as institutional discrimination, may reduce the blame the victim misconceptions while directing emphasis of culpability on detrimental structural policies.

**Socioeconomic Statues and School Characteristics**

SES (Coleman, 1966; Jencks, 1972; Hanushek, 1986; Nyhan and Alkrady, 1999) and race (Coleman, 1966; Ferguson, 1991; Clotfelter, 1999; Harter, 1999; Nyhan and Alkrady, 1999; Darling-Hammond, 2000; Linton, 2003) are known predictors of student achievement. School level variables such as number of enrolled disadvantaged pupils (Ferguson, 1991; Clotfelter, 1999; Harter, 1999; Nyhan and Alkrady, 1999; Darling-Hammond, 2000; Duncombe and Yinger, 2000; Unnever et al, 2000; Bickel et, 2001) and number of enrolled students with disabilities (Pollard and Rojewski, 1993; Ross and Thibodeau, 1994; Duncombe and Yinger, 2000; Bolon, 2001) have also been found to predict student achievement. Additionally, school level predictors such as enrollment size (Fortune and O'Neil, 1994; Harter, 1999; Unnever et al, 2000; Duncombe and Yinger,
2000; Bickel et al, 2001) and poor building conditions (Frazier, 1993; Kozol, 1995) have been found to influence student achievement. However, when one thinks of school simultaneously one thinks of teachers. Therefore, it should come as no surprise that teaching resources have been found to influence student achievement. Teaching resources found to influence student achievement include pupil teacher ratio (Greenwald, Hedges, and Laine, 1994; Ferguson and Ladd, 1996; Wenglinsky, 1997), teacher certification (Darling-Hammond, 2000), and teacher salary (Ferguson, 1991; Greenwald, Hedges, and Laine, 1994; Wenglinsky, 1997; Harter, 1999).

Below I review research on the effects of student SES, pupil teacher ratio, teacher certification and teacher salary on student achievement. The focus of this literature review is based on the variables available in the data set analyzed for this thesis. Literature addressing standardized tests is then discussed. Specification of hypotheses and a theoretical model are then presented.

**Socioeconomic Status**

The 1966 Coleman Study is the foundation of the theory that student SES, rather than the funding of public schools, explains student performance on standardized tests. As a result of the 1964 Civil Rights Act the U.S. Education Department conducted extensive research to examine the equality of opportunity available in the nation's public schools. The Coleman study focused on the differences of school characteristics and student achievement across America. Student achievement was measured by standardized tests. Student SES was measured by parental SES, which was then averaged
representing student SES. Although Coleman concluded that academic achievement and student SES were strongly correlated he also found "it is for the most disadvantaged children that improvements in school quality (emphasis added) will make the most difference in achievement" (Coleman, 1966, p. 21).

Jencks (1972) confirmed in his extensive study that student SES is a strong indicator of student achievement. Hanushek (1986) concluded that student SES is significant when predicting student achievement. In his reanalysis of Hanushek's 1986 data, Baker (1991) found that "the various spending measures correlated with the achievement measures" and are "almost the same magnitude as the relationship between achievement and family socioeconomic status" (p. 629). He concluded:

"Even if family socioeconomic status is more powerful, it does not matter for policy purposes, because policy makers cannot do anything about family socioeconomic status. They can do a lot about spending, however." (Baker, 1991, p. 629).

Wenglinsky (1997) found that there is a strong relationship between student SES and achievement. He concluded that although increased spending can increase student achievement "it seems that the least spending occurs in precisely those school districts where the students need it the most on the basis of their SES" (Wenglinsky, 1997, p. 233).

Though student SES is a strong predictor of student achievement test scores, Nyhan & Alkrady (1999) emphasize that SES is outside of school control. Factors within school control, such as pupil teacher ratio, do influence test scores (Nyhan & Alkrady, 1999). Harter (1999) conducted a separate analysis of low and high poverty elementary
schools. "Even when student academic potential and socioeconomic status are taken into account, certain types of expenditures play an important part in explaining differences in student achievement between schools" (Harter, 1999, p. 301). According to Harter, increased spending on teacher salaries, instructional supplies and school maintenance were found to positively influence student performance. While the way in which money is spent influences student achievement, available funds influence how money is spent. Unnever, Kerckhoff and Robinson (2000) confirm the importance of pursuing this research with their findings that student SES is associated with district ability to invest in educational resources.

More recent research has focused on how the amount and direction of spending influences student achievement. Specifically, ability to invest in teaching resources is found to improve student achievement. Hartman (1994) concluded that wealthy districts spend more money per student than middle or low-income districts. Amount of spending determined the quantity and quality of the staff measured by ratio of students to personnel and personnel salaries. High income districts with more money to invest in education had lower pupil teacher ratios and higher teacher salaries compared to low income districts.

Wenglinsky (1997) and Harter (1999) found that increased instructional spending increased student achievement when spent on effective resources. Investing in low pupil teacher ratios (Wenglinsky, 1997) and increasing teachers salaries (Harter, 1999) increases student achievement. Ferguson and Ladd (1996) found that school expenditure influenced test scores. Ferguson and Ladd (1991) concluded that school resource input
buys teaching resources, specifically lower pupil teacher ratios that influence test scores. According to Ferguson (1991) "money matters when the real inputs that it purchases matter" (p. 483).

Unnever, Kerckhoff and Robinson (2000) concluded that per pupil expenditure is associated with test scores. The direction, or manner in which, money is spent is determined by the amount of money provided in the total school budget (Harter, 1999). "Most aid systems ensure minimum spending per pupil instead of minimum student performance" (Duncombe and Yinger, 2000 363). The amount of spending needed to achieve a specific performance standard varies by school district.

In the past, student SES has been found to have the greatest influence on student achievement. Recent literature explores the effects of school funding and teaching resources as well as SES on student achievement. When funding and teaching resources are included in analysis, they are found to have effects that are equal to or exceed that of student SES on student achievement.

**Pupil Teacher Ratio**

Pupil teacher ratio is calculated by dividing the number of teachers in the school district by the number of students in the school district. According to Hanushek (1989) and more recently Nyhan and Alkrady (1999) there is no relationship between pupil teacher ratio and student performance on standardized tests. Other studies (Ferguson, 1991; Wenglinsky, 1997) found that pupil teacher ratio influenced student performance.
According to Ferguson (1991) high pupil teacher ratio in first through seventh grade decreases student test scores. Test scores drop for each additional student exceeding eighteen to one student teacher ratio. Ferguson and Ladd (1996) stated that spending money on more teachers to reduce pupil teacher ratio was found to produce higher student achievement.

Hartman (1994) reported lower pupil to teacher ratios in wealthier districts. Wenglinsky (1997) found that pupil teacher ratio is influenced by instructional spending. When more teachers are hired, instead of maintaining large class sizes and increasing teacher salary, math test scores increased. Districts that raise teacher salary to compensate for higher pupil teacher ratios fail to improve student achievement. "The fact that economic resources are associated with student's achievement does not mean that all allocative decisions are equally productive" (Wenglinsky, 1997, p. 233).

Hanushek (1989) conducted a meta-analysis including 10 years of research. He concluded that pupil teacher ratio was unrelated to student achievement. However, his data was reexamined by Greenwald, Hedges, and Laine (1994) who concluded otherwise. Nyhan and Alkrady (1999) conclude in their study that pupil teacher ratio doesn't effect student achievement but they do point out that the class sizes they studied had at least 25 students in them and state that pupil teacher ratios under 15 students to one teacher have been found to have a positive effect on student achievement. The average pupil teacher ratio in U.S. public schools for 1998 was 17/1 (Snyder and Hoffman, 2001).

Investment in reducing pupil teacher ratio has been found to positively influence student achievement. However, instead of investing in lower pupil teacher ratios, school
districts may increase teacher salaries to compensate for higher pupil teacher ratios. This failure to invest in lower pupil teacher ratios negatively effects student achievement.

Teacher Certification

Teacher quality has been measured by verbal ability, level of education, years of experience and certification. Coleman (1966) measured teacher quality by verbal skills and educational background. He found that teachers' verbal skills and teachers' level of education influenced student achievement with the effect stronger for minority students. These relationships increased as grade level increased "indicating a cumulative impact of the qualities of teachers in a school" (Coleman, 1966, p. 22).

