EQUITY AND OUTCOME GAPS IN TEXAS FOLLOWING HOUSE BILL 1 (2011)

A doctoral thesis presented

by

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to

The School of Education
College of Professional Studies
in partial fulfillment of the requirements for the degree of
Doctor of Education

NORTHEASTERN UNIVERSITY

BOSTON, MASSACHUSETTS

March 2019
Abstract

The purpose of this study was to determine how equity changed following Texas House Bill 1 (2011) and whether the change in equity correlated with a change in standardized test scores. The major research question was to determine whether school funding correlates to changes with student outcomes in reading and math. Using the equity framework of school finance, this study looked at how horizontal equity and fiscal neutrality changed during an 8-year period from 2009 to 2016. The equity measures were then compared to reading and math scores on a nationally administrated standardized test for students in fourth grade. The study found that although equity and funding decreased immediately after changes in state law in 2011, per-pupil spending increased surpassing 2009 amounts and equity increased. Most of these increases came from an increased share of local funding through property taxes, which increased as property value across Texas also increased, despite decreased federal and state funding. Recommendations include continuing to research ways to measure changes of equity and compare those changes to student outcomes to better evaluate school finance systems. This study did not reveal a connection between equity and outcomes but provided greater understanding on how equity did change in Texas, which can help led to better policy decisions when developing state funding systems for public education in the future.

Keywords: Equity, school finance, Texas House Bill 1 (2011), student outcomes.
Dedication

When I first started writing this paper, the woman who would become my wife was not yet my life partner. We went from dating to engaged, to married, to pregnant, to parents in the span it took me to complete this paper. Along the way I took time off to deal with our life changes but she also stayed interested in engaged in my progress. Thank you, Lauren, for all the support you have provided and all the love you have given. I will always treasure the times when you and I studied at the same time for our current programs as a “date.”

I want to thank Dr. Erin Martin, who I worked with at the Texas Education Agency. In a casual conversation I had shared my enjoyment or continuing to learn and further my education to which she suggested I never give up that desire. While most likely not her intention, it was the encouragement I needed to look at future options and enroll in this program. While she was the catalyst for this adventure, there were many before and after her who also encouraged me and inspired me towards public education and to continue my own education.

Dr. Kelly Conn and Dr. Tom Mowle both deserve my gratitude. Dr. Conn, my advisor, patiently worked with me despite my wide gaps in communication and never let me give up on the paper. Dr. Mowle provide me the advice I needed to keep writing and served as an important thought partner allowing me to talk through my various questions and search for advice I needed.

More than anyone I want to thank my father, who instilled work ethic, curiosity, perseverance, and a drive to constantly bettering myself through learning and purist of knowledge. He has been my biggest fan, and never doubted my ability to complete any task I take on. I hope that one day my daughter will look at this paper as a small sign of the accomplishments of her father and that it adds to the desire in her life to do and complete anything she sets her mind to.
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CHAPTER 1: INTRODUCTION

In 1854, 16 years after Texas declared independence from Mexico and 9 years after Texas joined the United States to become the 28th state, the Common School Law of Texas was passed providing funding for the first state school system in Texas (Texas Education Agency [TEA], 2004). The fund that was created became known as the Texas Permanent School Fund, and it is the state’s sovereign wealth fund that is used exclusively for the funding of public primary and secondary education in the state (Davis, Dawn-Fisher, McKenzie, Rainey, & Wall, 2014).

In 1876 the State of Texas passed a new constitution, still in effect, that included a section regarding Education commonly referred to as the Education Clause. The Education Clause dictates that “it shall be the duty of the Legislature of the State to establish and make suitable provision for the support and maintenance of an efficient system of public free schools” (Texas. Const. art. 7, pt. 1). Seven years later in 1883, a constitutional amendment authorized the districting of Texas schools and allowed these newly created districts to exercise taxing authority over property within district boundaries (TEA, 2004).

The new school districts utilized their taxing authority, supplemented by per capita flat grants from the State through the sovereign wealth fund, to provide the bulk of school revenue (Hobby & Walker, 1991; TEA, 2004). In 1909, the State Legislature began to pay attention to the disparities engendered by the current state of school finances, which allowed all districts to receive flat grant funding regardless of a district’s actual fiscal capacity. By 1919, the Texas Legislature began to authorize appropriations to supplement state aid to rural school districts that were already at the maximum property tax rate to better equalize per capita apportionment to schools (Hobby & Walker, 1991). This authorization was the beginning of the State’s efforts to
equalize funding across school districts; an effort that would continue for the next 100 years (Ascher, 1993).

The resources available for Texas schools relied heavily on district wealth for the next 54 years. The State did provide additional resources to supplement both rural and property poor districts, but many districts felt those actions failed to provide adequate resources and property wealth perpetuated inequity between districts (Lesley, 2010). In 1973, a family in the Edgewood school district of San Antonio, Texas, filed a lawsuit on behalf of many families in the district against neighboring school districts and the State of Texas in Federal Court, claiming the Texas method of funding education was unconstitutional by the United States Constitution’s 14th Amendment’s equal protection clause as it did not sufficiently provide equity to all school districts (San Antonio ISD v. Rodriguez, 1973). The Supreme Court ruled against the plaintiffs stating that education was not a fundamental right under the U.S. Constitution; instead, educational practices including funding were issues for the states to decide under the 10th Amendment and that any legal challenges should therefore be decided per state laws and regulations (Baker & Green, 2008; Barrera, 2012)

Statement of the Problem

Since the Rodriguez case, the State of Texas has encountered other major legal challenges to its education funding system that were determined by the State Supreme Court, as well as a multitude of minor legal challenges in local courts that were never heard by the State Supreme Court (Kauffman, 2008 Pace, 2014). While some of these cases focused on the taxing authority of the state for education finance funding, most focused on various aspects of equity of available resource and adequacy of resources to provide a sufficient education as well as the state’s degree of adherence to the Education Clause (Kauffman, 2008).
While several cases are described in greater depth in the literature review, of significant note is *Edgewood Independent School District vs. Kirby* (1989), which led to the current major system of education finance in Texas (Pace, 2012). Following the failure of the Rodriguez case, the Mexican American Legal Defense and Education Fund filed a new suit on behalf of the Edgewood school district alleging that the current system of financing created unequal opportunity for districts due to differences in property wealth, and thus was in violation of the Texas constitution (Walker & Thompson, 1989). In response, the Texas Legislature created a system, commonly referred to as the “Robin Hood plan,” that designated Chapter 41, or property wealthy districts, and Chapter 42, or property poor districts, and then recaptured funds from Chapter 41 districts to be redistributed to Chapter 42 districts to increase equity (Legislative Budget Board, 2001).

In 2011, the State of Texas government passed House Bill 1, their annual funding bill that includes the state funding for public schools. For the first time, this annual bill failed to fund enrollment growth in the state; it also cut $4 billion for the biennium from the Foundation School Program, which along with local revenue provided for districts’ maintenance and operation (M&O) (MacLaggan, 2011). This was accomplished by decreasing the required allotment per student. In addition, the state cut $1.4 billion in funds that were used for competitive and formula grants that benefited schools and school age students, for a total of $5.4 billion (H.B. 1, 2011).

To add to the shortfall, funding from the federal government through ARRA, the American Recovery and Reinvestment Act, ended that year and decreased the total sent to the state by about $1.6 billion (Castro, 2009). In total, the state put $5.4 billion less into education then what was expected and had $1.6 billion less in federal funding then the previous year.
Some claimed the State cut $6.6 billion if they would have considered cost of living increases and other increases to keep up with federal and state promises that went unfunded (Intercultural Development Research Association [IDRA], 2016).

Despite the difference in total funding spent on education in Texas and the failure to fund enrollment growth, some members of the legislature claimed that the state did not cut money at all and that the Foundation School Program increased (Michels, 2012; Shelby, 2012). Closer examination showed that education spending did make up a greater share of total state spending, but total education spending was less than previous years (Shelby, 2012).

Whether this process is considered a funding cut or a failure to fund education at the same levels as previous years, Texas school districts had less money in the 2011–2012 biennium than in previous years. Estimates left most districts with 6% decreases in 2011 and another 6% decrease the following year, which averaged about $500 per student each year of the biennium (Weissert, 2012). Even after the state increased their funding levels in the following years and restored some grant programs, the state still funded education at $3.2 billion less in the 2016–2017 biennium than what would have been expected for similar levels in 2009–2010 after accounting for enrollment growth (Marder & Villanueva, 2017).

These cuts were not equal across all students and districts, however. The law was written to try and help districts who were held harmless by the state providing the difference in previous funding changes due to the state requiring all districts to decrease their tax rates in 2006 and attempted to not decrease funding for property-poor districts that received a larger share of funding from the state. In addition, these cuts provided no additional funding for the additional 100,000 new students in Texas that year (Murphy & Smith, 2012; Smith, 2011; Smith, 2012).
The state also called a special session following the legally required end of a regular session in May. In June, the legislature returned with a request from the governor to make changes to the state school finance system to account for the funding changes. The legislature passed Senate Bill 1 (2011) which covered fiscal matters related to public education. This bill accomplished the task by making changes to the regular and basic allotment and required that the Foundation Schools Program be done in proration the first year of the biennium and then reduction made to the target revenue portion of the school finance formula in the second biennium (Texas S.B. 1, 2011).

The *Texas Tribune*, an online news periodical, examined high level descriptive statistics by administering a 22-question survey for 120 districts following the cuts to determine how they managed with decreased revenue. They found that the average class sized had increased, the number of teachers had decreased, and standardized test scores had remained flat (Collier, 2015). Children at Risk, a nonprofit in Texas, also surveyed schools and found in addition to cuts in teachers and increases in class sizes that many Districts were delaying or excluding building maintenance as a means to balance their budgets (Goff, Madore & Sanborn, 2012). This, combined with strong sentiment from district superintendents and education advocates, left many districts to move towards lawsuits challenging these cuts and changes as decreasing equity and efficiency for all school districts (Chen, 2017).

**Research Problem**

Equity in school finance has been a major issue in Texas ever since the Supreme Court ruled in *San Antonio Independent School District v. Rodriguez* (1973) that education is not a “fundamental right” under the U.S. Constitution, but that it is an issue left to the state. The state is legally required to provide “sustainable provision” for education and the courts have
determined that this includes funding for both an adequate system and an equitable system (Imazeki & Reschovsky, 2004). The state accomplishes this goal through their Foundation School Program (FSP) which establishes an amount of funding for each district. The program’s goal is to ensure that all districts, regardless of tax wealth and property wealth, receive equal access to revenue per student (Texas Education Code [TEC] §42.001; Davis et al., 2014).

Local property taxes are the major portion of funding, averaging 45.97% of the total amount of funding for a district in 2011, but the range varies greatly between all districts (TEA, 2018). In 2011, excluding special districts and charters that receive 100% of funding from only state and federal sources, the lowest amount of funding from local sources was $361 per student, or 3.4% of all sources, for general funds from local sources at Boles Independent School District (ISD). The highest district was Port Aransas with $28,275 per-pupil, or 87.14% of all sources, for general funds from local sources (TEA, 2018). The state would then make up the other portion in an effort to create equity between districts for revenue and per-pupil spending.

Since that time, the per-pupil spending, or average amount of funds spent on education per student at a district, has been a major issue for the state. As local tax revenue through property values is the major source for all districts funding, ensuring that all districts provide adequate education but also an equitable education has become a major issue for the state (Robledo Montecel, 2011; IDRA, 2011).

In addition to the legal argument, another important reason to review equity of inputs for public school is that direct correlation to student outcomes. Studies have confirmed that increased spending leads to increased quality of schools, and that quality can account for 25% to 33% of the variation among student performances on standardized test scores (Ferguson, 1991; Lafortune, Rothstein & Whitmore Schanzenbach, 2016; Levin, Belfield, Muennig, & Rouse,
2006; OECD, 2012). An alternative view proposes that factors outside of the control of a school system, such as family background and family wealth, have a stronger indicator of student success and outcomes (Grubb, 2009). A common myth that is sometimes echoed by both business leaders and education reformers is that money doesn’t even matter in education (Berliner & Glass, 2014). Bill Gates once claimed that the cost of schools has doubled while student achievement has remained flat (Gates, 2011).

The idea that money doesn’t matter does not tell the whole story however, which is why equity is so important (Berliner & Glass, 2014; Lesley, 2013; Grubb, 2009). Research has shown that how money and other resources are utilized for programs that help bridge the opportunity gap do have success in improving student outcomes (Grubb, 2009). Equity attempts to look at how we can equalize those opportunity gaps that are outside of a student’s control, such as the wealth of their own family or their neighbors and provide an equal opportunity for all students to be successful in school despite differences outside of the school.

The idea of looking at equity to measure fairness in financial spending is relevant for Texas. Previous court cases have ruled that equity can be defined in educational spending as equal spending for equal tax rate. In other words, districts that levy a tax at the same rate should have similar level of resources to expend on education. This study looked at the changes that came from the state cutting their share of education funding for all district as part of House Bill 1 in 2011 to better understand how these changes effected the state requirement of providing equity in school finance.

Prior to 1995, there was a large gap in the funding available to various school districts in Texas, which relied heavily on local property value and property taxes to fund schools. On average, wealthy districts could raise funds that equated to over $10,000 per pupil, whereas some
poor districts could only raise $3,000 (IDRA, 2016). This created an equity issue, or a fairness issue, where students were not gaining similar educational opportunities between districts.

The State, which typically shouldered a similar share of educational spending in Texas with local districts, with federal spending making up 10%, had maintained around 45% of the total spending on education. In 2010 and 2011, the percentage of funds from federal sources through ARRA increased to around 16%, with the State benefiting from the change and decreasing their percentage to below 40%. Following the end of ARRA however, the state did not return to its original funding level, and this left local districts shouldering a higher share (Taxparency Texas, 2017).

Funding cuts from the state in 2011 led to cuts in programs and services in districts. While many of the cuts were across the board at the per-pupil level, the cuts to some grants included some programs. One notable example is the pre-K grants that provided additional funding to districts to increase pre-K programs for high needs students from half day to full day. Surveys from Children at Risk showed that across Texas, districts cut their full day pre-K programs to half day, decreased the number of seats available, cut 1,132 pre-K teachers, and increased class size (Goff, Madore, & Sanborn 2012).

This study looked at how equity and funding changed following budget cuts under House Bill 1 and how student performance on a national normed test taken regularly by all states, the National Assessment of Educational Progress (NAEP), have changed for Texas students. The study examined whether changes in equity correspond to changes in state funding, and whether changes in funding correspond to any changes in student performance. The study started in 2008 to create a baseline before cuts and continue through the 2017 year to provide a longitudinal series of data to review. In order to provide a range of equity statistics, both a wealth neutrality
measure of correlation coefficient of variation, and the Gini coefficient was calculated to
determine whether equity changed across the state. The calculation of each of these measures
are reviewed in Chapter 3 of this paper.

**Justification for the research problem.** The very idea and concept of this research study can be traced back to earlier research conducted on Texas school finance changes by Lovett (2007) and Hawkins (2011), who compared previous school finance systems in Texas before and after major legislative shifts in allocating resources to school districts. These two researchers used the mean of per-pupil spending of all district to calculate equity between school districts, and then compared the measures of equity before and after the implementation of new legislation to measure if the new funding systems improved, decreased, or kept equity the same between Texas districts. Lovett focused on changes brought by House Bill 1 (Texas H.B. 1) in 2006 and showed that the new legislation widened gaps between “Property Poor” and “Property Wealth” school districts, and increased inequities. Hawkins repeated the study in 2011, focusing on House Bill 3646 (Texas H.B. 3646) in 2009. Texas H.B. 3646 attempted to correct the inequities that critics claimed were caused by H.B. 1 and provided greater funding towards “Property Poor” districts through State funding. Hawkins found that while this new bill did increase overall education spending, a gap persisted between “Property Poor” and “Property Wealthy” school districts.