Hanushek (1986) found that teacher education is not significant. While 30% of the studies in his meta-analysis were significant for teacher experience Hanushek concluded "these results are hardly overwhelming" (1986, p. 47). Greenwald, Hedges, and Laine (1994) re-examined Hanushek's data and found that teacher experience was related to student achievement. Wenglinsky (1997) concluded per pupil spending for instruction is related to student achievement although per pupil expenditure intended to increase the number of teachers with higher educations was not significant.

According to Ferguson (1991) increased investment in teacher certification increased student achievement more than any other direction of spending. In the most recent literature, Darling-Hammond (2000) found that teacher certification is related to student achievement while controlling for SES and teacher quality.
The conflicting results of the effects of teacher verbal skills and teacher level of education on student achievement suggest that an alternative measure of teacher quality should be examined. Studies using teacher certification as a measure of teacher quality result in consistent findings. This consistency suggests that the examination of the effects of teacher certification on student achievement should be explored.

Teacher Salary

The use of teacher salary in student achievement research has produced varying results. Hanushek (1989) concluded that teacher salary had no relationship with student achievement on standardized tests. Greenwald, Hedges, and Laine (1994) found that teacher salary had a direct, positive relationship with student achievement. Ferguson (1994), Wenglinsky (1997), Harter (1999), and Darling-Hammond (2000) found that interrelationships between teacher salary and other teaching resource variables influenced student achievement.

While Hanushek (1989) found no relationship, Greenwald, Hedges, and Laine's (1994) reanalysis of Hanushek's data found direct, positive effects of teacher salary on student achievement. Most of the research has found that teacher salary has a positive effect on student achievement. Wenglinsky (1997) found an interrelationship between teacher salary and pupil teacher ratio. "Instructional spending leads to smaller classes because it makes more money available for hiring more teachers. Yet that money can just as easily be spent on maintaining the same number of teachers but at higher salary levels" (Wenglinsky, 1997, p. 233). This suggests that teacher salary may not always be
related to improved student achievement. If school districts increase teacher salary to compensate for larger class sizes, then increased teacher salary may not increase student achievement.

Hartman (1994) concluded that wealthier districts paid teachers higher salaries than middle and low income districts. Harter (1999) found that teacher salary, when related to increased years of experience, increased student achievement. Specifically, increased spending on teacher salary increased math and reading achievement. "This result suggests that schools promote student performance by employing teachers who merit special distinction and compensation" (Harter, 1999, p. 293). This finding was confirmed by Ferguson (1991) and Darling-Hammond (2000). According to Ferguson (1991), increased teacher salary had a positive impact on student test scores. He concluded that student SES and teacher quality was related. Wealthier school districts were able to offer higher salaries and therefore, hire more qualified, certified teachers. This suggests "a potentially effective but politically unlikely state policy for equalizing the quality of education" (Ferguson, 1991, p. 465). Darling-Hammond (2000) found public schools that focused on raising teacher salaries while failing to also improve teacher quality through certification were unsuccessful in improving student performance.

Teacher salary has been found to have a positive effect on student achievement. The interrelationships of teacher salary with other teaching resource variables implies that teacher salary should be included in further analyses. Specifically, the
interrelationships of teacher salary with pupil teacher ratio and teacher certification are complex relationships that are important to examine.

Summary

Past research concluded that public school funding was unrelated to student achievement (Jencks, 1972; Hanushek 1986, 1989). This research affirmed the impact of student SES on student achievement. While these researchers concluded that student SES was the most important predictor of student achievement, they also questioned the ways in which public school funds are spent. These questions led to research focused on the amount and direction of spending. Baker (1991) found that the amount spent was more important to student achievement than the direction of the spending. Spending on teaching resources has repeatedly been found to increase student achievement. Investment in reducing pupil teacher ratio positively influences student achievement. However, some school districts increase teacher salaries to compensate for higher pupil teacher ratios producing a negative effect on student achievement. Teacher certification has a positive effect on student achievement. Teacher certification as a measure of teacher quality has produced consistent findings. Teacher salary has a positive effect on student achievement. However, teacher salary is interrelated with pupil teacher ratio and teacher certification. A negative effect on student achievement may occur when investment in teacher salary compromises the investment in lowering pupil teacher ratios. Additionally, when higher teacher salaries coincide with teacher certification, student achievement increases.
Standardized Tests and High Stakes Testing

Since the 1970's, accountability laws were enacted to monitor the efficiency and productivity of public schools (Ravitch, 1983). Legislators require a system to track the return on the investment of tax dollars in public schools. Performance accountability has traditionally been measured by standardized tests in America's public schools. Coleman used standardized tests in the 1966 analyses of student achievement. He stated that these tests were not meant to be "'culture-free'. Quite the reverse: they are culture-bound" (Coleman, 1966, p. 21). These standardized tests were designed to measure "skills which are among the most important in our society for getting a good job and moving up to a better one" (Coleman, 1966, p. 21). The intent of the tests was to determine which jobs a student would be qualified for based on skills acquired "as he finishes school - wide range of choice of jobs or colleges if these skills are very high; a very narrow range that includes only the most menial jobs if these skills are very low" (Coleman, 1966, p. 20).

Darling-Hammond (1994) discussed the importance of alternative methods of educational assessment. She asserted that multiple-choice standardized tests failed to measure "complex cognitive and performance abilities" (Darling-Hammond, 1994, p. 6). Sanders and Horn (1995) stated that test results misinterpreted by the media are partly to blame for negative opinions surrounding standardized tests. However, educational assessment is important and standardized tests are an inexpensive way to generate generalizable data.

Scafidi, Freeman and DeJarnett, (2001) wrote about the increasing demands on high-stakes test results. High-stakes tests are standardized tests used to assess student
achievement and school quality. High-stakes tests are used as the sole method of student achievement assessment. Diplomas may be withheld for failure to pass a graduation exam. In some states bonuses are given to teachers whose students perform well. Failure to meet certain standards may result in the loss of school personnel and ultimately local school control. Bolon (2001) examined student performance on the MCAS tests. He concluded that student SES had the strongest influence on test scores. Based on MCAS test scores the greatest consequences would fall on school districts and students already at a disadvantage.

Policy decisions based on educational assessment measured by standardized tests produce increased inequality in public schools. Kober (2002) reported an increase of teachers teaching to the test. Instances of cheating have been reported. Kober states: "leaders have created accountability systems centered on higher test scores, with little regard for how these scores are attained" (2002, p.1). When tests were used to improve teaching the results were positive. For example, students in a Massachusetts high school were having difficulties completing the writing portion of the state test. Increased writing skills in teachers were emphasized school wide. Writing was encouraged in all subjects. Student writing skills improved raising test scores. Kober concluded: "leaders should keep in mind that test scores are a tool to improve teaching and learning - and not the other way around" (2002, p. 11).

Because standardized tests are so widely used in U.S. public schools their use in research is common. Standardized tests may be used to justify decreasing investment in public schools. Successfully politicizing student achievement allows legislators to argue
that district failure to meet legislated standards of accountability should result in the reduction of revenue. Standardized test are increasingly the principal outcome measures that determine amount and type of funding.

**Hypotheses**

H1: Student SES has a direct positive effect on proficiency test scores of Ohio public school students.

The lower the SES the lower the student achievement. Student SES is a reflection of parental SES. Parental SES is a known indicator of student achievement.

H2: Student SES has a direct negative effect on federal revenue and state revenue and a direct positive effect on local revenue.

Low SES communities will receive more federal funds than high SES communities. Low SES communities will receive more state funds to meet the state minimum per pupil expenditure requirement. Student SES determines local revenue. The lower the student SES the lower the local revenue.

H3: Local revenue has a direct negative effect on state revenue.

State revenue is related to the amount of local funds a school district receives. The higher the local revenue the lower the state revenue.

H4: State and local revenue have direct negative effects on pupil teacher ratio and direct positive effects on teacher certification and teacher salary.

Type and level of funding determines the districts ability to buy teaching resources that influence student achievement with the exception of federal revenue. State,
and local funding have independent effects on the ability to purchase teaching resources. Because federal revenue funds generally purchase non-teaching resources, I hypothesize there will be no association between federal funding and teaching resources when controlling for student SES. State, and local funds purchase teaching resources that influence student performance. The greater the level of state and local funding the lower the pupil teacher ratio, and the higher the teacher certification and teacher salary.

H5: Pupil teacher ratio will have a direct negative effect on teacher salary.

Based on the literature, I expect to a negative relationship between pupil teacher ratio and teacher salary. School districts that have lower pupil teacher ratios will pay higher teacher salaries. Therefore, controlling for all other variables I predict that low pupil teacher ratios will result in increased teacher salaries.

H6: Teacher certification will have a direct positive effect on teacher salary.

I expect to find that as teacher certification increases, teacher salary will increase. Teachers with certification will receive higher salaries than those teachers who are not certified.

H7: Where as pupil teacher ratio will have a direct negative effect on percentage of students passing the proficiency test, teacher certification, and teacher salary will have direct positive effects on percentage of students passing the passing the proficiency test.

The ability of a district to purchase teaching resources determines student achievement. I expect to find the following relationships of the teaching resource variables and student proficiency test scores. Pupil teacher ratio will have a negative effect on student test scores. The lower the pupil teacher ratio the higher the test scores.
Teacher certification and teacher salary will have positive effects on student proficiency test scores.

Summary

The long term impact of the Coleman study has been to focus attention on parental SES as the primary determinant of student achievement. More recent research, however, has moved away from placing blame on the victim - low SES students, and searching for intervening explanations of the variability in student achievement. Class size, teacher certification, and teacher salary have been found to influence student achievement. Funding levels determine a school district's ability to invest in instructional expenditure that purchases valuable teaching resources that directly influence student achievement. Although the effects of public school finance and expenditure have been researched, there has been a failure to link institutional discrimination to inequality in education. Type and amount of funding using a property tax-based funding system results in district-to-district variation in education quality. District-to-district differences in the ability to invest in instructional expenditure results in disparities in pupil teacher ratio, teacher certification, and teacher salary. The differential quality of teaching resources results in varied student achievement.

There is a growing importance on standardized test performance as a measurement of student achievement. Ohio public school class of 2007 will be required to pass the Ohio Graduation Test before receiving a high school diploma (Proficiency Tests, 2002). This is intended to increase school quality and student performance across
Ohio. One consequence has been a change in the curriculum. However, altering the curriculum without also addressing disparities in education resources is unlikely to have an effect on student achievement. The property tax-based funding system in Ohio produces disparities that cannot be eliminated by simply changing the curriculum.

Recent research shows overwhelmingly that increases in school expenditures results in increases in student achievement. But research does vary on what the most productive resources are in student achievement. This study will examine both direct and indirect impact of types of funding on student achievement. The indirect effects of funding are through the teaching resources of pupil teacher ratio, teacher certification, and teacher salary. The following theoretical model (Figure 2.1, p. 32) of the effects of differential type and amount of funding on student performance will be estimated in this thesis.

![Diagram](image-url)  
Figure 2.1. Theoretical Path Model. The Effects of the Amount of Funding by Type of Revenue on Student Achievement.
other teaching supplies, school utilities, school construction, and repairs. Per pupil local revenue is computed by dividing the annual ADM into district local revenue.

**Pupil Teacher Ratio** is the ratio of the number of pupils for every teacher. The school district pupil teacher ratio divides the ADM by the total number of K-12 teachers. Pupil teacher ratio includes those teachers employed in regular teaching assignments only, thus excluding tutors, music, art, and physical education teachers. While pupil teacher ratio is similar to class size, class size is the number of pupils in a class, not the entire district divided by district number of teachers.

**Teacher Certification** is the number of all high school courses taught by teachers with appropriate certification divided by the number of high school course taught by teachers multiplied by 100. Special education teachers, and teachers on leave of absence are excluded.

**Teacher Salary** is the district average teacher salary for teaching staff with regular teaching assignments. Teacher salary also includes special education, vocational education, educational services, and supplemental service teaching assignments. A regular teaching assignment is instructing pupils in a regular classroom setting. Special education is an assignment to specially designed instruction to meet the needs of a child with special needs. This includes classroom instruction, physical education instruction, home, hospital, and institutional instruction. Vocational education involves teaching designed for employment in a specific occupation. Educational services include physical education, art, and music. Supplemental services involves supplemental aids and services to allow students with disabilities to learn in a regular classroom.
RESEARCH METHODS

Sample

This study utilizes data from the 2000 Ohio Report Card District Data project. Data is recorded for the 1998-99 school year. The 1998-99 school year is the first year that the Ohio Department of Education issued official online district report cards. These data were submitted by school districts through the Education Management Information System (EMIS). These existing data are available for public access on the internet at the Ohio Department of Education website. These data are in aggregate form by school district. Information is given for 607 Ohio school districts. Five Ohio school districts, Put-in-Bay, Kelleys Island, North Bass, Middle Bass and College Corner are not included in these data because of very low student enrollment. The exclusion of these schools ensures that there is no way to violate student confidentiality. There are a total of 1,826,415 students represented in the 607 Ohio school districts. The data include median income, amounts and types of funding, pupil teacher ratio, percent of teacher's with appropriate certification and average teacher salary as well as the Ohio school's proficiency test scores for grades 4, 6, 9, 10 and 12.

Full data sets and sub-samples are examined in student achievement research. Full data sets include all of the data. Homogeneity is indicated as necessary when studying
education data (Greenwald, Hedges, and Laine, 1989; Fortune and O'Neil, 1994).

According to Greenwald, Hedges, and Laine (1989) and Fortune (1994), the use of homogeneous samples in student performance analysis increases the validity of the results.

Subsamples may be selected based on spending or revenue differentials such as comparing results from high and low spending districts (Hartman, 1994). Subsamples may also be selected because full data sets fail to address outlier problems in their data analyses. Greenwald, Hedges, and Laine (1989) addressed the outlier problem by eliminating the top and bottom 5 percent in their analysis. Fortune and O'Neil (1994) also excluded the top and bottom five percent of school districts based on SES to ensure group homogeneity.

Unit of Analysis

District level analysis was selected for this study because student SES, pupil teacher ratio, and revenue per pupil are available only at the district level. State aggregated school district data are most often examined in studies using input output analyses (Coleman, 1966; Ferguson, 1991; Hartman, 1994; Fortune and O'Neil, 1994; Wenglinsky, 1997; Duncombe and Yinger, 1998; Unnever et al, 1999). Inter-state analysis has been used in some studies (Verstegen, 1994; Darling-Hammond, 2000; Amrein & Berliner, 2002). Analyses across individual schools have also been conducted (Harter, 1999; Nyhan and Alkrady, 1999; Haney, 2002). While individual schools have been examined, aggregated school district data have been found to be adequate units of
analyses. Ferguson and Ladd (1996) disaggregated district data. Individual school level
data were found to have similar results to that of aggregated district data. While the size
of the relationship between variables may vary when using different units of analyses,
district level data often offer variables individual school level lacks such as, median
income of the community. I will be using aggregate data because it is more readily
available and provides a greater amount of variables. Specifically, median income, type
and amount of funding, and pupil teacher ratio are necessary for my analysis. These
variables are not available at the individual school level.

Independent Variables

Exogenous Variable

Student SES is measured by 1999 median Ohio adjusted gross income. Median
income is a fiscal capacity measure of community ability to invest in public schools. This
information was retrieved from Ohio Department of Taxation 1999
(http://www.state.oh.us/tax/publications.html). The reporting of resident school district is
required by law on Ohio income tax returns. Median income is a better measure when
examining data with extreme outliers. In a given U.S. community, it is generally
understood that there will be a few extremely high incomes resulting in a positively
skewed distribution computed on a mean. Skewed data distributions will provide an
inaccurate representation of actual community income. Median income is the exact
middle of income distribution, with 50% of the incomes above and 50% below the
median.
Endogenous Variables

Federal Revenue consists of federal grants. These grants may be restricted or unrestricted. Restricted grants can only be spent on specified expenditures. Federal government grants aid educational programs for disadvantaged students (Title I) and students with disabilities. Federal government grants provide additional funds for student breakfast and lunch programs. Some federal funds are also allocated for vocational programs.