Del Bosque conducted a similar study in 2011, also looking at equity before and after H.B. 3646 in 2009, this time with a stronger focus on horizontal equity using four tests of equity to measure levels of change in school funding. This research also found that although the variance between districts narrowed, a significant gap still existed.
Each of these changes to school finance, H.B. 3646 (2009) and H.B. 1 (2006), came as the result of lawsuits filled by school districts in Texas and rulings that the current financial system was unconstitutional under Texas law and requiring the legislative to adjust the current funding system. This study builds on previous research, but also looks at the bigger question of how this may have affected student outcomes due to less funding and decreased programming. In this way, this paper addresses two important questions left after Texas cut funding for education. First, after looking at the relationship between decreased funding, equity, and outcomes, does money matter in education? Second, did lower student outcomes correspond to Texas’s funding cuts?

**Deficiencies in the evidence.** While past changes to the school finance system in Texas has been the result of lawsuits and court orders to create and refine the existing system, 2011 is unique as the change to the system came not from a lawsuit or court order but from a claimed budget shortfall. Thus, the law was not a result to create more adequacy or equity, but a means to balance the state budget as required by law. For this reason, the change from 2011 is apt for study due to the change not occurring to decrease inequity, the claim that the changes would not have any effect on the equity of financial resources, and further claims that schools were already sufficiently funded but could absorbed changes through local property taxes and through increased efficiencies.

This study adds to the existing literature by reviewing how equity changed following a decrease of state funding in the school financial system and what effect this had on student outcomes. The effects of this decrease have not been significantly reviewed by other researchers, and research on how funding decreases effected student outcomes in Texas are incomplete. The study also provides more detail and understanding into the effect that state
funding has on the overall equity of the school system in Texas. Finally, this study adds to the
literature of school finance equity measurements by not just measuring equity in a single year but
looking at how equity has changed over a span of 10 years and comparing it to both overall state
funding and student performance.

As the Texas Constitution provides for a free and adequate system of education for all, the issue of school finance is important for all Texans. In addition, residents all share the burden of funding some portion of public schools through property taxes. The state, which does not rely on property taxes but on sales taxes, fees, oil and gas leases, and other sources, directly affects all tax payers when their changes may shift burden to the local level. Furthermore, as quality education and a well-educated populace has been shown to be beneficial in multiple ways to the community and to others, it is important that a public education system be sufficient and adequate for all students in the state.

**Relating the Discussion to Audiences**

This research provides relevant evidence towards the discussion of whether state funding changes in school finance influence equity of district school systems across the state and have a negative relationship with student performance. The findings should provide factual data to either support or deny claims made on both sides regarding fairness and equity and if the decreases in state funding related to the overall equity between districts.

In the long term, this research could also show if the portion of state funding influences overall equity. This can be used by both policy makers and future researchers to ensure that future ideas or policy changes do not contribute to greater inequity in the overall school finance system. The bigger question focuses on how student performance changed and whether it is correlated to changes in funding and equity. It also adds to the theory of equity in school finance
by providing more research to support the idea that the state plays a role in ensuring equity for school funding across the state.

In addition, this research supplements the current universe of research on school finance equity, especially dealing with historical horizontal equity in Texas and in the use of comparing equity measures to determine the changing of equity before and after policy events. Finally, if a decrease in student performance is shown to be correlated with a decrease in funding and equity, it could provide greater insight into the idea that money does matter and provide research to support the need for equitable resources for public schools. If the state’s goal is to both provide an equitable school system and prepare students for life, a decrease in equity and student outcomes would provide cause to revisit the funding needs of schools.

**Significance of Research Problem**

In Texas, as of the 2017–2018 school year there are 5,359,127 students enrolled in public education, of which 3,159,327 are considered economically disadvantaged, or 58.9% of all students (TEA, 2017). Research has shown that students who lack inadequate access and resource to education will be at a distinct disadvantage in outcomes, graduation, and later-life opportunities (Lesley, 2013). This risk goes up even more when the student themselves are economically disadvantaged (Hanover, 2015; McKinsey & Co., 2009). Due to this position, it is increasingly important to address fairness of educational resources for all students (Coons, Clune, & Sugarman, 1970).

There is a popular position that money plays an important role in equity and student outcomes in education (Odden, Goetz, & Picus, 2008). Other researchers have claimed that student performance and per-pupil spending are not correlated (Hanushek, 1997). While Hanushek provides some additional research and alternative ideas on the role of funding in
education, traditional wisdom and research still support that equitable funding for education is important to ensure all students are receiving an adequate and basic education to be successful in life (Equity Center, 2016; McKinsey & Co., 2009).

This research can provide needed understanding and data on determining whether the changes to state school finance created a more inequitable system, as many critics claim, or had no effect on equity, as some lawmakers hoped. In addition to providing insight into how changes to the state portion of funding plays a role in the horizontal equity of inputs across school districts in Texas, the paper also looks at how it is related to student outcomes.

The findings of this study benefit both the researcher and the state. The state could gain by having better understanding of how changes in state funding effect equity by providing demonstrable evidence of overall equity. Policy makers and educational leaders can use this information to better inform their own decisions and priorities when focusing on school finance. The public can use the information to better inform their own priorities when determining if they wish to support greater equity in school finance. The researchers can also use these findings as a change agent to lobby for changes to increase equity and ensure that the public is fully informed of what the possible outcomes of changing state funding would have on the school system in terms of equity between districts. As it is, due to planned lawsuits by school district in 2012, the State legislators undid many of the changes in 2011 during their biannual session in 2013 and took back more in 2015. Despite these changes, districts still sued in 2015. While the lawsuits went forward, and the courts first ruled the system to be unconstitutional and then on appeal was found to be flawed by still constitutional, the question was still not reviewed on whether the changes in 2011 exacerbated inequity in the school system for Texas. This question was left
unanswered, and the question of how the percentage of state funding effects the equity in Texas was not examined.

**Research Central Questions**

Did changes in funding from the state correlate to changes with student outcomes in reading and math? This question can be further divided as:

1. How has equity changed from 2008–2016, as measured by equal opportunity and horizontal equity from year to year?
2. How has fourth-grade reading proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?
3. How has fourth-grade math proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?
4. What is the relationship between a change in equity and a change in student proficiency?

The first question investigates the two major equity principles, equal opportunity and horizontal equity. Per-pupil spending was used as the variable of study. Statistical calculations of wealth neutrality measure of correlation, coefficient of variation, and the Gini coefficient was run for each year and plotted to determine how equity has changed compared to the amount of top funding provided by the state for education.

The measure of wealth neutrality allows the researcher to determine two things. One, had changes in state funding resulted in an increased reliance on local funding and local wealth of an individual district. Two, did changes to the wealth of a district have any effect on equity. For this study, the property wealth of the district is measured compared with per-pupil spending to determine whether there is a statistical relationship between the two variables. Detailed
explanation on the formula and method for calculating all three equity measures is provided in Chapter III of this study.

The second and third question look at student performance of fourth-grade testers in the NAEP in Texas for math and reading. Each result is mapped during the 10-year period to determine how performance has changed for Texas students. The U.S. student average is also measured to compare any change in Texas with the U.S. population as a whole to see whether any changes in Texas student performance are following a national trend and thus not linked to factors in Texas.

**Positionality Statement**

School finance in Texas has been a strong interest of mine for many reasons. First, I have a strong connection to Texas public schools. I was a product of public education in Texas and was enrolled in college when Texas made one of the biggest changes to school finance, property taxation, and the Robin Hood program to equalize funding for districts in 2005. As a Junior in college, I used the changes to the finance system as a policy study in a public policy course I was taking. I was then able to expand on my understanding of school finance in Texas and how public policy plays a major role in governmental spending and funding while working on a master’s degree in public policy. During that program, I learned the basic concepts of school finance and public funding equity, including the concepts taught by Berne and Stiefel (1981, 1984, 1999) on how to measure financial equity and the importance of equity as required under the Texas constitution.

While the topic and changing policy in Texas stayed as an item of interest to me, it took a more personal turn in 2011 due to the passing of the policy I am studying in this paper. At the time, I had already spent 2 years working in a high needs school in Texas and following the
completion of my Masters in Public Policy had started work for the TEA in Austin, Texas. While at TEA I also enrolled in Northeastern’s Education Leadership program. While in my final year of classes, I was let go from my position at the TEA due to the funding cuts that happened under House Bill 1 in 2011. This provided a very personal connection to House Bill 1, and a desire to understand how this bill may affect education in Texas.

Personally, I had conflicting feelings on the budget cuts in 2011, and many of those feelings continue to this day. While I strongly believe in public education and support the Texas constitutional requirement to fairly and adequately fund publicly education, I also believe in the rules in the state constitution that require the State to pass a balanced budget. This is a strong rule that ensures the state does not run a deficit or create debt that must be balanced at some point. Overall, I feel it was a bad situation for all those involved due to an even lower than expected revenue situation for the State. It is my opinion that the State could have taken steps to balance the budget without making such large cuts to education, and I found it unfortunate for myself, for the students of Texas, and for the local districts that education was the major victim of budget tightening. While I understand why the State made the cuts they did, the outstanding question I have always had was if these cuts created larger problems for cities and students. With this research, I hope to provide some guidance for that question in understanding if this provided less equity for Districts and to better understand the role the state plays in ensuring equity for schools and in turn ensuring we are meeting the constitutional requirements of the State.

**Theoretical Framework**

The equity theory of school systems is a set of concepts first studied by Leanne Stiefel and Robert Berne to help understand the idea of fairness in education. To start their theory, they
looked to answer of the questions of who, what, how and how much. The authors hoped that these concepts and questions could be used to developed ways for measuring and determine equity (Berne & Stiefel, 1981; 1994).

Equity as a theoretical framework is based on earlier studies into fairness theory, which looked at social inequality between people and argued that “broad principles are able to capture the nature of what constitutes a just society” (Schneider, 2005, p. iii). J. Stacy Adams built on the theory of fairness and developed a theory of inequity that looked at inequality between people and how to reduce or eliminate such inequity (Adams, 1981).

Similarly, educational equity began as an understanding of inequity among students and the effects of certain criteria; outcomes, access, and participation (Brookover & Lezotte, 1981). Educational equity assumes “a basic belief that all citizens regardless of sex, race, creed, or economic circumstance should be guaranteed equality of education” (Brookover & Lezotte, 1981).

Berne and Stiefel (1984, 1999) described their focus, or the “who,” as children’s equity concepts and labeled their target as students in the school system. They theorized that children are an important focus for equity as education’s primary goal is to prepare a student for their own future, and so to ensure that student had equitable student life choices later in life it was important to ensure equity in the school system. This focus is different than an idea of equity that focused on the taxpayer, as they pay for the educational services and would expect to receive an educational system equal to their taxes when compared to a tax payer elsewhere.

Another factor in education equity, resources, examines how time, money, and work (or people) contribute to how people understand inequity and measure equity between different groups (Berne & Stiefel, 1999).
The equity theory of education reviews two different types of equity: macro-level inter-district equity, which compares the equity of one district to another, and micro-level intra-school equity, which compares the equity of one school to another within the same district (Berne & Stiefel, 1984, 1994). Intra-district equity can be further broken down into horizontal, vertical, equal opportunity, fiscal neutrality, taxpayer and program adequacy equity (Berne & Stiefel, 1984; Stevens, 1989). Inter-district equity measures of horizontal, vertical, and taxpayer equity, have been ruled to be the central tenets of the state’s education clause by the Texas Supreme Court (Imazeki & Reschovsky, 2004; Minorini & Sugarman, 1999).

Berne and Stiefel’s theoretical framework on school equity focuses on three major principles of how to measure equity: equal opportunity, horizontal equity, and vertical equity (Berne & Stiefel, 1984). The first point of these three principles was to separate the idea that equity and equality were the same thing (Rubenstein, 2016). The authors argued that it would not be fair for all students to receive the exact same amount of funding because that would not consider the differences in actual needs. Equity would need to be measured more deeply and these three principles would help explain that focus.

Equal opportunity measures if a relationship exist between the object of study and a second variable that would be considered illegitimate or unwanted. When the relationship does not exist, it can be considered to show equal opportunity. A common study of equal opportunity looks if school funding is a factor of property values. In other words, do or that schools with higher property values have more per-pupil spending. In perfect equal opportunity, all students would have the same chance to be successful and we would not be able to estimate their chance of success due to criteria outside their control like wealth or geographical location.
There are two major concepts to wealth neutrality, ex ante and ex post wealth. The ex post measure looks at the comparison of wealth to another variable after it happens and is a simple mathematical calculation of correlation to determine if the one had a relationship to the other. This is measured after the tax rates are set and the expenditures or budgets are set. An ex ante wealth neutrality requires “equal tax efforts results in equal expenditures” after the tax rates are set but they influence the expenditures or budgets by hopefully providing additional funds through policy for those who would be behind (Feldstein, 1975; Friedman, 1977).

In Texas, policy already provides certain mechanism for balancing the variance on wealth neutrality, including the equalized wealth measure and the recapture measures for districts. These policy decisions are considered *ex ante*. This study focused on ex post wealth neutrality for schools in Texas and look if wealth neutrality exists considering the current policy and changes to the policy.

*Vertical equity*, commonly called “the unequal treatment of unequals,” measures whether students with different needs receive statistically different inputs (Berne & Stiefel, 1984). In understanding vertical equity, determinations need to be made on when different needs require different resources (Rubenstein, 2016).

*Horizontal equity*, which this study focused on, looks at the equal treatment of equals. This ensures that similar students receive similar financial inputs irrespective or where they live, their property value, taxes, or other factors (Berne & Stiefel, 1984, 1994; Rubenstein, 2006).

**Definitions**

**Ad valorem tax.** *Ad valorem* is a Latin term that translates to “according to value” (Kagan, 2018). In regards to Texas and its taxing laws, it relates to the taxes placed on the worth of real property of taxpayers in a district (Davis et al., 2014).
Adequacy. A benchmark to evaluate capacity of an education system to meet a basic level of standards and provide for a minimum of sound education for all students (Clune, 1994; Park, 2011).

Assessed property value. The value of property, minus any homestead exemption or other exemption that is determined by government officials. This value may differ from a market property value (Gilliland et al., 2011).

Average Daily Attendance (ADA). The total number of students who are in attendance each day of the school year divided by the number of instructional school days (Davis et al., 2014).

Equity. School finance defines equity as the equal distribution of resources for the use of schooling. Texas law currently defines equity as similar revenue for similar tax effort, an idea known as fiscal neutrality (Alexander et al., 2000).

Equalized Wealth Level. The amount of tax revenue a district may keep based on their tax effort (Davis et al., 2014).

Foundation School Program (FSP). State program administered by Texas Education Agency that determine amount of state and local funding each school district is due under state law (Davis et al., 2014).

Horizontal Equity. Commonly referred to as “equal treatment of equal,” meaning that school districts like each other have comparable levels of funding (Toutkoushian and Michael, 2007).

Independent School District (ISD). The local education agency used for all but one public education district in Texas (Stafford Municipal School District is part of the city of
Stafford) that creates an independent governmental entity that serves a defined population (Davis et al., 2014).

**Interest and Sinking (I&S).** Funding used to pay interest and principle on bonds used to finance facilities and fixed assets. I&S is not subject to recapture (Davis et al., 2014).

**Maintenance and Operations (M&O).** The administration and operational cost to run schools. The current M&O tax rate is capped at $1.17 per $100 valuation for all districts except those specifically exempt by law (Davis et al., 2014; IRDA, 2011).

**Permanent School Fund (PSF).** Land set aside by the State of Texas in the 1876 that is used as a trust through lease payments and royalty payments to provide public school education funding (IRDA, 2011). This sovereign wealth fund was started in 1854. In 2013 the fund was estimated at $26.9 billion (TEA, 2004; McClellan, 2010).

**Property wealth.** Also referred to as property value, the property wealth is the estimate of the total value of property if it were sold on an open market (IRDA, 2012).

**Recapture.** Any revenue of property wealthy districts raised above the equalized wealth level of $319,500 per weighted student (Pace, 2014).

**Robin Hood.** Nickname used for the Chapter 41 state law that requires property wealthy districts to share locally generated property tax by providing a portion of funding above the EWL back to the state. Currently the “Robin Hood” plan redistributes over $1.8 billion (Pace, 2014).

**Texas Education Agency (TEA).** The administrative governmental unit that oversees primary and secondary education in the State of Texas (Davis et al., 2014).

**Tier 1.** Part of the FSP that provides all schools a basic, or adequate, level of funding for regular education, special education, compensatory education, career and technical education,
bilingual, gifted and talented education, transportation, high school allotment, and new instructional facilities (Davis et al., 2014).

**Tier 2.** Supplementary funding to Tier 1 that guarantees a specific amount of funding per student based on WADA (Davis et al., 2014).

**Tier 3.** Provides supplemental funding for school facilities based on I&S bonded tax effort of districts, only available to a limited number of districts (IRDA, 2012).

**Vertical Equity.** Common referred to as “unequal treatment of unequals,” this equity principle states that certain student characteristics should receive greater funding than other characteristics to compensate for student differences (Toutkoushian and Michael, 2007).

**Weighted Average Daily Attendance (WADA).** The adjusted Tier 1 entitlement divided by the district’s basic allotment amount (Davis et al., 2014). The WADA is used to provide additional monies based on a district’s demographics and student characteristics (IRDA, 2012).
CHAPTER 2: LITERATURE REVIEW

This section reviews previous literature and research of intra-district equity measures. The purpose of the review is to gain understanding into previous research of the concepts of equity, the literature surrounding vertical, horizontal, and equal opportunity, understanding into the education climate that lead towards research of intra-district equity, along with studies that dealt with the framework and actual practice of measuring intra-district equity.

To identify the research and previous studies, key word searches of EBSCO, ScienceDirect, Google Scholar, and ProQuest were utilized for school finance equity, specifically intra-district equity and resource use distribution. Research by the Center on Reinventing Public Education (CRPE) and the Consortium for Policy Research in Education (CPRE) for studies on measuring urban intra-district equity and literature into the theoretical methods of understanding equity was also reviewed. Furthermore, special issues of the Journal of Education Finance were utilized that specialized on intra-district equity concepts. The sources used for the history of education and school finance in Texas came from the Texas Education Agency and their resources for additional information. The legal history of school finance in Texas was researched through the actual case law and legal challenges that have made up the major decisions in Texas school finance.

The following sections look at the history of school finance in the United States and Texas. A major focus looks at how public funding for schooling became the norm in the United States to understand the historical justification for publicly funded education. The legal history of school finance, including national and Texas court cases are then reviewed to understand the legal justification of school finance and previous court case that have ruled the importance of equity when looking at public school systems. Next, a review of equity regarding school finance
is discussed to better understand the previous academic research with a focus on intra-district equity and literature connecting equity with student outcomes. Finally, previous research and literature on school finance equity is reviewed. This includes studies with a focus on intra-district equity and horizontal equity, including studies conducted at the state and national level with an express focus on studies conducted on the Texas school finance system.

**History of School Finance**

School finance has been connected to education in the United States from the start of the very first public schools in Massachusetts. In 1642, the Bay School Law required those in Massachusetts settlements to provide education for all children, so that children of the indigent or those whose guardians neglected to provide education would still provide the means necessary to promote literacy, governance, and bible studies (Eberling, 1999). It would still be many years before universal education became a reality for Massachusetts or the other colonies and future states.

These early attempts at proving equity for schools demonstrated state efforts to provide access of education for all children. As schooling in colonial and territorial America were still new, it was common that only the rich or the religious obtained any type of schooling (Coulson, 1999). Early schools typically were found at missions and churches or large urban areas provided for those that had the means to attend. Those that worked or lived in rural areas had little opportunity, and thus access was inequitable among the well-off citizens compared with the immigrants, poor, and natives. Focus on early laws and policies were focused on closing the equity between who received schooling (Mondale & Patton, 2001; TEA, 2004).

The Republic of Texas faced a similar start. Texas hoped the Republic’s vast resources of land and minerals could provide for education for all, without the need of taxes or fees. In
addition, Texas President Lamar required that 3 square leagues of land in each county must be set aside for primary education, but these measures failed to establish a single public school during the time of the Republic (TEA, 2004; Lang & Haigh, 2010).

In 1839, President of the Republic of Texas, Mirabeau Lamar, set aside public land that local communities could use for the creation of public-school buildings. Fifteen years later the state provided the first appropriation for public schools, providing each school $0.62 for each student. In 1876 the state then created a Permeant School Fund (PSF) made up of existing and new lands that would be set aside for lease and interest revenue that would go towards funding public education. This funding remained the only source of state funding for schools for over 35 years (TEA, 2004; Equity Center, 2016).

The first large reform in school finance came in 1947, when the Gilmer-Akins law, which were a set of three proposals created from an advisory committee that sought to make schools more effective and efficient. One lasting provision of this law was state funding provided for equalization purposes meant to supplement local taxes, and the state tying funding to attendance of students (Texas State Historical Association, n.d.; TEA, 2004).

The Texas Constitution of 1876, still in place today, provides for the “general diffusion on knowledge” and ensures that state “establishes and make suitable provision for the support and maintenance of an efficient system of public free schools” (Article 7, Sec 1).

The power to enact public education is with the state legislators, but the judicial branch has stated that they have the power to interrupt if the system of education meets the letter of the law and have developed constitutional test that any system must satisfy. Specifically, they test:

- Efficiency. Be focused on equity of both inputs, or results, and outputs, or financial support
• Adequacy. Must provide for general diffusion of knowledge
• Suitability. Must be structured, operated and funded to accomplish its purpose

It is the second part of the first test, known as the *implicit prong test for efficiency*, which is the major focus of many of the lawsuits in Texas for state funding, and the focus of this paper (Barba, Ginn, Grusendorf, & Hefin, 2016).

**Legal History**

The legal context of equity in education is new, judging by court decisions. The first and most well-known court case focused on equity of access and equity of opportunity. In *Brown v. Board of Education*, it was argued that education being a cornerstone of American values, and separate but equal doctrine of segregated education being not truly equal, that segregation caused an inequitable situation in direct contradiction to the United States’ Equal Protection clause which guaranteed the government must act equally in both provision of and execution of laws and rules (Brown v. Board of Educ., 1954).

Coons, Clune, and Sugerman (1970) argued that the Equal Protection Clause of the United States Constitution extended to state education systems and prohibited local property wealth to determine local school spending levels (see also Thro, 1989). The main argument was that a district’s per-pupil spending could not be directly correlated with their property wealth, a concept known as *wealth neutrality* (Berne & Stiefel, 1999).

The idea of wealth neutrality and the Constitutional protections of the 14th Amendment met a quick legal challenge in 1971 in California (Metzler, 2003). Initiated in 1968, parents of the Los Angles public school system sued the state over the State of California’s school finance system and its reliance on property wealth and property taxes to fund individual school systems. The State Superior Court ruled that the California system violated the U.S. Constitution’s 14th
Amendment as it failed to provide the same protection of all tax payers due to district-to-district disparities and created a system that required many districts to pay higher taxes than many others in order to obtain similar level of services (Serrano v. Priest, 1971).

During the time that parents in California claimed that the California system of education finance was unconstitutional, a group of parents in a property poor suburb of San Antonio, Texas filed a lawsuit alleging that Texas, like California, had violated the Equal Protection Clause of the U.S. Constitution by not fairly funding education to a fair and equitable level for all districts under the current school finance system (Alexander & Alexander, 2011; Walker & Thompson, 1989). Unlike the California case, who sued in state court, the parents of Texas sued in federal court (Orozco, 2013; San Antonio ISD v. Rodriguez, 1973; Hobby & Walker, 1991).

Following the California Supreme Court ruling in 1971, the U.S. District Court ruled that Texas had violated the Constitution and had enacted an unconstitutional school finance system (Hobby & Walker, 1991). Scholars and education experts claimed the ruling brought focus to, at the time, a new idea of school finance known as resource equity (Walker & Thompson, 1989). The victory of poor Texas communities was short lived however, as in 1973 the United States Supreme Court overturned the District court decision, citing in a landmark education case that education was not a federal issue and not protected in the Federal Constitution (Hobby & Walker, 1991). The ruling effectively shifted future challenges of school finance reform to the states, which all have a state constitutional provision to provide education funding at the K–12 level (Baker & Green, 2008). The court ruled that education may be a state protected right, as most states contained clauses providing for education, and many states provide some version of equal protection. The court also ruled however that district wealth was not a suspect class, as a school district is a governmental entity and not a person, and thus no discrimination was created
by different wealth levels (McDonald, Hughes & Ritter, 2004). Following this case, all future education finance lawsuits have been directed towards state government based on state constitutional provisions and not at the federal level (Reschovsky & Imazeki, 2003).

School finance has stayed an important issue for states and local districts. While early lawsuits moved towards the state level, a period of financial equalization begin with major changes, through both new laws and court actions, to how district fund education and the state’s role in supporting districts and ensuring fair resources (Card & Payne, 2002).

In 1984, a group of parents and the Mexican American Legal Defense and Education Fund filed a suit against the state of Texas claiming that the state system of funding discriminated against poor, and typically minority, school districts. This case, Edgewood ISD v. Kirby, popularized as Edgewood I, was a landmark case in school finance equity and determined that the state system that allowed local property taxes to be the major source of funds for education while the state only provided supplemental funding based on attendance was unconstitutional under Texas law (1989).

Five years later, in 1989, the Texas Supreme Court ruled in Edgewood I that the current system of school funding was unconstitutional. The Texas legislature then meet to determine a new system of school funding. After four consecutive special sessions with a focus to develop a new system, the legislature finally approved a bill that increase the state share of funding by over $500 million. Despite this new agreement, the original plaintiffs appealed in a case named Edgewood II, claiming the legislature did not follow the direction of the Supreme Court. The local district court agreed, ruling that the changes did not provide greater equity or equal access to education. The State Supreme Court agreed, and the legislature was called back for a new special session on school finance.
After 2 months, a new plan was developed and signed into law by the Governor. This new plan created additional formulas that ensure all public money spent on students were equal. The new law would set all tax rates at 0.72 cents per $100 valuation with a future increase to $1 based on new County Education Districts in place of local school districts. The state would then guarantee per-pupil spending of $2,200, which would increase to $2,800 in the future. Property wealth districts quickly sued, in a case named Edgewood III, and the Supreme Court ruled that this new plan was unconstitutional as it created unlawful taxing units which were illegal under the state constitution (Acosta, 1993).

During Texas Supreme Court hearing on Edgewood III, the state legislature developed a new plan, called a local option plan, that set out guaranteed yields for tax effort and equalized wealth level for tax revenue. This plan set up five options that Districts could choose who exceed the equalized wealth level. One of these options was that a District could purchase attendance credits with the proceeds going to the state. This plan was commonly referred to as the “Robin Hood Plan” as the rich districts gave money to the state, who then gave additional funding to poor districts who were not able to get the tax yield. A group of property wealth and a group of property poor districts each sued, and the Supreme Court heard the case in 1995 as Edgewood IV and finally determined that the state had created a constitutional system (Barrera, 2012; Equity Center, 2016).

Another case outside of Texas involved parents of the Los Angeles Unified Schools District (LAUSD) in 1992. The parents argued that the distribution of teachers across schools deprived students of equal protection of the law, as poor and minority students were more likely to have a less experienced and less educated teacher (Kaplan & Owings, 2010). The parents alleged that LAUSD allowed teachers with greater seniority to transfer to any school, which
resulted in the teachers with the most experience working in the schools with the greatest level of parental income and percentage of white students. Furthermore, per-pupil expenditures were lower for campuses that were overcrowded, which also happen to be largely minority (Rodriguez v. LAUSD, 1992). These two criteria together caused minority schools to have lower teaching salaries, and thus teachers with lower experience. The California State Court found for the parents, ruling that LAUSD failed to provide equal protection, and this failed to provide intra-district equity between schools (Rodriquez v. LAUSD, 1992). LAUSD changed funding to campuses by equalizing all spending in 90% of school to within $100 of the district average (Kaplan & Owings, 2010).

In 1995, a New York appellate court came close, in deciding Campaign for Fiscal Equity v. State of New York, in defining what would equate to equitable resources (Darden & Cavendish, 2011). Petitioners argued that the State of New York failed to provide adequate resources for each school, and in kind, failed to provide equity between all campuses (Fiscal Equity v. State, 1995). The court ruled the State’s education clause required the State to provide both adequate and equitable education (Darden & Cavendish, 2011). Of particular interest for determining equity and to provide a definition of what would or would not be adequate, the court ruled that; teachers with less than 2 years of experience were not effective, art and physical education was part of a sound and basic education, science labs and technology were required for learning, and class sizes greater than 18 to 20 for lower grades was detrimental, and thus all could be considered to be unconstitutional (Fiscal Equity v. State, 1995; Darden & Cavendish, 2011).
Equity

School equity continues to be an important issue for all states. The U.S. Department of Education’s Equity and Excellence Commission stated in their latest report (2013) that school systems “must start with equity” to improve education for all students. The report compels States to act now as inequalities in education could cast the country in a recession by failing to provide the quality of education that is needed for a strong workforce. The report defines equity by districts providing sufficient resources for all students based on need, not based on where they live and that all levels of government should design systems to meet these needs (Brown, 2013).

Berne and Stiefel’s framework for school finance equity has been used to measure and analyze equity for school finances for over 30 years. First researched in 1976 and followed up in their comprehensive study *The Measurement of Equity in School Finance* (1984), Berne and Stiefel created a framework of four questions:

1. **Equity for whom?** What is the makeup of the groups for which school finance systems should be equitable?

2. **Equity of what?** What services, resources, or, more generally, objects should be distributed fairly among members of the group?

3. **How should equity be measured?** What principles should be used to determine whether a particular distribution is equitable?

4. **How much?** What quantitative measures should be used to assess the degree of equity (Berne & Stiefel, 1984)?

To help answer these questions, Berne and Stiefel expanded their framework to look at three principles of equity: horizontal equity, vertical equity, and fiscal neutrality. The authors defined horizontal equity as students who are alike should be treated alike. Horizontal equity is
commonly referred to as “equal treatment for equals.” The premise of which is that students who have similar needs and require similar services should be treated with similar inputs. This is explained as equal expenditures or revenues per pupil, equal access to programming, equal teacher competency, and equal pupil-teacher ratios (Berne & Stiefel, 1984).

Berne and Stiefel provided a series of theoretical measures to understand equity. Berne and Stiefel felt that a good equity measure should be able to calculate the dispersion or distribution of a given resource, such as money, across students or schools and assess the effect of the dispersion to determine how equitable a given system is for students. They provided 11 measures of horizontal equity, including range, restricted range, federal range ratio, mean absolute deviation, McLoone index, variance, coefficient of variation, standard deviation, Gini coefficient, Theil’s measure, and Atkinson’s index (Berne & Stiefel, 1984).

Range is the difference the highest and lowest number in a distribution. In the case of school finance, this is the difference between the highest and lowest per-pupil spending. This measure is limited as it only considered two single measures and makes no determination to understand if these are outliers or to provide weight to any important characteristics such as size. Restricted Range attempts to account for this shortcoming by only looking at the 5th and 9th percentile numbers and then creating a range (Berne & Stiefel, 1984; Hale, 2013). Federal range ratio goes further by the dividing the restricted range by the number at the 5th percentile to create a ratio, which can then be compared to another ratio from a different measure to determine which ratio is smaller and provides a more equal structure. These range ratios could also be measured at different percentiles (Hale, 2013). Atkinson’s measure is another ration measure that looks at the poorest decile compared to the richest decile (Haughton & Khandker, 2013).
The mean absolute deviation is a standard deviation measurement that looks at how close the standard deviation is to the mean. A smaller measure would show that the standard deviation of numbers is tightly clustered around the mean, and that this may mean there is greater equity of all the measures to each other. Similarly, the coefficient of variation measures the standard deviation divided by the mean. The measure typically gives a good idea of how dispersed the different objects are from one another. The McLoone Index measures one part of the distribution, the lower half, to the mean of all the numbers in the observation. The measure looks to see how much of the resources are concentrated at the lower half of the observations (Hale, 2013).

Theil’s measure looks at aggregated data in situations where complete information of exact information can be found. Theil’s is an entropy measure that looks at differences within group and across the group. While the calculation is considered complicated, it can provide a reliable measure when full individual information for all observations in the population are not provided (Hale, 2013).