In these data, per pupil federal revenue is calculated by dividing annual average daily membership (ADM) into district federal revenue. ADM is the district's number of enrolled students minus preschool students with disabilities, 1/2 of the kindergarten pupils, and 75% of the Joint Vocational Students.

State Revenue consists of the Foundation payments, disadvantaged pupil impact aid and grants. The Ohio state legislature determines the minimum amount of per-pupil expenditure. The Foundation payments supplement lower income districts helping them meet the requirements of minimum per pupil expenditure. Vocational programs, special and gifted pupil education are supplemented by state funds. A portion of pupil transportation costs is funded by state funds. Per pupil state revenue is computed by dividing the annual ADM into district state revenue.

Local Revenue consists of local property taxes, local income taxes, and investment earnings. Local revenue is used to pay for teacher salaries, textbooks and
**Dependent Variable**

Percent Pass represents the percent of students who passed proficiency tests in grade 9. Subjects tested include citizenship, math, reading, science, and writing. Once a test is passed the student has completed the requirement and is exempt from retaking the test. Percent pass was calculated by dividing number of 9\textsuperscript{th} grade students who passed the test by the actual number of students required to take the test. This is the total number by the end of 1998-99 school year reported in June. The reason I am including all five proficiency tests is to test the effects of my model on the different subjects that are available in the data. Past research has used various subjects as outcome variables, specifically, reading and math (Finn and Achilles (1991); Achilles (1996); Harter (1999)). However, because Ohio public school students are required to pass all five tests to demonstrate academic proficiency I will use citizen, math, reading, and writing in my analyses.

**Analysis**

Multiple regression analysis is commonly used to examine the effects of purchased and non-purchased inputs on student achievement outputs (Coleman, 1966; Ferguson, 1991; Verstegen, 1994; Nyhan and Alkady, 1999; Harter, 1999; Darling-Hammond, 2000; Unnever et al, 2000). However, Wenglinsky (1997) used LISREL to examine input output variables in an attempt to address the limitations of past studies. Specifically, LISREL is a method of analysis that allows for the testing of multiple path
relationships on a single outcome variable. Variables in LISREL can be tested as independent and dependent within the same model. For example, teacher salary can be tested as an effect of median income and as a cause of proficiency test scores.

LISREL also tests goodness of fit, which allows for the improvement of the model. I will use the chi-square test, the goodness of fit index (GFI), the comparative fit index (CFI), and the normed fit index (NFI) to test my model. Chi-square tests the fit of the model to the data. A probability value (p value) greater than .05 and a small chi-square indicates good fit. The variances and covariances of a model are measured by the GFI. The fit of the theoretical model compared to the baseline model is measured by the CFI. Model parsimony is measured by the NFI. Values greater than 0.90 for the GFI, CFI, and the NFI are indicators of good fit.

I will use SPSS to generate descriptive statistics and correlation matrices to be used in the LISREL analysis. LISREL requires correlation and standard deviation input for model estimation. Bivariate correlations measure the strength of the relationship between two variables. Pearson's correlations range from -1 to 1 with zero indicating there is no relationship. The significance levels .01 and .05 indicate the levels of probability that the relationship of the variables happened by chance. A significance level of .01 indicates that there is a less than 1% chance that the relationship occurred by chance. A significance level .05 indicates that there is a less than 5% chance that the relationship occurred by chance.

Significance can be tested by using a one or two-tailed test. A one-tailed test indicates the direction of association. This be determined before the test is run. Using a
one-tailed test increases the likelihood of significance if the direction specified is the correct direction. A two-tailed test is used when the direction of significance is unknown. While direction may be predetermined, a two-tailed test provides a more conservative measure of significance. However, because of the predicted directionality of my hypotheses I examined the association of the variables using a one-tailed test.

When computing correlations of multiple variables missing data must be taken into consideration. Either pairwise or listwise deletion may be used to examine correlations among variables with missing data. Pairwise excludes cases based on missing data for only the two variables being examined. The result is a correlation table with varying numbers of cases. Listwise includes only the cases with available data. While this may reduce the number of cases examined, it provides a consistent representation of the data. I used listwise deletion in my analysis.

Because of the likelihood that there will be large correlations among student SES and funding sources I will use SPSS to examine multicollinearity. I will examine the standard errors, variance inflation factors (VIF), and tolerance values as measures of multicollinearity. A large standard error indicates multicollinearity. The square root of the VIF represents the magnitude of the standard error of a highly collinear variable compared to what the standard error would be if the variable were uncorrelated with the other independent variables in the model. A large VIF indicates high multicollinearity and a small VIF indicates low multicollinearity. The VIF is equal to 1/1-R^2. Tolerance is equal to 1-R^2. The tolerance range is from 0 to 1. A low tolerance level indicates high multicollinearity and a high tolerance level indicates low multicollinearity. Researchers
have used a tolerance level as low as 0.10 (VIF=10) (Norusis, 2000) and as high as 0.40 (VIF=2.50) (Allison, 1999) as indicators of multicollinearity. I will examine variables that have tolerances higher than 0.20 (VIF < 5.0) for multicollinearity. Samples will then be selected based on absence of multicollinearity. LISREL will be used to examine the qualified sample(s) to test the relationship of the independent variables with each other as well as their effects on the dependent variable. The models will be respecified as necessary to improve goodness of fit.
DATA ANALYSIS

The sample analyzed was selected by student socioeconomic status (SES) measured by public school district median income (Fortune and O'Neil, 1994). The highest 5% and lowest 5% SES public school districts were eliminated from the full data set. The highest and lowest 5% are often eliminated from a sample in education research because of the possibility of extremely high and low information compared to the remaining 90% of the units of analysis in the data set (Greenwald, Hedges, and Laine, 1989; Fortune and O'Neil, 1994). Descriptive statistics and multicollinearity were analyzed. Path analysis was conducted. This sample met the requirements for path analysis, which include the absence of multicollinearity and a sample size of at least 200.

In the following chapter, I will present the descriptive statistics and measures of multicollinearity. Two path models were conducted. I will compare the fit indices for Model 1 and Model 2. Finally, the direct, indirect, and total effects for Model 2 will be examined and discussed.

Descriptive Statistics

There were a total of 547 school districts in the sample. However, one district was excluded because of missing data. The information missing for this district was the amount received from federal and state revenue. The median income for this school
district was $24,266 making it a lower income district in this sample. As depicted in Table 4.1 and 4.2 (p. 45), the average district student SES of school districts (N=546) was $29,751. The minimum was $22,423. The maximum was $42,574. All of the school districts received federal and state funds. The average district federal revenue per pupil for the 546 districts in this sample was $278 with a minimum of $40 and a maximum of $1,203. The average district state revenue per pupil was $2,873. The minimum state revenue received by a school district in this data set was $338 per pupil and a maximum of $5,458, The average local revenue collected by a school district in this data set per pupil was $2,930. The minimum local revenue per pupil was $624. The maximum was $14,386. Of the three types of revenue collected by school districts per pupil local revenue had the highest variance with a standard deviation of $1,554, followed by state revenue (s = $769) and finally, federal revenue (s = $171).

The average pupil teacher ratio was 19. The minimum average pupil teacher ratio for the school districts in the sample was 9 with a maximum of 24 pupils per 1 teacher. The average percent of teachers per district with appropriate certification was 97. The minimum was 77% teachers appropriately certified and a maximum of 100%. The district average teacher salary was $38,033. The minimum district average teacher salary was $25,781. The maximum district average teacher salary was $54,860.

The maximum number of students per school district to pass each of the 5 proficiency tests was 100%. When comparing the district average percentages of student passing each proficiency test, the highest student performance was on the writing proficiency (93%, minimum = 68%; s = 5) closely followed by the reading proficiency
<table>
<thead>
<tr>
<th></th>
<th>Student SES</th>
<th>Federal Revenue</th>
<th>State Revenue</th>
<th>Local Revenue</th>
<th>Pupil Teacher Ratio</th>
<th>All Certified Teachers</th>
<th>Teacher Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>$22,423</td>
<td>$40</td>
<td>$338</td>
<td>$624</td>
<td>9</td>
<td>77</td>
<td>$25,781</td>
</tr>
<tr>
<td>Maximum</td>
<td>$42,574</td>
<td>$1,203</td>
<td>$5,458</td>
<td>$14,386</td>
<td>24</td>
<td>100</td>
<td>$54,860</td>
</tr>
<tr>
<td>Average</td>
<td>$29,751</td>
<td>$278</td>
<td>$2,873</td>
<td>$2,930</td>
<td>19</td>
<td>97</td>
<td>$38,033</td>
</tr>
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<td>Standard Deviation</td>
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<td>$171</td>
<td>$769</td>
<td>$1,554</td>
<td>2</td>
<td>4</td>
<td>$4,502</td>
</tr>
</tbody>
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Table 4.2: Descriptive Statistics N=546

<table>
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<tr>
<th>9th Grade Citizen Proficiency</th>
<th>9th Grade Math Proficiency</th>
<th>9th Grade Reading Proficiency</th>
<th>9th Grade Science Proficiency</th>
<th>9th Grade Writing Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>45</td>
<td>33</td>
<td>65</td>
<td>42</td>
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<td>Maximum</td>
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<td>100</td>
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<tr>
<td>Average</td>
<td>85</td>
<td>76</td>
<td>93</td>
<td>81</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>10</td>
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</tbody>
</table>
Students performed moderately well on the citizen proficiency (average = 85%, minimum = 45%; s = 9) and the science proficiency (average = 81%, minimum = 42%; s = 10). The lowest average student performance was on the math proficiency (76%, minimum = 33%; s = 11).

**Summary**

When examining the revenue variables, local revenue has the highest amount of variance, followed by state and federal revenue. There is a greater amount of variance in district collection of local revenue compared to district collection of state and federal revenue. The test with the greatest amount of variance in district average percentage of pupils passing was math, closely followed by science, and then citizen. The reading and writing proficiency tests had the lowest amount of variance. The math proficiency is clearly the test with the lowest student performance and the greatest amount of variance in district average amount of students successfully passing the exam.

**Multicollinearity**

Multicollinearity occurs when independent variables in a multiple regression model are highly correlated. In my model, student SES, and the revenue variables are likely to be highly intercorrelated. Student SES determines amount of funding a school district. Furthermore, state and local revenues are highly intercorrelated. Low local revenue increases the need for state supplemental aid. The effect of multicollinearity raises standard errors. Large standard errors reduce the likelihood of finding significance
in collinear variables. While multicollinearity causes problems in analysis, the solutions may cause problems themselves. Chiefly, the solution to eliminate one or more of the highly collinear variables may change the model and challenge the original hypotheses (Asher, 1983). Tolerance levels ranging from 0.40 (VIF = 2.50) (Allison, 1999) to 0.10 (VIF=10) (Norusis, 2000) have been used in past research to detect multicollinearity. I selected the midpoint 0.20 (VIF = 5.0) to identify multicollinearity. A tolerance level lower than 0.20 and a variation inflation factor (VIF) higher than 5 indicates high multicollinearity between two or more variables in a model. Table 4.3 (p. 48) depicts the tolerance and VIF values. Local revenue is highly collinear. However, the tolerance and VIF values meet my requirement for acceptable collinearity. While I could eliminate local revenue from my model to address the problem of multicollinearity, this elimination would profoundly alter my analysis. Therefore, I will analyze the sample while retaining local revenue in my model.
Table 4.3. Multicollinearity Diagnostics. Tolerance and Variance Inflation Factors.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student SES</td>
<td>.422</td>
<td>2.368</td>
</tr>
<tr>
<td>Federal Revenue</td>
<td>.532</td>
<td>1.880</td>
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<tr>
<td>State Revenue</td>
<td>.322</td>
<td>3.106</td>
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<td>Local Revenue</td>
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<td>4.911</td>
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<tr>
<td>Pupil Teacher Ratio</td>
<td>.656</td>
<td>1.523</td>
</tr>
<tr>
<td>Teacher Certification</td>
<td>.935</td>
<td>1.070</td>
</tr>
<tr>
<td>Teacher Salary</td>
<td>.407</td>
<td>2.455</td>
</tr>
</tbody>
</table>

Path Analysis

The relationships of independent variables may be examined by conducting path analysis. In path analyses, variables may be evaluated as having both dependent and independent effects. Exogenous variables are determined by causes outside of the model and may be specified as independent variables only. Endogenous variables may be affected by the exogenous variables and the other endogenous variables as specified in the model. This means that an endogenous variable may be considered an independent or dependent variable depending on the specific relationship being examined within a model.
The variables in the path models may be calculated as unstandardized or standardized regression coefficients. Individual equations are calculated for the relationships specified in a path model. This means that a separate analysis is calculated for each endogenous variable in relation to the other variables specified.

Models can be either recursive or nonrecursive. Recursive models are unidirectional. A model that has one or more specifications to test reciprocal causation between two variables is nonrecursive. Nonrecursive models may have identification problems. There are three types of path model identification. Underidentified models lack the information to estimate paths. These models cannot be tested. A recursive path model with manifest variables will be either just identified or overidentified. Just identified models may be tested but because they are exactly identified goodness of fit indices cannot be determined. An overidentified model allows for the evaluation of goodness of fit measures. Overidentified models have specified path restrictions. Specified paths may be free, fixed, or constrained. A free path is one specified to be calculated between two variables. A fixed path has a specified value. Fixing a path to 0 eliminates the path between two variables. A constrained path may be specified to equal one or more paths in the model.

Degrees of freedom are determined by the number of restrictions placed on the model. For example, in the theoretical path model (Figure 4.1, p. 50) tested as Model 1 the degrees of freedom were 12. Student SES paths were fixed to 0 between SES and the teaching resource variables. Federal revenue was fixed to 0 between the teaching resource variables and the dependent variable percent pass. State and local revenues were
fixed to 0 in relation to percent pass. Therefore, 12 paths were eliminated from the model resulting in 12 degrees of freedom. Paths were eliminated based on past research and my hypotheses.

Exogenous | Mediating | Mediating | Dependent
--- | --- | --- | ---
Student SES | Federal Revenue | Pupil Teacher Ratio | % Pass Proficiency
State Revenue | Teacher Certification | Teacher Salary | —
Local Revenue | — | — | —

Figure 4.1. Theoretical Path Model. The Effects of the Amount of Funding by Type of Revenue on Student Achievement.

Goodness of fit measures include the chi-square test, the goodness of fit index (GFI), the comparative fit index (CFI), and the normed fit index (NFI). Chi-square tests whether the theoretical model being tested fits the data. A model with good fit has a probability value (p value) greater than .05 with a small chi-square. A significant p value and large chi-square rejects the null hypothesis that the theoretical model fits the data. However, the chi-square test is sensitive to large samples. In the case of large samples, when a significant chi-square is found the chi-square/degrees of freedom ratio can be calculated to determine fit. A ratio less than 2 indicates a good fit.
The GFI measures the variances and covariances of a model. The CFI measures the fit of the theoretical model compared to the baseline model. The NFI measures the parsimony of the theoretical model. GFI, CFI, and NFI values greater than .90 indicate a good fit.

The fit indices for Model 1 are reported in Table 4.4 (p. 52). The chi-square tests of models for all five proficiency tests were significant with a large chi-square (between 169 and 228) and chi-square/degrees of freedom ratio over 2 (between 14 and 19). These results indicate poor fit. All GFI values were above .90. All CFI values were at or above .90. The NFI scores fell between .882 and .907. This indicates poor model parsimony. While this model lacked good fit according to the chi-square and NFI the fit of the GFI and CFI suggests that this model should be investigated further. A second model was tested producing better fit indices presented in Table 4.5 (p. 52).