The coefficient of variation and the Gini coefficient are typically thought of as the strongest measures of equity when the study looks at the entire population of study, and are the measures used for this study. Some positive aspects of the coefficient of variation are that it is typically immune to inflationary changes, is easy to understand, and is immune to outliers. The Gini coefficient is typically thought of as the best measure for equity and has the positive aspect of limiting the effect of different size (Hale, 2013). Both measures require a large data set. These two measures both focus on money and are sensitive to changes, but the coefficient of variation uses a mean for the central measure of comparison while Gini coefficient focuses more on all levels compared to one another. The result is to determine how changing the input of
resources, in this case state funding, could create either a more equitable or less equitable situation among all Texas school districts when compared to each other.

Recent literature has questioned the ability of these measures for states, such as Texas, that provide adjustments, or weights, for multiple factors (Ladd, Chalk, & Hansen, 1999; Toutkoushian & Michael, 2007). The claim is that the methods developed by Berne and Stiefel fail to take into effect how to judge vertical equity and fail to take into effect the actual need of the districts for measuring horizontal equity. This assumption is confirmed by Berne and Stiefel in their earlier work in claiming the assumption that most children are equal is easily refuted (1984).

Such limitations have created situations where measuring vertical equity and horizontal equity can produce drastically different results. Costrell demonstrated that states that scored high in Education Week’s horizontal equity ranking typically scored low in Education Trust’s ranking of state vertical equity (Costrell, 2005).

To correct for these limitations, new research suggested additional alternative ways to measure for equity that look at both a combined horizontal and vertical measure. Researchers Toutkoushian and Michael suggested the use of multiple regression models of vertical equity and cost-related factors regressed against per-pupil spending. Horizontal equity could then be measured by studying the variation in per-pupil funding not explained by the vertical equity and cost-related factors. The new approach uses these multivariate models to remove the effects of student and district characteristics to create a measure of equal treatment of equals without the assumption that all districts have the same needs (Toutkoushian & Michael, 2007).

Previous research has attempted to determine if money matters in education (Burtless, 1997; Hedges, Laine, & Greenwald, 1994; Kaplan & Owings, 2010). The major
premise behind equity is determining fair and purposeful distribution of resources (Berne & Stiefel, 1994). Policies have been created for the goal of educating all students to high academic standards, and these same policies require fiscal capacity and resources for meeting such standards. Research has argued that money matters, and if spent wisely will influence student learning. Owings and Kaplan reviewed previous research over if money mattered. Their review showed mixed results (Kaplan & Owings, 2010). How the money was spent seemed to have a better effect than a simple measure of more money (Hedges, Laine, & Greenwald 1994; Kaplan & Owings, 2010). This line of thinking has been linked by newer research to claim that fiscal disparities and inequitable variation hurt the learning opportunities of students (Kaplan & Owings, 2010).

**Intra-district Equity**

In 1994, a shift in school finance literature had begun away from using entire states or individual districts as the unit of analysis when studying quantitative variables towards a new focus of looking at the individual school. The idea of using the individual school as the unit of analysis, commonly referred to as intra-district analysis, contrasted with 2 decades of previous research focusing on the district level, commonly referred to as inter-district analysis, to test equity and measure financial trends in educational spending and measure educational outcomes (Berne & Stiefel, 1984; Wyckoff, 1992).

In studying the financial perspective of intra-district analysis, Berne and Stiefel discuss three principals that lead to the shift from district to individual campus. First, attitudes during the time began to focus more on the individual child when attempting to understanding how to improve education. To accomplish this, it was suggested to focus on activities and programs at the school level, which is closer to the individual student. Second, focusing on the school level
allows greater use in measuring processes, outputs, and outcomes and to better understand variation and relationships of variables. Third, data was finally coming available that made analysis at the school level meaningful (Berne & Stiefel, 1994). The three principles of meaningful campus level data, along with strengths of such data, reliability, and difficulties in finding such data, are be discussed in greater detail in preceding section.

Berne and Stiefel, in critiquing their earlier work on inter-district analysis, argued strongly that future analysis would be more meaningful at the campus level. With the release of campus level data for all school in the New York Public School system in 1992, the authors felt the time was right. The authors had already created a theoretical framework of school equity on principles of equal opportunity, horizontal equity, and vertical equity (Berne & Stiefel, 1984). According to Berne and Stiefel, by focusing on the campus level, these principles could be strengthened and provide greater use and understanding. Equal opportunity takes on a new meaning away from tax capacity and towards actual distribution of resources towards areas, with the ability to look at relationship of resources and other data, such as race or geography. Horizontal equity becomes more meaningful as focus can be placed on actual funding streams to campuses to determine equity. Likewise, vertical equity becomes more important at the lower level as it can better compare the differences between actual students and their needs (Berne & Stiefel, 1994).

The authors also discuss a few points of concerns to consider. Looking at campus level data may mask district provided services and distort the actual expenditure by failing to account for federal of state resources that may be managed centrally. In early releases of campus level data, there was also worry about the quality and reliability of campus level data, which at first was not as easily audited as was state or district level data. School level data also may fail to
take into effect the evolving definition of what a makes a “school.” Typically, data is based on a building, but new reforms and movements in education may lead to multiple programs, schools, grades, or organizations that share a building. Berne and Stiefel question if the definition of a “school” should be by program, by building, or some other construct (1994, p.405).

**Equity and Outcomes**

The importance of understand equity in schools is focused on the idea that certain inputs can lead to certain outcomes. For school finance, this focus is on the resources provided to each campus and how those can lead to better outcomes (Berne & Stiefel, 1984). While the mission of public education may differ across school districts and states, one common theme is to prepare students for something following their time at school. To borrow from the U.S. Department of Education (2011), the mission is to “promote student achievement and preparation for global competiveness.”

In Texas, the Equity Center as spelled out the importance of equity and money to provide quality education by defining excellence and providing a framework for achieving excellence. The Center defined excellence in Texas by leading the nation in achievement results, having all students graduate, and leading the nation in the percentage of adults with college degrees or skilled technical training. Their call for excellence is predicated on the requirement in the Texas constitution for quality education and the findings of court cases that support adequate and equitable funding for schools (Lesley, 2010).

Their study on Texas looked at the revenue per student at Texas campuses and mapped them against student performance on state test, percentage of students dropping out, and percentage of students passing. The authors found that current lack of equitable funding had a direct relationship with poorer performance on these measures (Lesley, 2010). In this study and
a follow up study in 2013, the researchers did state that money itself is not the solution but how the money is actually spent. The researchers discussed four focus areas on how to equitably spend money including quality teachers, class size, early childhood education, early interventions, and rigorous classes and curriculum (Lesley, 2013).

One of the first studies to provide a link on inputs and outcomes came from a 1966 report, *Equality of Educational Opportunity*, where researchers found a relationship between expenditures and outcomes on a vocabulary test. The paper documented a lack of opportunity for African American students who predominantly attended schools with lower expenditures (Coleman, 1966). However, the same study also found a stronger link on family background and student outcomes, which led some to claim that money is not as strong of a factor as other variables outside of a school’s control, such as family background (Grubb, 2009). The idea that money doesn’t matter, but instead it is a host of other factors that led to different outcomes, has become popular. A review of literature both other researchers have confirmed that per-pupil spending itself has either weak or little effect on test scores (Hanushek, 1989; Sirin, 2005).

Other researchers have looked at the actual role of resources, not just resources themselves, and what relationship they have in determining and improving outcomes. In his book *The Money Myth* (2009), Grubb argued that money is neither the whole problem nor whole solution. That how that money is spent on other inputs are more important than just money alone. The author stated that money is important to improvement but does not ensure improvement takes place. The author argues that there is effectiveness in certain programs, and how resources that lead to certain programs create better outcomes.
School-Level Data

The 1997 winter edition of the *Journal of Education Finance* was a special issue dedicated to the use of school-level data, which at the time was still new. The introduction explained the current availability for district level data which included fiscal, student, and teacher level information. The journal described how such data could be used, and current and future studies that will utilize this data to provide research over campus resource use. The journal hoped to answer four core questions regarding the new use of school level data and utilizing such data to improve educational policy. These questions focused on addressing existing questions of the use of school-level data, what kind of school-level data can be obtained, what data is needed by not easily obtained, and what recommendations are there for improving data availability (Busch & Odden, 1997).

Questions that can be answered by school-level data are a central idea of all the journal articles in the special issue (Busch & Odden, 1997). As mentioned earlier, previous research focused on district and state level resource use. Picus (1997) pointed out this is due to the district holding main responsibility in both raising and reporting revenue and reporting expenditures, surmising that, as “production” of educational processes are focused on the school level, it would make sense to provide data based on the school level. Such data would provide utilization figures on actual spending difference between grades, students, ethnic groups, programs, and similar, which would support better understanding of both equity between individual schools and actual resource use (Monk, 1997; Farland, 1997).

Site-level data would also provide better understanding of governance, especially during a time that was new for school-based reform, charter, magnet, and other whole school reforms (Berne, Stiefel, & Moser, 1997). Furthermore, site-level data would allow studies to tie equity to
outcome measures by understanding resource use and funding level and how they relate or how the use of such resources may relate to under productivity, inefficiencies, or efficiencies (Berne et al., 1997). For the greater issue of equity, the authors stressed the importance of school-level resources such as per-pupil spending at the campus to better understand equitable distribution of resources and vertical equity (Berne et al., 1997; Farland, 1997; Goertz, 1997; Monk, 1997). The data could then be used to compare resource use by poverty status, race, and other student indicators. Location data could be used to understand resource use across neighborhoods of the same city. However, the authors cautioned that without understanding the actual wealth of the district, as it is the district controls and provides revenue, analysis between wealth and expenditures would be difficult (Berne et al., 1997). For the issue of adequacy, the authors also felt such data would allow the measure of appropriate resource levels compared to students based on varying characteristics, and thus provide a better gauge of adequacy for the district overall (Clune, 1997).

One of the largest problems of researching intra-district equity of the past years was the availability of site level data (Berne et al., 1997; Goertz, 1997). Early research showed that even when financial and human resource data was available for the site level, the data was incomplete and of poor quality thus making valid research difficult (Goertz, 1997). The National Center for Education Statistics provides a Common Core of Data for many years, which provide educational data on districts including the number of campuses. The data set also provided demographic and financial characteristics of those districts and schools. This allowed early research at the intra-district level, but still lacked actual comparisons between individual campuses (Burke & White, 2001). Following passing of the NCLB legislation, the USDE began to collect site level data of all Title 1 campuses (Heuer & Stullich, 2011). At the local level,
New York City Public Schools was one of the first districts to release detailed financial performance, and human resource data at the school level through their Board of Education School Based Expenditure Reports (Iatarola & Stiefel, 2003; Stiefel, Rubenstein, & Berne, 1998; Rubenstein, Schwartz, Stiefel, & Amor, 2007). Ohio and Texas were the first states to gather and disseminate data at the school level as part of statewide accountability efforts (Stiefel et al., 1998; Rubenstein et al., 2007; Roza, Guin, Gross, & Deburgomaster, 2007).

**Previous School-Level Research**

Review of research shows previous studies demonstrating variation of resources at large urban districts when compared with differences between students and differences between teachers (Betts, Rueben & Dannenberg, 2000; Heuer & Stullich, 2011; Iatarola & Stiefel, 2003; Miller & Rubenstein, 2008; Rubenstein et al., 2007; Stiefel et al., 1998). Three common themes persist through previous research. First, disparities among schools displays inequity. Second, schools with greater needs are more disadvantaged in both financial resources and teacher quality than other schools. Third, disparities are typically not purposeful, but a result of position-based budgeting that funds positions, such as teachers, without considering student need or teacher characteristics (Miller & Rubenstein, 2007).

Burke and White found that the individual characteristics of schools were a primary factor of variation in resources (2001). Their final results showed economies of scale play a large role, both in the size of the district and size of school. Those districts that were larger, and which also happened to be urban, displayed wider variation between schools and between students of resource allocation. The strongest relationship was found between minority enrollment of a district and distribution of resources, signifying that the more diverse a district, the greater the inequity between both schools and students (Burke & White, 2001).
An early look at the practicality of measuring intra-district equity was researched by Stiefel and colleagues in 1998. The authors hoped to follow up on previous qualitative research conducted to help understand the theoretical framework of intra-district equity (Berne et al., 1997). The authors used the Berne and Stiefel inter-district equity and adapted the concepts of vertical, horizontal, and equal opportunity equity to compare between schools of four large urban districts. The researchers collected data from Chicago Public Schools (CPS), New York City schools, Rochester City Schools, and Ft. Worth Independent School District (ISD) in Texas (Stiefel et al., 1998).

When collecting data, the authors found complete and useful data to be sparse. While New York City schools and Ft. Worth ISD had detailed information, the former provided by the city Board of Education and the later by the State Department of Education, neither Rochester nor Chicago had complete information of school level data. The authors collected data from schools on all funding sources and built data files, but due to these differences were unable to compare districts quantitatively against one another (Stiefel et al., 1998).

To measure horizontal equity, the authors used the coefficient of variation (CV), a measure of dispersion that is commonly used to measure horizontal equity and claimed by Berne and Stiefel in earlier research to be a well-rounded approach to determining equity between all observed groups (Berne & Stiefel, 1984). As each district provided varying data sets, the variable was different for each district. All objects focused on some type measurement of general fund and general fund expenditures by campus. All schools showed acceptable range of horizontal equity, although no district provided perfect equity. For vertical equity, the researchers used a measure of relationship between the original variables compared to percentage of students in poverty. Results were mixed across and between districts, with some measures of
expenditures showing weak relationships (lack of vertical equity) and some a strong relationship (proof of vertical equity; Stiefel et al., 1998). Such results could be an effect of validity of data, or the results of an unobserved variable. For equal opportunity, the researchers looked at percentage of non-white students related to expenditures for three systems (no data for New York City) which overall showed effects of equal opportunity, meaning more money going to schools with higher minority enrollments, although must results were weak (Stiefel et al., 1998).

The next step of research in intra-district equity had a focus on understanding not just the distribution of resources, but also the distribution of performance. Using the same framework and equity measures of earlier research that adapted Berne and Stiefel’s intra-district equity to better understand inputs for inter-district equity, Iatarola and Stiefel considered both input and output equity in a study of New York City Public elementary and middle schools. Like previous research on New York City Public School, the authors found wide disparities between resources, teacher experience, teacher certification rate, and teacher pay between schools. For output equity, the authors laminate the lack of previous studies that can be used for comparison. Still, their results reflect a gap in performance between students who are poor, mobile, and ELL compared to general education students, and that these results corresponded to input equity. However, the authors stop short of linking the input equity of resources with outputs until additional research can be accomplished (Iatarola & Stiefel, 2003).

To compare one district in one state to districts in other states, Rubenstein, Schwartz, Stiefel and Amor looked at the intra-district distribution for resources at New York City Public Schools along with Cleveland and Columbus public schools in Ohio. The authors focused on a link of student characteristics and student resources, but also hoped to analyze the differences between both different districts and different states. To calculate equity, the authors used
Coefficient of Variation, which showed an overall result in the high end of acceptable equity (below 0.20; Berne & Stiefel, 1984) yet wide variation between elementary and secondary. The results showed that New York had a negative statically significant relationship between students on reduced and free lunch, limited English proficient, and special needs with resources per student (Rubenstein et al., 2007). This meant that these students received lower amounts of resources compared to students of differentiated need, as also seen by earlier research (Iatarola & Stiefel, 2003; Stiefel et al., 1998). For Columbus and Cleveland, similar results were shown as New York, although not at any significant level (Rubenstein et al., 2007).

While earlier research focused on large urban districts that resulted in revealing widely recognized disparities, researcher Miller and Rubenstein (2003) hypothesized that the results would likely be replicated in non-urban middle size districts as well. Their research unearthed disparities similar to large urban districts when calculated based on student demographics. The mid and small sized districts also failed to provide incrementally greater resources to students with higher need. Of note in their research is a warning however, that unlike large urban districts, the small districts faced unique circumstances regarding lack of additional resources and lack of economies of scale that may also drive some variances. Two key recommendations of their research including greater district control over human resources to ensure equitable distribution of teacher, and greater school control overall all fund sources allowing for more transparency and better autonomy of resource use (Miller & Rubenstein, 2003).