Based on past literature federal revenue was fixed to zero in the first path model tested. Because of the poor fit, a second model was tested. In this model federal revenue was free to determine its effects on pupil teacher ratio, all certification, teacher salary, and percent pass. This reduced the degrees of freedom to 11. Contrary to theory but consistent with the correlations calculated for the LISREL analysis, federal revenue has a highly significant negative relationship with proficiency test scores. As federal revenue increases, test scores decrease.
Table 4.4. Fit Indices Model 1

<table>
<thead>
<tr>
<th>Citizen 9</th>
<th>Math 9</th>
<th>Reading 9</th>
<th>Science 9</th>
<th>Writing 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>197.510</td>
<td>222.738</td>
<td>191.382</td>
<td>227.506</td>
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<td>GFI</td>
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<td>.908</td>
<td>.919</td>
<td>.907</td>
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<tr>
<td>CFI</td>
<td>.900</td>
<td>.890</td>
<td>.903</td>
<td>.887</td>
</tr>
<tr>
<td>NFI</td>
<td>.895</td>
<td>.885</td>
<td>.898</td>
<td>.882</td>
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</tbody>
</table>

Table 4.5. Fit Indices Model 2

<table>
<thead>
<tr>
<th>Citizen 9</th>
<th>Math 9</th>
<th>Reading 9</th>
<th>Science 9</th>
<th>Writing 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>120.224</td>
<td>123.145</td>
<td>115.438</td>
<td>121.456</td>
</tr>
<tr>
<td>GFI</td>
<td>.949</td>
<td>.948</td>
<td>.951</td>
<td>.949</td>
</tr>
<tr>
<td>CFI</td>
<td>.941</td>
<td>.941</td>
<td>.943</td>
<td>.942</td>
</tr>
<tr>
<td>NFI</td>
<td>.936</td>
<td>.936</td>
<td>.938</td>
<td>.937</td>
</tr>
</tbody>
</table>
The chi-square tests of Model 2 for all five proficiency tests were significant with a large chi-square (between 111 and 123) and chi-square/degrees of freedom ratio over 2 (between 10 and 11). The chi-square results in the second model are less than the chi-square results in the first model tested. All fit indices, with the exception of chi square, for all of the models indicate good fit. All GFI values were above .90 indicating good fit. All CFI values were at or above .90 indicating good fit. All NFI scores were above .90. This indicates good model parsimony. Freeing federal revenue in the second model improved the fit.

**Direct Effects**

The direct are depicted in Figures 4.2 through 4.6 (pp. 54 - 58). The solid lined arrows depict significant paths in the direction I hypothesized. The dashed lined arrows indicate paths that would be significant if these specific hypotheses were stated in the opposite direction. For example, I predicted that state revenue and local revenue would have positive effects on teacher certification. However, when examining the data I found that these two types of revenue had direct negative effects on teacher certification. While these paths and the paths between pupil teacher ratio and teacher salary, and teacher salary and percent pass, are not significant according to my directional hypotheses, I am including them in my analysis for future model respecification.

Student SES had the predicted directional effect on the three types of revenue for all of the five proficiency tests. An increase in student SES reduced the amount of
Figure 4.2. Model 2. Standardized Effects of the Amount of Funding by Type of Revenue on Student Achievement 9th Grade Citizen Test. N= 546. Dashed lined paths depict significant effects in the opposite direction hypothesized.

* p < .05; ** p < .01; *** p < .001

\[ \chi^2 = 120.224 \ (p = 0.0) \quad df = 11 \quad GFI = .949 \quad CFI = .941 \quad NFI = .936 \]
Figure 4.3. Model 2. Standardized Effects of the Amount of Funding by Type of Revenue on Student Achievement 9th Grade Math Test. N= 546. Dashed lined paths depict significant effects in the opposite direction hypothesized.

\[
\chi^2 = 123.145 \ (p = 0.0) \quad df = 11 \quad GFI = .948 \quad CFI = .941 \quad NFI = .936
\]

* \( p < .05 \); ** \( p < .01 \); *** \( p < .001 \)
Figure 4.4. Model 2. Standardized Effects of the Amount of Funding by Type of Revenue on Student Achievement 9th Grade Reading Test. N= 546. Dashed lined paths depict significant effects in the opposite direction hypothesized.

\( \chi^2 = 115.438 \) (\( p = 0.0 \))   \( df = 11 \)  GFI = .951  CFI = .943  NFI = .938

\* \( p < .05 \);  \** \( p < .01 \);  \*** \( p < .001 \)
Figure 4.5. Model 2. Standardized Effects of the Amount of Funding by Type of Revenue on Student Achievement 9th Grade Science Test. N= 546. Dashed lined paths depict significant effects in the opposite direction hypothesized.

\[ \chi^2 = 121.456 \text{ (p } = 0.0) \text{ df } = 11 \text{ GFI } = .949 \text{ CFI } = .942 \text{ NFI } = .937 \]

* \( p < .05; ** p < .01; *** p < .001 \)
Figure 4.6. Model 2. Standardized Effects of the Amount of Funding by Type of Revenue on Student Achievement 9th Grade Writing Test. N= 546. Dashed lined paths depict significant effects in the opposite direction hypothesized.

*p < .05; **p < .01; ***p < .001
federal (Beta = -.637, p < .001) and state revenue (Beta = -.566, p < .001) an Ohio public school district received. An increase in student SES increased the amount of local revenue a school district received (Beta = .079, p < .05).

Including the direct effect of federal revenue on percentage of students passing the proficiency test reduced the direct effect of student SES on percent pass for all five proficiency tests. Student SES was significant (p < .001) for math (Beta = .195), followed by science (Beta = .177), reading (Beta = .176), and citizen (Beta = .175) tests. Student SES was also significant (p < .01) for the writing test (Beta = .136). Compared to federal revenue, student SES had a slightly less direct effect on percent pass. Federal revenue had the strongest negative direct effect on science (Beta = -.495), followed by math (Beta = -.476), citizen (Beta = -.436), reading (Beta = -.434), and writing (Beta = -.394).

Local revenue had a significant direct effect on state revenue (p < .001). An increase in local revenue decreased state revenue by .708. In other words, as local revenue increased, state revenue decreased. This relationship supports hypothesis 3.

State revenue had a direct negative effect on pupil teacher ratio and teacher certification (p < .001) and a direct positive effect on teacher salary (p < .001). As state revenue increased, pupil teacher ratio and teacher salary decreased (Beta = -.478, Beta = -.279, respectively). As state revenue increased, teacher salary increased (Beta = .155). Compared to state revenue, local revenue had the greater negative direct effect on pupil teacher ratio (Beta = -.478, p < .001). However, compared to state revenue, local revenue had a lower direct negative effect on teacher certification (Beta = -.194,
p < .001). This negative relationship between local revenue and teacher certification rejects hypothesis 4. Local revenue was expected to have positive direct effects on teacher certification and teacher salary. Local revenue had a direct positive effect on teacher salary (Beta = .913, p < .001). This relationship supports hypothesis 5.

The relationship between pupil teacher ratio and teacher salary showed the confounding effect of pupil teacher ratio on teacher salary. As pupil teacher ratio increased, teacher salary increased (Beta = .325, p < .001). The reason this relationship is of interest is because, it was expected that low pupil teacher ratio and higher teacher salary would increase test scores. However, if pupil teacher ratio increased teacher salary, then the relationship of teacher salary to percent pass changes meaning when pupil teacher ratio is included in the model. This effect was realized in the science, reading, and math proficiency tests. Teacher salary had direct negative effects on these tests. An increase in teacher salary resulted in a decrease in percent passing the science proficiency by .106 (p < .01), followed by a decrease in percent passing the reading proficiency by .093 (p < .01), and a decrease of .067 passing the math proficiency (p < .05).

Teacher certification had a positive direct effect on teacher salary. As teacher certification increased teacher salary increased by .074 (p < .01). This positive relationship supports my hypothesis. However, the low degree of the effect is interesting. A great deal of importance is placed on the certification of teachers. While the effect is significant, the importance of teacher certification should be explored further.
Indirect Effects of SES and Mediating Variables

The indirect effect of student SES on percent pass through federal revenue \((I_{821})\) was greatest for science (.315) followed by math (.303), citizen (.278), reading (.276), and writing (.251). This indirect effect indicates that a change in student SES causes a change in federal revenue that causes a change in percentage of students passing the proficiency test. In other words, a one unit increase in student SES causes a .315 increase in student performance on the science proficiency test through federal revenue.

The indirect effect of student SES on pupil teacher ratio through state revenue \((I_{531})\) produced an increase in pupil teacher ratio (.271). As student SES increases state revenue, pupil teacher ratio increases. When the effect of local revenue is included with state revenue \((I_{5341})\), pupil teacher ratio increases (.027). Student SES through local revenue \((I_{541})\) produces a .053 decrease in pupil teacher ratio.

The indirect effect of student SES on teacher certification through state revenue \((I_{631})\) produced a .158 increase in certified teachers. When the effect of local revenue is included \((I_{6341})\), teacher certification increases by .106. Student SES through local revenue \((I_{641})\), decreases teacher certification by .015.

The indirect effect of student SES on teacher salary through state revenue \((I_{731})\) produces a .088 decrease in teacher salary. As student SES increases state revenue, teacher salary decreases. When the effect of local revenue is included with state revenue \((I_{7341})\), teacher salary decreases (-.008). The indirect effect of student SES through local revenue rejects my hypothesis. Student SES through local revenue \((I_{641})\) produces a .072 increase in teacher salary. Student SES produces a positive effect on teacher salary when
pupil teacher ratio and state revenue are included in the interaction ($I_{7531} = .088$).

However, when local revenue is included, indirect effects of teacher salary through pupil teacher ratio are negative ($I_{7431} = -.088; I_{7541} = -.017$). Including the effects of teacher certification and state and local revenues on teacher salary produces positive effects ($I_{7631} = .012; I_{76341} = .001; I_{7641} = .005$).

**Direct, Indirect, and Total Effects**

The direct, indirect, and total effects of SES, revenue, and teaching resources on proficiency tests are presented in Table 4.6 (p. 63). In support of hypothesis 1, student SES has a direct effect on proficiency tests. Additionally, federal revenue has a greater total effect on percentage of students passing the proficiency test for all tests except for the citizen proficiency (SES = .442, federal revenue = -.436). Federal revenue has the greatest total effect on the science proficiency (-.495) followed by math (-.476), reading (-.434), and writing (-.394).

When comparing revenues, federal revenue has the greatest total effect on test performance. Compared to state revenue, local revenue has greater total effects on reading (state = .002, local = -.065), and science proficiencies (local = -.063, state = .002), followed by math (local = -.046, state = .001), and citizen (local = -.025, state = .001). State and local revenue do not influence writing test scores.

Of the teaching resource variables, salary has the greatest total effect on proficiency test performance (science = -.106, reading = -.093, math = -.067,
Table 4.7. Direct (DE), Indirect (IE), and Total Effects (TE) of SES, REVENUE, and TEACHING RESOURCES on PROFICIENCY. N= 546.

<table>
<thead>
<tr>
<th></th>
<th>CITIZEN</th>
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<td>DE</td>
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<td>-.106</td>
<td>-</td>
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<td>-</td>
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</tbody>
</table>
citizen = -.045). This negative effect rejects my hypothesis. The negative effect of pupil
teacher ratio supports my hypothesis. Increased pupil teacher has the greatest effect on
science (-.034) followed by reading (-.030), math (-.022), and citizen (-.015). The total
effects of teacher certification on test performance reject my hypothesis (science = -.008,
reading = -.007, math = -.005, citizen = -.003).

Summary

Student SES has a strong influence on types of revenue, teaching resource
variables, and percentage of students passing proficiency tests. When examining the total
effects, federal revenue has a slightly greater effect than SES on proficiency test scores.
Federal revenue and SES total effects on test scores significantly surpass state and local
revenue total effects. The total effect of state revenue on proficiency test scores is
minimal. The negative total effects of local revenue are unexpected as are the negative
effects of teacher salary.
Using Ohio public school data I tested the presence of class based indirect institutional discrimination by examining the direct and mediating effects of student SES on percentage of students passing the proficiency exams through types of revenue and teaching resource variables. In this chapter I will first discuss my findings as related to my hypotheses. This will include examination of my findings. Next, I will address the limitations of my study. This will include discussion of model misspecification. I will then discuss my contributions to the literature including the implications of my findings concerning future research and school funding policy.

Findings

In hypothesis one I predicted that an increase of student SES would increase test scores. My findings supported this hypothesis. Each of the five proficiency tests was positively effected by student SES. Past research argues that parental SES is the single most important factor in predicting student achievement. This argument may be used to justify the failure to invest in public schools. If SES predicts student achievement, then investment in schools will fail to increase student achievement. However, my findings are evidence that type of funding has a greater direct effect on student test scores than student SES. When federal revenue was included, the direct effects of
student SES decreased as the direct effect of federal revenue surpassed that of student 
SES for each of the proficiency tests. The positive effect of student SES on test scores 
was reduced by the greater negative effect of federal revenue on student test scores. 
When the indirect effects of student SES through federal revenue were examined, I found 
a positive relationship. While student SES still has a significant direct effect on 
proficiency test performance, there is a partial mediating effect of federal revenue which 
increases student performance on proficiency tests. This demonstrates the importance of 
using the funding variables in the analysis of student achievement.

In hypothesis two I stated that student SES would determine the type and amount 
of funding a school district receives. In the directions I predicted an increase in student 
SES decreased federal and state funding and increased local revenue. 
I expected to find a stronger relationship between student SES and local revenue. 

In hypothesis three I predicted that increased local revenue would decrease state 
revenue. Examination of the path analyses revealed a strong relationship between local 
and state revenue. As local revenue increased, state revenue decreased. This inverse 
relationship indicates the importance of examining the interrelationships of the revenue 
variables.

In hypothesis four I predicted the relationships between types of funding and the 
teaching resource variables. Based on past literature, direct effects on teaching resource 
variables were not analyzed for federal funding. State and local revenue have the 
predicted effects on pupil teacher ratio. When comparing these two types of revenue on 
this variable I found that local revenue has a larger effect on reducing pupil teacher ratio.
This indicates that basing Ohio's public school funding system so heavily on local property taxes produces a disparity in district-to-district pupil teacher ratios. Districts with a greater amount of local funding can afford to spend more money on reducing pupil teacher ratios. While state revenue did decrease pupil teacher ratios, it failed to match that of local revenue. A district receiving a larger amount of state revenue will not reduce pupil teacher ratio as much as a district collecting a larger amount of local revenue. Furthermore, the indirect effect of student SES through state and local revenue on pupil teacher ratio reveals that the mediating effect of state revenue actually increases pupil teacher ratio while the mediating effect of local revenue decreases pupil teacher ratio.

The relationship of state and local funding on teacher certification fails to support my hypothesis. Both types of revenue decreased certification. However, this negative effect was less for local revenue than for state. An increase in state revenue reduced teacher certification in a school district more than an increase in local revenue. State revenue fails to match that of local revenue. More teachers will be certified in a district collecting a larger amount of local revenue compared to a district receiving a larger amount of state revenue.

Compared to state revenue, I found that local revenue had the greatest direct effect on increasing teacher salary. Districts collecting a larger amount of local revenue paid teachers more compared to districts receiving a larger amount of state revenue. State compensation failed to reduce the disparity in community ability to pay higher teacher salaries. Theoretically, these greater effects of local revenue, when compared to state revenue, illustrate that the property tax wealth based public school funding system in
Ohio creates a disparity in the amount of money school districts have to invest in teaching resources. This holds true when examining the indirect effect of student SES. The mediating effect of state revenue reduces teacher salary while the mediating effect of local revenue increases teacher salary.

When testing hypothesis five I expected to find that pupil teacher ratio has a negative effect on teacher salary. By examining these relationships with path analysis, I was able to confirm the complexity of the interrelationship between pupil teacher ratio and teacher salary Wenglinsky found (1997). This finding is contrary to what I hypothesized based on the literature results that wealthier communities could afford lower pupil teacher ratios (Hartman, 1994). My findings indicate that pupil teacher ratio has a positive rather than the expected negative effect on teacher salary. School districts compensate teachers with large class sizes by increasing their salaries.

When testing hypothesis six I expected to find that teacher certification has a positive effect on teacher salary. Teacher certification was found to have a positive effect on teacher salary. However, pupil teacher ratio has a greater positive effect on teacher salary when compared to teacher certification. While the positive relationship between teacher certification and teacher salary was supports my hypothesis, the positive effect of pupil teacher ratio on teacher salary is profound and fails to support my hypothesis.

In hypothesis seven I predicted a negative relationship between pupil teacher ratio and proficiency test scores and positive relationships between teacher certification, teacher salary and proficiency test scores. There were no significant direct effects on test scores from pupil teacher ratio and teacher certification. There were however significant
effects on test scores from teacher salary for math, reading, and science. For each of these
tests teacher salary had a negative effect on test scores. This negative relationship rejects
my hypothesis.