Following the Metropolitan Nashville County School District’s decision to start breaking down school funding by funding source in 2005, a new data set emerged that allowed for new research into intra-district equity. A major point of interest for researchers with the new data sets was the inclusion of performance data specific to Tennessee and the inclusion of individual
student value-added scores that was part of the set. Klein, in determining equity through the new data set, also created his own construct of school social wealth based on the number of internet connected computers per student. The author hoped to use this indicator as another dependent variable to compare towards equity of different campuses and their ability to raise outside funds through parents and nongovernmental sources.

Unlikely previous studies of New York City and other urban districts, Nashville demonstrated statistically significant vertical and horizontal equity, with funds being positively correlated with students qualifying for free and reduced lunch. The results also showed no relationship between resources and performance, both at the student level and the school level. However, the results did find that higher social “wealth” was strongly correlated with reading performance, possibly signifying that outside resources are being strategically utilized to target performance in ways that scripted and regulated governmental funds cannot be utilized (Klein, 2008).

While sparse research has demonstrated examples of intra-district equity studies at some urban school districts, another focus of intra-district equity has look towards the major drivers of between campus equity. This research has shown that variation in human resources, of which salaries and benefits are a major financial portion, can be a major cause of variation between overall resources between schools (Miles, Ware & Roza, 2003; Provasnik & Stearns, 2003; Roza & Miles, 2002; Rubenstein, et al., 2007; Miller & Rubenstein, 2008).

This idea of human resource variance driving equity between campuses is popular due to the way most of school districts provide a majority of resources to campuses. Roza and Miles (2002) and Miles and colleagues (2003) focused on the idea that providing resources based on the number of staff masks inequities. Providing resources based on student’s numbers in the
form of staffing formulas has many names, such as staff-based budgeting, staffing formulas, or budget table staffing. The basic premise of such budgeting style has a formula that determines the number of teachers and staff, and the position of teacher or staff, based on the enrollment of the school for funding by general funds. Additional resources may then be provided based on other enrollment factors or allocated through other funding sources, but these sources tend to be a small percentage of overall expenditures for campuses (Miles et al., 2003; Roza & Miles, 2002; Roza & Hill, 2004). These authors argue that staff formulas mask inequity by failing to account for actual cost of teachers’ salaries and failing to account for higher tenure staff with greater experience typically accounting for higher salaries, while inexperienced and beginner teachers typically have lower salaries. Carey and Roza believes that these policies lead to situations where higher experienced teachers, and thus higher cost teachers, move towards higher performing schools, while leaving lower performing schools with less experienced and more beginner staff. When this is calculated out financially, it shows inequity of resources as the salary difference is great, even if the low performing campus happens to receive greater compensatory funding targeted towards at-risk or lower performing students (Carey & Roza, 2008; Aportela, 2010).

This theory of human resources as a contributing factor towards inequity was studied by Anabel Aportela for her dissertation in 2010. A student of Allan Odden, a researcher mentioned above, Aportela hoped to analyze how teacher resources, which she defined as a ratio of teacher to students, average teacher salaries, and per-pupil expenditure per teacher on salaries, was equitably distributed across and within schools in Wisconsin and Wyoming. The research looked at traditional vertical and horizontal equity measures using teachers as the variable to measure variance. Using vertical and horizontal equity measures, the author noticed both that
the range between school districts was wide and equity measures were short of displaying equity, but that the same results were not displayed at the campus level. The author observed that differences in human resources may not be a great cause of inequity at the campus level in Wisconsin.

Wyoming showed slightly different results, with state variance and ranges being within accepted standards of vertical and horizontal equity, but per campus measures falling short. The author again observed that this could be contributed towards the large number of exceptionally small schools in Wyoming. A major finding by the author demonstrated an important by unintended conclusion. Typical equity methodologies may be successful in comparing schools and districts within a state, but they fail in making comparison between states. The author found state level dynamics that greatly contributed towards the strength and direction of variance between the two states, and only by conducted in-depth case studies of each state was the author able to determine that other characteristics played a role in determining equity (Aportela, 2010).

Other research conducted by students as part of their thesis or dissertation has played an important role in the growing research base of intra-district equity. Previous research through dissertations and thesis have mirrored and complimented scholarly research happening by researchers and educators. Patrice Iatarola, whose later work is mentioned above and who was a student of Leanna Stiefel whose theory of equity is used in this paper, conducted a dissertation that complimented Stiefel’s own work in looking at the equitable distribution of resources between elementary schools in New York City. Iatarola’s research tested the new theory by Berne and Stiefel that their previous theory of equity could also be used to measure intra-district equity and variance between schools within a district. The dissertation included the use of multiple years of data, looked at the equitable distribution of student outcomes, and focused on
the financial system of distribution by focusing on just one district with the same method of resource distribution for all campuses. The author found vast disparities in the elementary level to such an extent that it nullified any effects of entitlement and supplemental funding. However, the author determined that this relationship when measured by racial group disappeared when teacher salaries were removed, which suggested that the greatest disparities were driven by differences in teacher pay and in turn differences in teacher experience and tenure. This problem was compounded by teacher shortages in New York City, with schools with large populations of high risk and out need students having more vacancies in staff and higher rates of beginner staff than schools with low needs (Iatarola, 2002).

As mentioned before, most early research in intra-district equity focused on New York City due to their early adoption of making such data available (Iatarola & Stiefel, 2003; Stiefel et al., 1998; Rubenstein et al., 2007). While some states and districts release various levels of data, research on campus equity has been sparse. In 2002, student Lana Clark conducted a dissertation study on an unnamed school district in the south to measure vertical and horizontal equity. To conduct the statistical research, Clark built her own database by crosswalking the district’s general ledger with campus and individual reports of campus level expenditures to create per-pupil expenditures. Clark looked at horizontal equity between elementary campuses and equity between secondary campuses in the district. Overall, the results showed a lack of horizontal equity and a large range and standard deviation, especially among elementary campuses. While Clark stopped short of providing a reason for the observed equity gaps, the results still contributed towards the issue of equity by looking at a small urban district that did not previously provide data on the campus level (Clark, 2004).
To address deficiency with staff funding models and the inequity that may be caused through allocating resources through staffing formulas, some districts have begun to distribute resources based off student characteristics and need that provide a weighted amount of funds per student to the school and allowing the school to decide how to utilize the resources. Such an approach is called a weighted student funding model and has become popular for large urban districts with large variances among student populations. Arbuckle compared districts utilizing SBF with similar districts in the same state that were utilizing a different system. The author found that SBF districts provided more vertical equity, but the variance was small (Arbuckle, 2011).
CHAPTER 3: RESEARCH DESIGN

This study aims to understand whether decreased funding from the state of Texas led to changes in equity, how this measure of equity changed following the decrease in funding, and whether this change of equity corresponded with changes in student outcomes measured by NAEP. In 2011, Texas, while addressing lower than expected state revenue, a desire not to raise taxes, and a requirement to pass a balanced state biannual budget, funded public education at $5.4 billion dollars less than what would have been expected to maintain programs and account for enrollment growth across the state. While the state increased funding in subsequent years, the funding gap between what was expected based on 2008 calculations and student enrollment growth and what was provided continues to this day.

The state had a requirement to guarantee equity between districts, but failed to study whether a major cut in the state share of education funding to districts would have an effect on equity or outcomes. This study reviewed how equity changed during the years and whether outcomes changed. The specific research questions are:

1. How has equity changed from 2008–2016, as measured by equal opportunity and horizontal equity from year to year?
2. How has fourth-grade reading proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?
3. How has fourth-grade math proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?
4. What is the relationship between a change in equity and a change in student proficiency?
This study allowed the researcher to determine whether and how much equity between school districts changed over time. The study began in 2008, which established a baseline for expected funding based on enrollment to help calculate the possible funding gap, which is the difference between what would have been expected to be funded and what was actually funded. Equity measures were calculated for years 2008 to 2016 using two generally accepted measures of horizontal school finance equity, the coefficient of variation and the Gini coefficient, and a general accepted measure of equal opportunity, wealth neutrality, by measuring the correlation of property wealth and per-pupil spending and wealth per pupil and per-pupil spending.

**Research Paradigm**

When looking at financial data, such as those used in this study to determine equity by financial resources, there is one single truth and these truths can be observed and measured. Due to this ontology, this quantitative research uses a positivist paradigm to understand the data and reasoning for such research, and how these results can be seen as true and then be used to build on our understanding of equity and school finance. To understand this truth, the context of equity and school finance is reviewed throughout this research.

To understand the research paradigm, it is important to look at the parts that make the paradigm and how they build towards the method and methodology used in this study (Scotland, 2012). The ontology, or the state of reality, for this research focuses on understanding what is true, in this case what is the state of equity and how does it change. The epistemology, or the knowledge base that helps us understand why we know what we are researching, states that our sense of reality is real, can be observed and measured, and that tools can be used to assist in that practice (Crotty, 1998; Guba, 1990). This leads to our positivist theoretical perspective, which
allows us to use the ontology and epistemology already discussed to understand how context can build our research design to answer the questions presented in our purpose (Guba, 1990).

**Research Design**

This quantitative study utilizes multiple designs for the various research questions. Research questions 1, 2, and 3 utilize a descriptive research design. Research question 4 utilizes a correlational research design. Ultimately, the major focus on how a change in equity may relate to a change in student outcomes also follows a correlational research design. This design allowed for a study of how per-pupil spending may have changed as a measure of equity over a span of years, and then compare that measure of equity to student outcome scores (Gall, Borg, & Gall, 1996).

Descriptive research is typically used by social researchers to answer, “what is going on” when looking at a problem of study (de Vaus & de Vaus, 2001). For this study, the descriptive design looked at how the phenomenon of equity has changed by comparing different years of data. This longitudinal design allowed the researcher to review data over multiple years to observe whether equity had changed following the reduction in state funding.

Descriptive research design does not include a hypothesis before creating the study, but typically one is developed after data is collected and reviewed (Bernard, 2012). The design allowed the researcher to observe whether any change of equity that occurs is related to a decrease in state funding. Another key part of descriptive research design, and the longitudinal study, is that no intervention is applied and the variables are not controlled (Bernard, 2012). As this study looks at historical data, it can be assured that intervention by the researcher has not occurred.
Correlational research attempts to measure whether a relationship exist between variables and what is the strength of such relationship. Correlational research looks at how changes in one variable (X) are related to changes in a second variable (Y). No influence is made on any of the variables to measure change, instead researchers only observe any existing relationships (Gall et al., 1996).

Population and Sampling

The site for this study was the state of Texas and its public, independent school districts. For the 2010–2011 school year, Texas had a total of 4,912,385 students across 1,228 districts, which includes charter districts, traditional school districts, and special districts. The sample includes 1,006 public school districts, which does not include districts serving military bases, special districts, and charter school districts which do not have direct taxing authority or have unusual arrangements for revenue. Districts that did not exist during the entirety of the observed span, either due to consolidation or closure of the district, were excluded from the study. In addition, 9 districts were removed for having incomplete financial data for one of more years during the target span. This includes the following districts: Abbott ISD, Blackwell CISD, Canadian ISD, Clyde ISD, Texas City ISD, Westhoff ISD, Wildorado ISD, and Zepher ISD. La Marque ISD and Texas City ISD were removed as they were combined into a single district during the observation period. McMullen County ISD was removed as in 2013 they reported property values that were double of previous years, making them an outlier for all districts. The researcher could not determine what causes this sudden single year increase or why it decreased back to previous values the year after. Stafford Municipal School District was also removed, which is a city run district who sets the tax rate, and not an independent district like all other
districts in Texas. Boles Independent School District, a state orphanage high school district, is also excluded.

The whole set of school districts help prevent errors due to small sample size and lessen the effect of outliers on the test population. If any district, following a review of district data, shows a change in tax rate, or a change in total property value greater than expected or 1 standard deviation for either of the years, the district was removed from the sample to limit the effect those changes could have on their total local revenue.

**Data Collection**

Data came from two different sources. The financial data for the equity questions was retrieved through the State of Texas Public Education Information Management System (PEIMS), a publicly available database that includes all information the state collects on public education. NAEP test results came from the NAEP Nation’s Report Card, an online tool that provides state and national data on NAEP testing results.

Data retrieved from PEIMS includes the following: district number, district name, year (financial), county name, 20XX (property) value assigned (used for school funding), self-reported m&o rate, self-reported i&s rate, self-reported total tax rate, gen funds-total operating revenue, gen funds-cost per student total operating revenue, gen funds-local tax, gen funds-% of local tax, gen funds-cost per student local tax, gen funds-other local & intermediate revenue, gen funds-cost per stud other local & intermediate rev, gen funds-state revenue, gen funds-cost per student state revenue, gen funds-federal revenue, gen funds-cost per student federal revenue, and fall survey enrollment.

The different revenue data points allow for descriptive comparison and one-way ANOVA calculations for each revenue source: federal, local, and state. The property value assigned and
self-reported tax rate were reviewed to determine if any district had drastic changes to either
figure, which may lead to an individual district being removed from the study to isolate any
changes that are due to changes outside of state funding. General funds-cost per student total
operating revenue was used to run the calculations for the Gini Coefficient measure and
Coefficient of Variation measure. All data points were taken for the 2008–2009 through 2015–
2016 school years.

The name and district number are used to ensure that similar districts are being compared
between the years. Gen funds-cost per student total operating, referred to now as per-pupil
spending, is a financial data points that show the amount of funds spent per actual student. The
three revenue files provided both the total amount of revenue from each source, but also allow
the percent of each source of revenue to be calculated to determine if any one source ended up
accounting for a larger source of the total amount of revenue for a district. The tax rates are
reviewed to determine whether any district changed their actual local tax rate during the test
period. Property values were reviewed to determine if the property value of any district changed
in a way that would dramatically affect the amount of revenue brought in through a property tax,
and thus could be a cause for the increase of decrease of revenue from a local source.

The financial data sets come from PEIMS Single File Financial Data sets. The three
different downloaded data sets, one for each year, were combined into a single excel file and the
non-tested data indicators and non-tested districts and charters were deleted from the file. The
data was then be sorted by per-pupil spending, and means run for each group to help establish
baselines and set up the data needed to run the statistical analysis, including determining the
mean and standard deviation for each year, running an one-way ANOVA test for each mean to
determine if the years are statistically different, and other descriptive statistic calculations.
The NAEP results include both math and reading state results for Texas and the United States. NAEP was administrated for 4th grade students in 2009, 2011, 2013, and 2015. The data and other information is publicly available on https://www.nationsreportcard.gov/. Data points were taken for all years available for the standard average score for 4th grade students in Texas. In addition, achievement-level percentages were taken for each year for the % of students at or above Basic as defined by NAEP, and the % of students at or above Proficient as defined by NAEP. All data were graphed by year in a line graph along with a comparison of the United States average to provide understanding in how federal scores may also have changed to see if any changes in Texas mirrored national results.

Confidentiality is not a concern for this research as all district-level data is publicly available online and free to access. No individual-level data was collected or used.

Data Storage

The data downloaded from the TEA and Nation’s Report Card website was loaded into a Microsoft excel spreadsheet and saved on the researcher’s personal computer. Once downloaded, the data was inputted into a spreadsheet and coded to make comparisons between years and calculation of the equity equations easy using the formula and calculation functions of an excel spreadsheet. No other person has access to the computer or the secondary storage devices used.

Once downloaded and coded, a backup of the data was saved on an external digital storage device and an online cloud storage device to ensure backups are secured. This also allowed the research to prevent having to re-download, sort, and code the data a second time due to any unforeseen circumstances with the original file. As the data is publicly available and free to anyone wanting to download the data, no steps were taken to secure or maintain
confidentiality of the data file. The only steps taken to maintain this file was to maintain the integrity of the file and the data it contains, which was completed by using a personal computer and secondary storage devices that does not have other users. When the study was complete, the backup files were compared to the original files, and then deleted.

**Data Analysis**

Two generally accepted statically measures of variation were used to review horizontal equity and a measure of correlation was used to measure the relationship between property wealth and wealth per student related to per-pupil spending to evaluate wealth neutrality. Pearson’s $r$ of correlation was used to determine if any change in equity has a relationship with any change in student test scores. All data was saved in an excel document. Analyze-It, an add-on for Microsoft Excel, was used to run the descriptive statistics, correlation of coefficients, and correlation measures in the research. A specialized add-on for Excel was used to measure the Gini Coefficient.

The first measure, which looked at equal opportunity and wealth neutrality, used a relational measure to determine if the property wealth of districts in Texas have a relationship with the per-pupil spending. Correlation is the measure of how two variables variate between each other. Correlation provides a measure of how strong the linear relationship is, and if it is positive or negative relationship. For wealth neutrality the calculation determines if two different variables have a relation, one of which is always a wealth measure such as per-pupil spending. This is especially true due to policy decisions that were created to hopefully create greater equity between districts through guaranteeing a certain tax yield and recapturing or forced reusing of funds generated above an expected amount.

The formula for correlation is as follows:
\[ r = \frac{1}{n-1} \sum \left( \frac{x - \bar{x}}{S_x} \right) \left( \frac{y - \bar{y}}{S_y} \right) \]

In this formula \( \bar{x} \) equals the mean of the \( X \) variable, and \( \bar{y} \) is the mean of the \( Y \) variable.

The expected outcome would be that none of the variance in per-pupil spending can be associated with the differences in property wealth, and that the correlation measure would be at or close to zero. A simple descriptive observation was used to determine if this number is getting greater, staying the same, or decreasing over time.

For equity, the Gini Coefficient measured horizontal equity relative to the dispersion of wealth among all districts, while a coefficient of variation measured equity by the variation of each district and the state mean per-pupil spending (Berne & Stiefel, 1984; Gini, 1921; Spillane & Hopkins, 2013). These calculations provide a variable statistic that was used for comparison.

Descriptive data were reviewed between each year, including mean, median, range, and standard deviation of per-pupil spending. Percent difference between each year provided a simple descriptive evaluation of the changes to sample, although it would not actually provide any meaningful information on how equity would have changed. It should be expected that there would be a large percentage change in these variables between the two years, as less money was put into the system. The question for this study however is if this change in funding increased or decreased equity among districts.

The Gini Coefficient is a typical measure of dispersion for any distribution of resources and common in economics and other social sciences. The calculation could range from zero, or complete equity, up to one, or complete inequity (Odden & Picus, 1992). The total value (total revenue) and the percent of increments (population) are then plotted on an X-Y chart. Each point would represent a district’s per-pupil spending. A perfect distribution would provide a 45-degree line. The actual points are plotted, which is referred to as a Lorenz Curve. The Gini
Coefficient is then the measure of the area between a perfect 45-degree line and the actual plotted Lorenz Curve divided by the area below a perfect 45-degree line. A measure less than 0.10 would be considered equitable distribution between districts.

The coefficient of variation is a measure of deviation from the mean of per-pupil funding. The total of per public spending is calculated to determine both the mean of all figures and the standard deviation, or average difference between any one item and the mean. The standard deviation is then divided by the mean, and then multiplied by 100 to obtain the final number. The calculation could range from zero, or complete equity, up to one, or complete inequity (Everitt & Skrondal, 2002). A result under 0.10 is typically considered a target level of equity (Odden & Picus, 1992).

A measure of correlation, Pearson’s \( r \), was calculated to determine if there is a relationship between the equity measures and student test scores for Texas. A correlation coefficient measures the degree of any relationship. A correlation coefficient provides a linear relationship between sets of data and can range from -1.0 and 1.0. A positive integer shows a positive relationship, and a negative integer a negative relationship, with the closer the number is to -1 or 1 the strength of the relationship.

The null hypothesis of the correlation measure is tested using a calculation of unequal variances as the two variables are different sets of data that have different variances from each. To test the hypothesis a Welch’s t-test is used (Ruxton, 2006; Lu & Yuan, 2010).

**Trustworthiness**

Using a secondary data set creates limitations. The data is limited to what is self-reported. State law is codified to require complete and accurate reporting of data, and data submissions are spot checked by the state. There is still the possibility that there is missing or
inaccurate data. There is also an assumption by the researcher and previous literature that pupil spending is a strong indicator of equity. These measures only focus on district level resources, however, and in no way guarantee equitable expenditures at the individual student level from the district.

Finally, this research does not review if districts took any measures to increase their overall budget during these years to make up for a decrease in state funding. Districts have the possibility of using reserve funding saved from previous years or of going out for a tax ratification election to raise greater revenue at the local level. It would be difficult to determine if reserve funding had been used by any district without reviewing every district’s approved budgets, but even with that information it would not be possible to determine if the use of those reserve were due to a decrease in state funding. Likewise, with a change in property tax revenue due to a call for a tax ratification election, it would not be possible to determine if it was done in response to decreased funding.

While test scores are typically considered an imperfect measure of outcomes, they are generally accepted as a measure of outcomes and a reliable and transferable measure that is easily compared and reviewed (Card & Krueger, 1998; Kohn, 2000; Orr, Young, & Rorrer, 2010).

Due to the lack of individual human subjects being studied and the use of publicly available data approval by an outside Instructional Review Board is not required.

It is also important to understand validity in this study to ensure that the study can be generalized. As this research looks at existing data, external validity is limited. The lack of test subjects limits the effects of external validity. One aspect of external validity, exclusionary validity, must be considered due to a very small number of districts being removed from the
study. The researchers attempted to clearly define what districts are excluded and as this exclusion is due to their extreme outlier effect of having no local revenue it is appropriate that these districts not be included in the study.

This research suffers few additional limitations that were not already discussed in the trustworthiness section. The actual methodology and equity calculations used should not suffer from measurement or procedural bias. The only procedural bias issue that could occur would be due to the actual availability of data at the state or national level and how that data is both reported and made available from different sources. In addition, this research looks at the whole of all districts in Texas, so no generalizations or sampling are used, also reducing limitations in this study.

The study, methodology used, and process have a high degree of transferability. The method of measuring equity and comparing between different years to determine the change of horizontal equity could be replicated to different years, different states, or expanded to look at the nation easily without adjusting any of the steps taken in this research.

The correlation of equity to another variable could be easily replicated if the second variable of study has a high degree of stability in the measurement and reliability of the variable. For instance, additional studies could look at how equity correlates with federal graduation rates, ACT and SAT scores when such scores are normalized to account for changes to the scale, and other nationally recognized student outcome measures. In addition, as these are all measures that are normalized across the nation, comparisons could also be made between states to determine equity and effects of equity.

While the idea of using generally accepted methods of measuring equity are not new, the process to look at multiple years to ascertain the change of equity, and attributing it to a policy
change or other change, is relatively new. Due to the lack of limitations address below, the methodology could be replicated to both determine the change of equity but also to determine how an input, such as state funding, would influence overall equity. The actual process could also be used for multiple span of years to show the longitudinal change in equity.
CHAPTER 4: RESEARCH FINDINGS

This chapter presents the findings from each research question and the associated calculations and analysis. All four questions are reviewed and detailed to explain the analysis used and the findings. Three distinct equity measures are calculated, and a measure of correlation used to determine whether test scores correlate with the equity measures. For wealth neutrality, a measure of correlation was calculated to determine whether property wealth has a relationship with per-pupil spending. Descriptive statistics for per-pupil spending are also calculated to provide an overview of the state of Texas in regard to the major data indicator for the study.

The data for per-pupil spending and associated financial measures were obtained through the Texas PEIMS system. The NAEP data results were collected from the Department of Education website. All public school districts were used, with the exception of charter, special, military districts, and those districts that did not have data for one or more years during the span of the study. McMullen County ISD, which was an outlier for 2013 due to a sudden increase in property value that could not be explained, was also excluded. This left 1,006 school districts in the study.

The purpose of this study was to determine how equity changed following Texas House Bill 1 (2011) and whether the change in equity correlated with a change in standardized test scores. The major research question is:

Did changes in funding from the state correlate to changes with student outcomes in reading and math? This major question was divided into subquestions:

1. How has equity changed from 2008–2016, as measured by equal opportunity and horizontal equity from year to year?
2. How has fourth-grade reading proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?

3. How has fourth-grade math proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?

4. What is the relationship between change in equity and change in student proficiency?

This study reviewed data from 2009 to 2016. The first year established a baseline for expected funding based on enrollment to help calculate the possible funding gap, which is the difference between what would have been expected to be funded and what was funded. This allowed for a full biennium of funding before the state changed funding mechanisms in 2011 for the 2011–2012 biennium. Equity measures were calculated for years 2009 to 2016 using two generally accepted measures of horizontal school finance equity, the coefficient of variation and the Gini coefficient, and a general accepted measure of equal opportunity, wealth neutrality, by measuring the correlation of property wealth and per-pupil spending and the wealth per student and per-pupil spending. All values in this study are reported as current dollars as reported by the Texas Education Agency. Also, as explained previously, the State of Texas funds schools through biennium, or every 2 years. The fiscal biennium starts on September 1 of every odd year and goes through August, 2 years later (Texas Comptroller of Public Accounts, n.d.).

**Research Question 1**

The first research question reviews equal opportunity and horizontal equity. Equal opportunity, or wealth neutrality, is the amount spent on the activity (per-pupil spending) and how it correlates to another variable. For this study, per-pupil spending was measured against
property wealth to determine whether a district’s property wealth is the driving factor of how much it can spend on education per student.

Horizontal equity, or the equal treatment of equals, is the last calculation for Research Question 1. These measures provide an understanding of how equitable student funding is when comparing one district to another. Two different measures are reviewed, Gini Coefficient and Coefficient of Variation.

The first set of tables provides general descriptive statistics for all 1,006 districts in the study. The data points are provided for each year of the study, and a percent change for the mean is provided to show how it has changed over the year. The first two years are a baseline year that occurred before the funding changes in 2011 that make up the previous state budget biennium cycle.

Table 1

| Total Per-Pupil Funding for Districts, 2009–2016 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Mean ($)        | 9,545 | 9,683 | 9,870 | 9,344 | 9,623 | 10,113 | 10,270 | 10,348 |
| Mean- % of change | 1.42% | 1.90% | -5.63% | 2.90% | 4.84% | 1.53% | 0.75% |
| Median          | 8,706 | 8,945 | 9,078 | 8,580 | 8,742 | 9,176 | 9,426 | 9,607 |
| Skewness        | 3.98  | 4.20  | 4.07  | 5.74  | 4.12  | 4.72  | 5.60  | 4.67  |

Average per-pupil spending shows little change during the first two years, followed by the first and only drop in per-pupil spending in 2012, which is the second part of the biennium following the funding changes. Skewness, which measures how symmetrical a distribution is or how many of the figures are above or below the average, shows that the skewness of all districts
is low, but slightly more districts have per-pupil funding that is above the average (Doane & Seward, 2011). Using Excel, skewness was found using the adjusted Fisher-Pearson method. Skewness is due to the mean being larger than the median figure of the data and provides context on variability. 2014 shows the largest change in skewness, as even more districts were above the average. That year was when the percent change of the mean increased the most, and the standard deviation of the data set shows the largest difference in per-pupil funding between districts.

Table 2

Local Per-Pupil Funding for Districts, 2009–2016

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ($)</td>
<td>3,991</td>
<td>4,048</td>
<td>4,160</td>
<td>4,092</td>
<td>4,587</td>
<td>4,756</td>
<td>4,916</td>
<td>4,643</td>
</tr>
<tr>
<td>Mean % change</td>
<td>1.40%</td>
<td>2.70%</td>
<td>-1.66%</td>
<td>10.79%</td>
<td>3.56%</td>
<td>3.25%</td>
<td>-5.88%</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2,782</td>
<td>2,729</td>
<td>2,926</td>
<td>2,640</td>
<td>3,557</td>
<td>3,729</td>
<td>3,508</td>
<td>2,982</td>
</tr>
<tr>
<td>Median</td>
<td>3,199</td>
<td>3,271</td>
<td>3,332</td>
<td>3,377</td>
<td>3,559</td>
<td>3,702</td>
<td>3,915</td>
<td>3,856</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.26</td>
<td>2.07</td>
<td>2.53</td>
<td>2.49</td>
<td>3.16</td>
<td>3.60</td>
<td>3.01</td>
<td>2.55</td>
</tr>
</tbody>
</table>

Table 2 shows the portion of district per-pupil funding that comes from local sources (i.e., local taxes based on property value and rate). The mean increases during most years, except for a slight decrease in 2012 and a larger decrease in 2016. In 2013, the mean of per-pupil funding from local sources increased by 10.79%. Across the entire 8-year observation period, the overall mean of local per-pupil funding increased 14%. Recalling that overall per-pupil funding increased by only 7% across this period, this means that the local portion drove the entire increase in per-pupil funding, even making up for some of the decrease in funding from
other sources. The skewness is also relatively low and positive, showing that per-pupil funding for most districts was above the mean. 2013 not only had the largest change increase in mean per-pupil funding, but it also had a large increase in the standard deviation and skewness. The increased skewness would show greater differences of per-pupil spending between districts. This, coupled with the overall increase in per-pupil spending, indicates that some districts increased their per-pupil spending to a great degree than others. In 2013 and 2014, the standard deviation is about 77-78% of the mean, another indicator that while overall spending grew, the differences between districts also grew greater.

The standard deviation also provides information on how spread out the districts are from the mean and how much per-pupil funding varies. The standard deviation is large for these groups of figures, with every year having a deviation that is above 70% of the mean, showing wide variance. In 2013 and 2014, the standard deviations of the samples were similar or larger than the actual median of all data for that year. The standard deviation also grew every year before sliding back down slightly in 2016. This shows that in addition to the funding going up, the actual share of funding between districts deviated between each other, and this increased in most years.

Table 3

*State Per-Pupil Funding for Districts, 2009–2016*

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean ($)</strong></td>
<td>5,110</td>
<td>5,220</td>
<td>5,305</td>
<td>4,820</td>
<td>4,593</td>
<td>4,876</td>
<td>4,857</td>
<td>5,164</td>
</tr>
<tr>
<td><strong>Mean- % of change</strong></td>
<td>2.11%</td>
<td>1.61%</td>
<td>-10.07%</td>
<td>-4.93%</td>
<td>5.80%</td>
<td>-0.38%</td>
<td>5.94%</td>
<td></td>
</tr>
<tr>
<td><strong>Standard deviation</strong></td>
<td>2096</td>
<td>2211</td>
<td>2217</td>
<td>2229</td>
<td>2223</td>
<td>2458</td>
<td>2461</td>
<td>2468</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>4888</td>
<td>5082</td>
<td>5165</td>
<td>4668</td>
<td>4550</td>
<td>4829</td>
<td>4896</td>
<td>5192</td>
</tr>
</tbody>
</table>
Table 3 shows the state portion of per-pupil funding. While all districts received some portion of their funding from the state, the tiered system of funding meant that a district with a lower capacity to fund itself through property taxes should receive a higher portion from the state. This was done in an effort to equalize funding for all districts. The state share of per-pupil funding decreased the most in 2012, which aligns with the central question of this research: did funding changes in the 2011 biennium change future years and outcomes. As had been shown in Table 2, the year following this state funding decrease had the largest increase in local funding. There is less variance in the amount of per-pupil funding provided by the state: the mean and median are close together, and (other than in 2011–2012) skewness is relatively small, less than 2. The standard deviation slightly increases, but at a lower increase than local portion has. Overall, the standard deviation also shows less variance between districts, and the mean and median of the state portion are more similar than they are for local funds.

Figure 1 and 2 show the percent and total dollars for per pupil average of each funding source and Figure 3 and 4 show percent and total dollars of each funding source spent on all education in Texas.
Figure 1. Percent of state, local and other portion of total per-pupil spending.

Figure 1 shows the change in the total percentage of the funding source for total per-pupil spending, as well as the change in dollars. Figure 1 shows that the state share gradually decreased. Even with a small increase in 2014 and a slightly larger increase in 2016, that year’s funding proportion was still less than in 2009. The difference is made up in the local portion, where the share gradually increased, with a large jump in 2013 before a decrease in 2016 resulted in a 2016 proportion that was 3% higher than 2009. During this time, other sources, which included federal and other local non-tax revenue, stayed mostly the same, with a 0.5% jump in 2012, and ended up 0.57% higher in 2016 than in 2009.
Figure 2. Total of state and local portion of total per-pupil spending.