Similar to Hanushek (1989) and Nyhan and Alkrady (1999), I found that pupil
teacher ratio fails to improve student performance. The absence of a pupil teacher ratio
effect may be, as indicated by Nyhan and Alkrady (1999), because of the high pupil
teacher ratio average in my data set. If the average were closer to the optimal pupil
teacher ratio then my results may have been different. However, the absence of a direct
effect from pupil teacher ratio on student test scores indicates that the proficiency test
measurement of student achievement and the teaching resource variable pupil teacher
ratio are unrelated.

Unlike Ferguson (1991) and Darling-Hammond (2000), who both found that
teacher certification is related to student achievement, I found no relationship between
teacher certification and proficiency test scores. This absence of an effect indicates the
need to explore the negative effects state and local revenues have on this variable using
Ohio data. I found that both of these revenues decrease the number of certified teachers in
Ohio public school districts. I expected to find that increased state and local revenue
would provide public school districts with the additional purchasing power to invest in
certified teachers. However, increased funding fails to purchase certified teachers. In
turn, certified teachers fail to influence proficiency test scores. The absence of a direct
effect of teacher certification on Ohio student's proficiency test scores indicates that this
teaching resource variable and the Ohio proficiency test measurement of student
achievement are unrelated.

Similar to Wenglinsky (1997), I found that teacher salary has a negative effect on
student achievement. As teacher salary increased, I found that proficiency test scores
decreased. This relationship rejects my hypothesis and suggests the need for the further
evaluation of the effect of pupil teacher ratio on teacher salary. If school districts are
forced to increase pupil teacher ratio and then compensate teachers with increased
salaries, then the effect of teacher salary on test scores will be compromised.

Limitations

I have identified certain limitations that may challenge the interpretation of my
findings. The first challenge involves my omission of additional measures. These
omissions were based on variable availability in the data and my theoretical model. The
possibility of spurious relationships is a matter of concern when conducting research.
However, the infinite possibilities can hinder the definition and testing of a model. A
parsimonious model focuses on not just the available variables but those that apply
specifically to the theory that is guiding the research. Measures of race and building
conditions, known predictors of student achievement, are not available in these data.
While additional known predictors of student achievement such as enrollment,
disadvantaged students and students with disabilities are available in the 2000 Ohio
Report Card District data they were not be tested at this time. While these variables may
be included as predictors of type and amount of funding, they are ultimately cost factors,
not measures of community fiscal capacity or specific measures of teaching resources. While I acknowledge that these additional variables have been concluded to be predictors of student achievement in past research, the focus of this thesis is on available variables that measure community ability to invest in public schools, type and amount of funding, and teaching resources. However, based on my results, the inclusion of these variables in future research may produce a better model.

Additionally, the inclusion of individual level predictors of parental socioeconomic status would have benefited my research. While I used student SES as an indicator of community member's SES, this measure fails to provide additional details such as level of education. My findings may differ from Coleman’s based on our different measures of student SES. Furthermore, based on Fortune and O'Neil (1994) I used student SES to select this sample. However, selection based on per pupil total property valuation, which includes business as well as residential property revenue, may provide a more precise estimate of district revenue.

Adjusting teacher salary to years of experience would enhance my research. Years of experience may lead to higher salaries. However, greater years of experience may reflect teaching fatigue. Additionally, the effects of pupil teacher may be more effectively examined and the kindergarten through 8th grade levels. The effect of large class sizes may have had the cumulative impact by the high school years.

The final challenge involves model specification. While I expanded on past research by using separate types of revenue in my model instead of the combined measure of total revenue, based on the fit indices my model needs improvement.
Specifically, based on the correlations computed for the LISREL analysis, there may be direct effects from state and local revenue on the outcome variable percent pass that I failed to specify. Inclusion of these paths may improve model fit as well as provide additional information about the effects of revenue on student performance. Specifically, suppression appears to be creating contradictory total effects. This is indicated by the counterintuitive negative total effect of local revenue as well as the positive total effect of state revenue on proficiency test performance. Inclusion of direct effects of state and local revenue on the dependent variable percent pass would allow for comparison of the direct and total effects in the examination of suppression. Additionally, pupil teacher ratio and teacher salary may have a moderating effect rather than the mediating effect I tested in my model. The interrelationship of these variables should be respecified to examine this relationship.

Contributions

Overall, I found five distinct results that contribute to the literature and indicate a need for future research based on the variables and path models analyzed for this thesis. First, by using the three revenue variables I was able to measure indirect institutional discrimination by examining the effects of the property wealth based public school funding system on teaching resource variables and proficiency test scores. I speculated that using total revenue instead of the types of revenue ignores the differential teaching resource purchasing power these very different types of funding allow. I found substantial variability in the amounts of these different types of funding by school
district. However, future research may benefit from using trichotomized samples based on district size. This would allow for the examination of effects within more homogeneous subsamples.

Second, I used path analysis to examine relationships between types of revenue, teaching resource variables and student performance. By doing this I developed an approach that replaced the traditional use of multiple regression analysis. I used path analysis to examine the direct, indirect, and total effects of exogenous and mediating variables on the dependent variable. I also examined the interrelationships of the exogenous and mediating variables. By using path analysis, I expanded upon the questions initially explored in past research to determine the interrelationships of the variables in my analysis. Furthermore, path analysis allows model adjustment for better fit. This enables a better understanding of the relationships of the variables with the assurance of reaching a sound model of explanation. However, a longitudinal analysis versus my cross-sectional study would allow for the examination of students progressing from elementary school to high school. Within districts elementary schools are stratified by income. Examining students based on early educational experiences would provide further insight of the effects of student SES on student achievement at the high school level.

Third, I found that the levels of state revenue received by school districts is not enough to improve teaching resources of low income communities. State revenue is intended to provide an adequate basic education for all students regardless of wealth of school district. Therefore, state funding should have a strong negative effect on pupil
teacher ratio and positive effects on teacher certification and teacher salary. However, the indirect effects of student SES through state revenue failed to improve teaching resources indicating unintended discriminatory effects. However, the comparison of my U.S. sample to that of sample from another country with a different school funding system would allow for more concrete evidence of the effects of institutional discrimination on student achievement.

Fourth, the relationship of pupil teacher ratio and teacher salary indicates that these variables must be included together in future analyses to get the full picture of the effects of the interrelationships of these variables. A higher level of teacher salary may not result in an increase in student achievement. If teacher salaries are raised to compensate for higher pupil teacher ratios then an increase in teacher salary may decrease student achievement. My finding of the interrelationship of these variables confirms that of Wenglinsky (1997) and reasserts the need to include both of these variables together in future research rather than just using one or the other in analysis.

Finally, my finding that pupil teacher ratio and teacher certification are unrelated to proficiency test performance is alarming. There is an increasing importance of test scores on public school district funding and student graduation. The failure of known predictors of student achievement to have an effect on proficiency test scores exposes a serious problem in Ohio's public schools. Therefore, it is important to find the reason for the non-significant relationships between the teaching resource variables and test scores. Furthermore, it is possible that the inclusion of additional expenditure variables such as administration, instruction, and staff support in future models would provide information
as to how money is being distributed in schools and the subsequent effects on student performance.

**Conclusion**

Unlike past education research I grounded my research in the concept of indirect institutional discrimination. By using this concept I have introduced a label for the cause of the inequality produced by property wealth based public school funding systems. Additionally, my research provides valuable findings about the effects of student SES on amount and type of funding, teaching resource variables, and percentage of students passing the Ohio proficiency test. By separating type of revenue rather than examining total revenue I contributed to the literature. Compared to state and local revenue, federal revenue has a significant effect on proficiency test scores. The effect of federal revenue is only slightly greater than the effect of SES. My findings indicate that state revenue has no statistically significant effect on test scores. However, the allocation of state revenue is not normally distributed. Low income districts receive a large share of state revenue while high income districts receive very little. To determine the differential effects of state revenue on teaching resource variables and proficiency test scores future research should compare sub groups selected by student SES.
## APPENDIX

### Bivariate Correlations

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**Means**

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*Correlation is significant at the .05 level (one-tailed), **correlation is significant at the .01 level (one-tailed).

Listwise \(N=546\).
BIBLIOGRAPHY