Figure 2 reviews how the total amount of funding from each source changed over time in current dollars. This chart shows that both the local share and overall spending increased. Therefore, local per-pupil spending increased more than the state portion of per-pupil spending decreased. According to the figure the largest local increase came in 2012, the year immediately after the largest state decrease, 2011. This occurred during the same biennium. The state allocation for those two years was allocated to provide a greater portion in the first year, but the local districts increased both their percentage share and total dollars in the next year.

Figure 2 also includes any additional funding the state included due to population and enrollment growth. Using enrollment data from the state’s enrollment growth report, the state added about 778,000 students during a 10-year span from 2006 to 2016, going from about 4.5 million students to 5.3 million students (see Appendix for enrollment growth in Texas).
accounts for a growth of 17.1%, which would also lead to the state adding new dollars simply to keep up with enrollment growth (Texas Education Agency, 2016).

\[\text{Figure 3. Total dollars (in millions) of school funding in Texas by funding source.}\]

Whereas Figures 1 and 2 show the average of per-pupil spending across Texas for the districts under review, Figure 3 shows the total amount of funding provided as revenue for all Texas school districts. These figures are the total amount of all funds for every district in Texas, including special schools and charters. This includes local funds raised through property taxes as well as an Other category that includes funds provided at a local level but outside the federal or state funding formulas, such as private grants, funding from local governments, or other revenue sources.
Figure 4. Percentage of total dollars of school funding in Texas by funding source.

As a percent of total funding by source, the percentage of funding by the state government decreased during the observation years, while the portion paid by local sources increased. Federal funding slightly increases in 2010–2012, which is due to increased federal spending through ARRA. The other category stays about the same every year, and if included with local tax revenue source for a total local source, would show local sources comprising an even larger share of total funding, which increases from 2009 to 2016.

Table 4 presents the descriptive statistics of the assigned property values for school districts.

Table 4

<table>
<thead>
<tr>
<th>Assigned Property Value for Districts, 2009–2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ($)</td>
</tr>
</tbody>
</table>
Table 4 shows descriptive statistics for assigned property values, or the total value of property within each of the school districts in Texas. The assigned property value does not take into consideration the actual population or geographic size of a district. For this reason, there is large variation in the numbers, as indicated by the standard deviation being greater than the mean and the large skew showing a positive variance between all variables. The percent change of the mean does show steady increases, after a very slight decrease from 2009–2010, during the Great Recession. After that, the average total value of property in districts tended to increase. This is noteworthy as increased property value leads to increased tax revenue for districts at the local level. When this is reviewed next to the information in Figure 4, the data shows that increased local funding rises at the same time property values increase. This shows that much of the local increase may be due to increased property values.

Table 5 presents the correlation coefficient results for comparing assigned property value to total per-pupil spending.

### Table 4

<table>
<thead>
<tr>
<th>Mean- % of change</th>
<th>-1.62%</th>
<th>1.15%</th>
<th>4.37%</th>
<th>5.50%</th>
<th>9.63%</th>
<th>2.54%</th>
<th>4.84%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard deviation</td>
<td>5,776,595,843.56</td>
<td>5,578,511,948.16</td>
<td>5,636,991,213.70</td>
<td>5,857,428,045.51</td>
<td>6,349,839,401.13</td>
<td>7,131,628,999.62</td>
<td>7,647,264,331.60</td>
</tr>
<tr>
<td>Median</td>
<td>326,520,599.00</td>
<td>331,898,641.00</td>
<td>326,698,373.50</td>
<td>353,201,18.00</td>
<td>385,245,662.00</td>
<td>400,665,495.50</td>
<td>383,335,860.50</td>
</tr>
<tr>
<td>Skewness</td>
<td>11.12</td>
<td>10.90</td>
<td>10.85</td>
<td>11.02</td>
<td>11.56</td>
<td>11.50</td>
<td>11.93</td>
</tr>
</tbody>
</table>

**Correlation of Assigned Property Value to Total Per-Pupil Spending, 2009–2016**

<table>
<thead>
<tr>
<th>Pearson correlation coefficient</th>
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<tbody>
<tr>
<td>2009</td>
</tr>
<tr>
<td>-0.1356</td>
</tr>
</tbody>
</table>
The Pearson correlation coefficient measure shows results all less than -0.1406; in 2014, as low as -0.1103. Typically, any correlation below 0.2 is considered weak, so there is a weak negative relationship between assigned property value and per-pupil spending. Wealth neutrality calculates if a relationship exists between two variables, typically property wealth and per-pupil spending. A positive relationship would show that property wealth may drive the per-pupil spending of a district. A negative score would show that poorer districts have more funding than other districts. For this calculation, the relationship exists, yet it is negative and very weak. This would appear to show that poorer districts have greater funding than wealthier districts, although the relationship is minimal.

Table 6 presents the descriptive statistics of the wealth-per-student assigned property values for school districts.

Table 6

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</tr>
</thead>
<tbody>
<tr>
<td>Mean ($)</td>
<td>533,312.2</td>
<td>527,606.6</td>
<td>518,636.9</td>
<td>578,509.77</td>
<td>598,691.69</td>
<td>649,581.12</td>
<td>600,905.5</td>
<td>533,585.7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mean- % of change</td>
<td>-1.08%</td>
<td>-1.73%</td>
<td>10.35%</td>
<td>3.37%</td>
<td>7.83%</td>
<td>-8.10%</td>
<td>-12.62%</td>
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</tr>
<tr>
<td>Standard deviation</td>
<td>858,687.1 7</td>
<td>864,067.5 3</td>
<td>837,272.6 7</td>
<td>1,017,593. 02</td>
<td>1,003,677. 39</td>
<td>1,096,41 3.53</td>
<td>970,008.9 6</td>
<td>723,672.3 6</td>
</tr>
<tr>
<td>Median</td>
<td>306,867.6 6</td>
<td>308,753.6 4</td>
<td>318,597.3 8</td>
<td>334,969.18 84</td>
<td>346,785.59 1</td>
<td>369,380.84 1</td>
<td>356,576.6 5</td>
<td>352,359.2 5</td>
</tr>
<tr>
<td>Skewness</td>
<td>6.89</td>
<td>7.60</td>
<td>8.20</td>
<td>7.95</td>
<td>7.13</td>
<td>6.89</td>
<td>6.90</td>
<td>7.04</td>
</tr>
</tbody>
</table>

While property wealth is the typical variable utilized to calculate wealth neutrality, the variable does not take into effect the size or geographical area of a population. For that reason, another variable is reviewed by dividing the property wealth by the number of students to calculate a wealth per-student of property value. The standard deviation is larger than the mean, which shows a much greater dispersion of the data. The median is also significantly lower than the mean, which could show that there are some outliers at the top of the spectrum. The skew is generally high for all years, with 2011 being as high as 8.2, also showing there is a strong right tailed variance to the data and contributing to the possibility of their being a few high outliers in the data, or districts that have significant wealth per student.

Another advantage of calculating this new variable is that it allows another way to review how the overall property wealth has changed. Originally, the data showed that property values increased. What it did not tell is if property values increased corresponded with the population increasing. This new variable shows us that the wealth per-student still had its largest increase in 2012, which could mean that the increase is due to the actual worth of the property increasing. Only incrementally higher wealth per student in 2009 than in 2016.

Table 7 presents the correlation coefficient results for comparing wealth-per-student assigned property value to per-pupil spending.
The next measure of wealth neutrality looks at a different variable, wealth per student of assigned property value. This variable is calculated by dividing the district’s property value by the number of students for the year. This provided an average amount of property wealth per student. This variable has the benefit of limiting the effect of the variability in size of district and total property value of districts.

These calculations provide a different result then the previous correlation coefficient, which only looked at property value. In this calculation, the results show a positive correlation between the per-student property wealth and the per-pupil spending. These moderately correlated results show that the property wealth of a district, when the number of students in that district is taken into consideration, is positively related to the amount of funding per student available to a district. This calculation could be considered more important to the premise of
wealth neutrality, as in this calculation the amount a district is able to raise through property
taxes per student is greater. Property wealth per student would then not be wealth neutral and an
inequity can be observed across districts in Texas. As the effect of the relationship slightly
decreases each year, more study could be done to look at what causes the decline and what role
the increases in overall property value and taxes, which increases every year, and the role of state
funding which decreases each year. Overall, the data shows there is a relationship between
property wealth and student spending when the population of the district is taken into effect.
Since these measures include both local, federal, and state funding, the data can show how this
changes as the amount of local funding changes, due to increased property values, and the
amount of state funding changes depending on the total of funds allocated for school funding
from state revenue.

While this would appear to show that property wealth may be a major indicator or per-
pupil spending, the calculation only shows the two variables are moderately related. While this
does imply that there is not wealth neutrality, more research would be needed to determine if the
per pupil property wealth caused the higher per-pupil spending. When compared to the previous
wealth neutrality calculation, the data shows that the population of a district is important and
plays an important role in understanding the actual wealth of a district.

Table 8 and Figure 5 present the Gini coefficient results for 2009 to 2016.

Table 8

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>0.1515</td>
<td>0.1407</td>
<td>0.1455</td>
<td>0.1452</td>
<td>0.154</td>
<td>0.1562</td>
<td>0.1432</td>
<td>0.1285</td>
</tr>
<tr>
<td>Year to Year Difference</td>
<td>-0.0108</td>
<td>0.0048</td>
<td>-0.0003</td>
<td>0.0088</td>
<td>0.0022</td>
<td>-0.013</td>
<td>-0.0147</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5. Gini coefficient, total per-pupil spending, 2009–2016.

The results show a low Gini coefficient across the years. Gini calculates how evenly distributed resources are across all groups. The results show that the per-pupil spending is close to showing complete equity, which is signified by a 0.0 result. The percent change shows that the results lowered slightly the first year, or that all districts became more equitable. This is followed by an increase, or an increase in inequity between districts. In 2012, the second year of the biennium following the state funding system change, the system became slightly more equitable with the largest increase in 2013 and another increase in 2014 before taking a large decrease and equity returning to below the first observation year. Appendix items A1–A8 provide the Lorenzo curve for each year and show how close the actual line of distribution is to a perfect 45-degree angle which represents perfect equality.

Table 9 and Figure 6 present the CV results for 2009 to 2016.

Table 9

Coefficient of Variation (CV), Total Per-Pupil Spending, 2009–2016
<table>
<thead>
<tr>
<th>Year</th>
<th>CV</th>
<th>Year to Year Difference</th>
<th>Year to Year Percent of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0.3573</td>
<td>-</td>
<td>-16.98%</td>
</tr>
<tr>
<td>2010</td>
<td>0.3324</td>
<td>-0.0250</td>
<td>-7.51%</td>
</tr>
<tr>
<td>2011</td>
<td>0.3479</td>
<td>0.0155</td>
<td>4.46%</td>
</tr>
<tr>
<td>2012</td>
<td>0.3669</td>
<td>0.0190</td>
<td>5.17%</td>
</tr>
<tr>
<td>2013</td>
<td>0.3786</td>
<td>0.0117</td>
<td>3.09%</td>
</tr>
<tr>
<td>2014</td>
<td>0.4036</td>
<td>0.0250</td>
<td>6.18%</td>
</tr>
<tr>
<td>2015</td>
<td>0.3676</td>
<td>-0.0360</td>
<td>-9.79%</td>
</tr>
<tr>
<td>2016</td>
<td>0.3142</td>
<td>-0.0534</td>
<td>-16.98%</td>
</tr>
</tbody>
</table>

Figure 6. Coefficient of variation (CV), total per-pupil spending, 2009-2016.

The data reflects a moderate amount of variation. The CV takes a small dip in the second year, and then in 2011 starts rising, indicating that inequity is increasing between districts. For the next 4 years the CV increases over 40%. CV, like the Gini Coefficient before it, shows a large spike in 2014, indicating greater inequity that year. This is followed by a quick decline that brings overall equity lower then it was before the first year.

Research Question 2

The second research question reviews reading proficiency for 4th grade students in Texas during the 2009–2016 timeframe. For comparison purposes, the national average is also provided. By comparing Texas results to National results, we can confirm that the state is different than the national population, and that changes are different year to year.
Table 10 and Figure 7 present the state and federal averages of NAEP reading scores for year 2009, 2011, 2013, and 2015.

Table 10

**National Assessment of Education Progress Reading Scores, State and Federal**

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NAEP Reading</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas Average</td>
<td>219</td>
<td>218</td>
<td>217</td>
<td>218</td>
</tr>
<tr>
<td><strong>Change in Texas Average</strong></td>
<td>-1</td>
<td>-1</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td><strong>NAEP Reading</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Average</td>
<td>220</td>
<td>220</td>
<td>221</td>
<td>221</td>
</tr>
<tr>
<td><strong>Change in National Average</strong></td>
<td>-</td>
<td>+1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* NAEP = National Assessment of Educational Progress. NAEP scores range from 0 to 300.

**Figure 7.** National Assessment of Educational Progress reading scores, state and federal.

Fourth-grade reading scores for Texas had a slight decrease in average scores for the first 3 years followed by a slight increase the next year. Overall scores stayed relatively flat.

Nationally, the fourth-grade reading scores remained flat the first year, increased by 1 point the
next year, and then remained flat. The changes observed for Texas and the National average are
different, but neither of the scores had noticeable gains or losses in fourth-grade reading. Texas
as a state was below the national average for reading in fourth grade, and this was reflected in
each year.

**Research Question 3**

The third research question reviewed math proficiency for fourth-grade students in Texas
during the 2009–2016 timeframe. For comparison purposes, the national average is also
provided. By comparing Texas results to National results, we can confirm that the state is
different than the national population, and that changes are different year to year.

Table 11 and Figure 8 present the state and federal averages of NAEP math scores for

Table 11

*National Assessment of Education Progress Math Scores, State and Federal*

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NAEP Math</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Texas Average</strong></td>
<td>240</td>
<td>241</td>
<td>242</td>
<td>244</td>
</tr>
<tr>
<td><strong>Change in Texas</strong></td>
<td>+1</td>
<td>+1</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NAEP Math</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>National Average</strong></td>
<td>239</td>
<td>240</td>
<td>241</td>
<td>240</td>
</tr>
<tr>
<td><strong>Change in</strong></td>
<td>+1</td>
<td>+1</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td><strong>National Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* NAEP = National Assessment of Educational Progress. NAEP scores range from 0 to 300.
Figure 8. National Assessment of Educational Progress mathematics scores, state and federal.

Fourth-grade math scores for Texas had a slight increase in each observable year with a larger 2-point increase in 2015. Overall scores stayed relatively flat. Nationally, the fourth-grade math scores showed similar gains each year. The changes observed for Texas and the National average are similar, but neither showed noticeable gains any year. Texas as a state was noticeably higher the national average for math in fourth grade, which is the opposite then the observable results for reading which show the state of Texas noticeably below the national average. The gains and losses in average test scores do not seem to correspond with overall gains or losses that were observed in the Gini Coefficient or the CV.

Research Question 4

The last research question reviews whether the change in equity correlates with changes in Texas examination scores. The NAEP reading and math average for Texas were compared to the per-pupil mean, Gini coefficient, and CV to determine whether any of these demonstrated a positive correlation. Pearson’s $r$ was used to calculate correlation.
Table 12, 13, and 14 present the correlation results for NAEP reading and math compared to the per-pupil spending mean, Gini coefficient, and CV.

Table 12

*Correlation, National Assessment of Educational Progress Reading and Math Compared to Per-Pupil Spending Mean*

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAEP Reading Texas Average&lt;sup&gt;a&lt;/sup&gt;</td>
<td>219</td>
<td>218</td>
<td>217</td>
<td>218</td>
</tr>
<tr>
<td>NAEP Math Texas Average&lt;sup&gt;b&lt;/sup&gt;</td>
<td>240</td>
<td>241</td>
<td>242</td>
<td>244</td>
</tr>
<tr>
<td>Per Pupil Mean ($)</td>
<td>9,545</td>
<td>9,870</td>
<td>9,623</td>
<td>10,270</td>
</tr>
</tbody>
</table>

*Note.* NAEP = National Assessment of Educational Progress. NAEP scores range from 0 to 300.

<sup>a</sup> $r = -0.0973$ $t = 0.0000107769$

<sup>b</sup> $r = 0.8415$ $t = 0.0000108575$

Table 13

*Correlation, National Assessment of Educational Progress Reading and Math Compared to Gini Coefficient*

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAEP Reading Texas Average&lt;sup&gt;a&lt;/sup&gt;</td>
<td>219</td>
<td>218</td>
<td>217</td>
<td>218</td>
</tr>
<tr>
<td>NAEP Math Texas Average&lt;sup&gt;b&lt;/sup&gt;</td>
<td>240</td>
<td>241</td>
<td>242</td>
<td>244</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>0.1515</td>
<td>0.1455</td>
<td>0.154</td>
<td>0.1432</td>
</tr>
</tbody>
</table>

*Note.* NAEP = National Assessment of Educational Progress. NAEP scores range from 0 to 300.

<sup>a</sup> $r = 0.2023$ $t = 0.0000000145$

<sup>b</sup> $r = -0.5243$ $t = 0.0000000974$

Table 14

*Correlation, National Assessment of Educational Progress Reading and Math Compared to Coefficient of Variation*

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2011</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAEP Reading Texas Average&lt;sup&gt;a&lt;/sup&gt;</td>
<td>219</td>
<td>218</td>
<td>217</td>
<td>218</td>
</tr>
</tbody>
</table>
Pearson’s $r$ calculations for reading showed a negative correlation with all the measures. However, the independent variables in these cases do not vary significantly between each year. For per-pupil spending, this would appear to show that higher scores are correlated with lower funding. For the Gini coefficient and coefficient of variation, a lower score indicates greater equity between districts. For Gini, there is a moderate negative correlation with reading scores. The reading scores showed a very strong negative correlation with the coefficient of variation. Because a lower Gini and CV are desirable, showing greater equity, this would indicate that increased equity correlates with increased test scores. For math, these results are mixed, with Gini showing a weak negative correlation and CV showing a moderate positive correlation. This would appear to show that greater inequity is moderately correlated with higher scores.

When testing the statistical significance of all Pearson’s $r$ calculations, I used a two-tailed significance test for each calculation. First, a null hypothesis is set, stating that there is no statistically significant relationship between the test scores through NAEP and the equity statistic used. The test is run to determine whether the $p$ value is less than 0.05, indicating at 95% confidence that the result was statistically significant. As there are only four observations, the calculation has only 2 degrees of freedom. A critical value table shows that the critical value for 95% confidence is 0.950. Using the statistical analysis package included in Microsoft Excel, t Stat variable provides the t-value. For all observations, the t-value is outside the acceptable range, so we would accept the null hypothesis. It is extremely unlikely that there is a
relationship between these two variables or that test scores are correlated with our equity
statistics.

**Summary of Findings**

Research Question 1 reviewed the school finance data and calculated per-pupil spending
and total spending across the state. Three equity measures were then calculated to provide a
better understanding of overall equity in Texas regarding spending.

A wealth neutrality measure was calculated for property wealth compared to per-pupil
spending. A second measure was then calculated for wealth neutrality using a new calculation of
wealth per pupil, calculated by dividing the total wealth by the number of students to help
account for size and wealth of a district. The Gini coefficient and coefficient of variation were
also calculated for the state as a whole using the per-pupil spending data for districts in Texas.

Research Questions 2 and 3 focused on the NAEP test, which is provided to a sample
group of students across the nation. Fourth grade NAEP scores were reviewed for the test period
in reading and math. Texas exceeds the nation in average scores for math, and both Texas and
the national average show slight increases each year. Texas lags behinds the nation for reading,
and its scores slightly decrease during the observational period while the national average
increase in only one year. All these changes were minimal, both year-to-year and across the
whole observational period.

Research Question 4 investigated the relationship between the equity measures and the
NAEP scores. Each equity measure was compared against both NAEP reading and math scores.
Pearson’s r was calculated to measure the possible relationship between variables. As the
measures had unequal variance, a Welch t-test was calculated to determine whether the
relationship was significant. None of the correlation calculations, which seemed to show some negative correlation between test scores and equity, were statistically significant.
CHAPTER 5: CONCLUSION

This final chapter reviews the entire study, providing an extended focus on the major findings, next steps, and an overall review of the strengths and weakness of this endeavor. The chapter starts with a summary of the study, then looks at its findings, discusses implications of the findings, suggests future research ideas, and finally summarizes the entire paper. This study reviewed equity and compared it to student outcomes to determine whether changes in equity led to a change in performance. Overall the study did not find a relationship between changes in equity and performance, but it did glean important information on equity in Texas, school funding, and suggestions for future research.

Summary of Study

In 2011, facing decreased revenue due to an economic downturn and decreased property values, the state of Texas passed a government funding bill that provided $5.4 billion less for state education than anticipated. In addition to not maintaining current spending levels, the bill also failed for the first time since the current school finance system was in place to cover the cost of existing enrollment growth in Texas.

The bill, House Bill 1, provided less funding to the state education agency, state programs like pre-kindergarten and career and technical education, and less funding through the state’s school finance system that distributes state funding to school districts across Texas. During a special session, the legislature passed Senate Bill 1, which provided the mechanisms for handling the decreased funding through entitlements, funding formulae, and decreased programs for Texas schools. The state attempted to avoid harm to some districts by focusing on various aspects of the funding formula, but all districts experienced some decreased funding, and more importantly the state did not fully fund for enrollment growth. Estimates left most districts with
6% decreases in 2011 and another 6% decrease the following year, which averaged about $500 per student each year of the biennium (Weissert, 2012).

To add to the shortfall, funding from the federal government through ARRA ended that year, which decreased the total sent to the state by about $1.6 billion (Castro, 2009). In total, the state put $5.4 billion less into education than what was expected and had $1.6 billion less in federal funding than the previous year. Some claimed the state actually cut $6.6 billion, if one considered cost of living increases and other increases needed to keep up with federal and state promises that went unfunded (IDRA, 2016).

The purpose of this study was to review how the change in funding in 2011 through House Bill 1 affected equity, as well as the consequence this had on student performance in math and reading. The study looked at equity among school districts in Texas and measured changes from year to year to review any connection between changes in equity and changes in student outcomes in reading and math. To gauge reading and math performance, the NAEP was used for fourth graders in Texas. The goal was to determine whether equity changed due to decreased funding from the state, and whether this change was correlated with student outcomes.

The following research questions were used for the study:

1. How has equity changed from 2008–2016, as measured by equal opportunity and horizontal equity from year to year?

2. How has fourth-grade reading proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?

3. How has fourth-grade math proficiency in Texas changed from 2008–2016 on the National Assessment of Educational Progress?
4. What is the relationship between a change in equity and a change in student proficiency?

The study reviewed 1,006 public school districts in Texas over an 8-year span that encompassed four different funding biennia. The study excluded some districts, including charter school districts, statewide districts, special districts, and those districts that were closed or consolidated during the observation period. The remaining districts each had data points for the observation period and neither added nor detached property during that time. Financial data for each district was reviewed, including the amount of funding, in total and per pupil, from federal, state, local and other sources.

The study used the following statistical measures to determine equity. Two generally accepted statistically measures of variation were used to review horizontal equity. The Gini coefficient was used to measure horizontal equity relative to the dispersion of wealth among all districts, while a coefficient of variation was used to measure equity based on the variation of each district and the state mean per-pupil spending. A measure of correlation was used to measure the relationship between property wealth and per-pupil spending to evaluate wealth neutrality. Finally, Pearson’s $r$ correlation was used to determine whether any change in equity had a relationship with any change in student test scores. Welch’s $t$-test was used to test the null hypothesis.

Descriptive data was reviewed for the major data points each year, including the mean, median, range, and standard deviation of per-pupil spending. The percent difference between each year was also reviewed to provide a simple descriptive evaluation of the changes in the sample. Simple descriptive statistics were also graphed to show the total and percent of funding that makes up the entire spending for school districts in Texas.
Findings

Overall, the study reached the following findings:

1. The total amount of funds and total percentage of funds from the state decreased overall, with a slight increase near the end of the study period. Overall, total funding actually increased as local funding grew in both total funds and percentage of funds. This is aligned with total property values also increasing, which would lead to local sources contributing a higher proportion of funding.

2. When reviewing the total amount of funding a district had compared to its property values, there was a negative correlation. This would appear to show that the property worth of a district, or how wealthy a district may be, causes a district to have less funding. When this is held constant for the student population of a district by dividing total value by number of students, a weak positive correlation appears. This helps control for the size of a district and shows that the overall wealth of a district does have a relationship with the amount of funds a district has to spend.

3. Both the Gini coefficient and the coefficient of variation followed a similar pattern of change during the observed period. The results showed that equity slightly decreased in the first 5 to 6 years following House Bill 1, and then started to slightly increase during the last 2 years, although results were still less equitable than the baseline year.

4. Comparing the per-pupil spending and equity measures to NAEP performance was not meaningful. Changes in overall NAEP scores, while constant with the
national changes, were not significant, and the low number of observable NAEP scores during the period did not allow for long term analysis.

The first question, how had equity changed during the time range, reviewed three measures of equity and a variety of descriptive statistics to review funding and funding changes from 2009–2016. An equity measure was taken for each year, and then compared year to year to measure change.

To start descriptive statistics were reviewed looking at average per-pupil spending for all districts in Texas. The researcher compared the average per-pupil spending for each year to the next and looked at the percent change for each year. Next, the researcher broke this down by local and state funding and again compared it for each year and the percent change per year. In addition to presenting the total per pupil for year, the portion of state, local, federal, and other that made up the total was charted to show their proportion by as a percentage and as a total dollar amount. This allowed for comparison of each funding source year to year and visually review how it changed.

While the mean per-pupil spending took a drop in 2012, overall it steadily increased and was higher overall by about $800 per student in 2016. When compared against the changes for local and state funding, the data shows that increases come from the local side of funding, which increased $650 during the timeframe while state funding stayed the same. 2011 and 2012 saw the greatest changes between years. This may be due to changes in federal funding, with the stimulus funds ending for states. State funding dropped over 10% in 2012 and the next year local funding increased over 10%.

For the first equity measure, wealth neutrality was measured by comparing per-pupil spending with the total property wealth of a district. Measures of wealth neutrality attempt to see
whether a relationship can be found between one variable and another variable where the researcher would hope to see that no relationship existed. Traditionally, wealth neutrality calculates the amount of money spent on an activity and the wealth of that population. For this paper, the researcher looked at the total property wealth of a district and the amount of per-pupil spending.

For the first calculation of wealth neutrality, total property wealth was compared to total per-pupil funds for the district. The results showed a small negative correlation, which would indicate that the richer a district, the less funding spent on education. After reviewing this result, it appeared that property wealth may not tell the whole story. Total property wealth was a net total and did not take into consideration either the population and size of a district or its relative wealth. To account for this, a new measure was created that divided the total property wealth by the total student population to provide a property wealth per student data point. This was then compared to per-pupil spending and a moderate positive correlation was found between the two indicators. With this information, it can be inferred that the property wealth per student, when size is taken into consideration, does lead to a district having more funding for education.

The next equity measure was Gini coefficient. The results overall showed a low result, which would signify equity between districts. The largest change comes in the last year where is drops over 11%, which would show even greater equity of all districts. This measure is a strong score, and appears to show that the amount of funding available to districts is at least equitable, and districts are close to having similar amounts of funding available. At the same time of the equity changing, the total amount of funds changed, first decreasing before increasing overall in the last 2 years. So, more money is in the system and it appears it is more equitable. What this
measure fails to incorporate is how local funding and how recapture and property wealth, change to put more money in the system at the expenses of the local funding system.

The last equity measure is coefficient of variation. The CV is not as strong as Gini was for equity. Results overall are fairly moderate, starting at 0.3573 and ending up at 0.3142. While the equity result is more moderate then Gini, they both show similar changes during the time period. They both had moderate drops at first, followed by times of increase inequity, and then larger changes in the end, including a 16% change for CV in 2016, and ending with greater equity overall at the end then during the first year.

The second and third research question in this study reviewed NAEP scores for math and reading in fourth grade. Both scores for Texas students and the national average were reviewed for the years the test was administered during the study period. Reading scores for Texas were just below the national average at 219 to 220. Texas then saw 2 years of single-digit decreases, followed by a point increase. The national average increased 1 point during the study period but maintained an overall higher average than just Texas for each year. Math scores for Texas and the nation were similar at 240 for Texas and 239 for nation. Both saw a 1-point increase for the next two testing periods followed by Texas increasing 2 full points while the national average dropped a point. Like Gini, this calculation fails to understand how the change in funding source contributes to overall equity. It does align with the total amount of spending however, and appears to show as the total amount of per-pupil spending goes up, equity also grows stronger, or more equitable.

The fourth research question compared the equity indicators from Question 1 with the NAEP results from Questions 2 and 3. Question 4 utilized Pearson’s $r$ to compare total per-pupil spending, coefficient of variation, and Gini coefficient to the 4 years’ worth of NAEP scores in
math, and then also in reading. The results varied widely. Per-pupil spending had a very strong positive relationship with math, but a slightly negative correlation, close to zero, with reading. Gini coefficient had a negative relationship with each test, with math displaying a moderate correlation and reading being slightly weaker. Since Gini coefficient measures equity from 0.0 to 1.0, with a smaller number indicating greater equity, this negative relationship would show scores increasing as equity increases. The coefficient of variation had a moderate relationship with each test, but reading had a negative relationship and math had a positive relationship. This would show that as equity increased, reading scores increased but math scores decreased.

Due to the small sample size of only four variables to compare, as the NAEP was only administrated four times during the study period, a t-test was also calculated to test the null hypothesis and determine significance. The t-test indicated that the relationships were not meaningful, and enough data was not available to determine if these results were meaningful. Also, NAEP is only reported for the state as a whole, or certain large urban districts who take part in a trial study of urban school districts. For this reason, individual district scores could not be compared to the districts actual per-pupil spending to determine if there was a relationship.

In 2009, the first year this study observed, Texas ranked 41st in per-pupil spending nationally and was tied for 37th for state revenue on public education. In 2016, Texas was 37th at per student spending and 34th for state revenue (National Education Agency, 2009; 2018). While they moved up in total funding, they are still in the bottom half of all states. The study did show that the spending in Texas was greater near the end despite early drops, and that the increase in spending came from the local tax base and not state or federal. While Texas spending did increase it was not enough to put them in the top half of all states.
Relating the Findings to the Theoretical Framework

The framework in this study theorized that equity of school spending is important, as it provides for equal opportunities for students. Because student outcomes are important to better life outcomes, it was important that all students succeed through quality education. The next section discusses what these findings say about the theory of equity in school systems.

Berne and Stifel’s framework of equity provide a method for measuring how equitable funding was for districts and how to explain what was seen. Four questions were proposed that should be answered to understand the equity situation being observed. First, they wanted to know who the equity was for. By using per-pupil spending as the major indicator in this study, they determined the equity they wanted to measure was money spent for students. This is important, as schools and the school system exist to provide education to students. This also answers the second question, which is equity of what. The framework wanted to ensure that whatever was studied, in this case money, was fairly distributed among whatever was being studied.

The next two questions looked at how equity should be measured, and then what the degree of equity is, or how much equity. Their question on how to measure equity looked at three major principle. First was the idea of horizontal equity or ensuring that similar students have similar resources. Next was vertical equity, which looked at ensuring students with different needs got different levels of resources. Finally, fiscal neutrality, which ensured that the amount of funding available for education was not the function of another variable, such as total wealth of district. This study focused on horizontal equity and on fiscal neutrality.

The researcher reviewed fiscal neutrality by looking at the wealth neutrality calculations of both per-pupil spending and property wealth, and per-pupil spending and property wealth per
student. Horizontal equity was reviewed through two calculations, Gini coefficient and coefficient of variation. Both calculations are part of measuring the degree of equity.

With these considerations and with the understanding of why equity is important, we can see that this research further contributes to how the theory of equity can be used to understand funding changes in a state and an attempt, while not meaningful in this paper, to connect equity to outcomes. Berne and Stifel created their theory due to the belief that an equitable system of education is necessary as it can offset effects of poverty and other random effects that many students in the United States must deal with them keep them from full access and opportunities for success. By measuring equity, we can determine how well we are providing these benefits and ensuring all students have the chance to be successful later in life.

The equity theory recognizes that all states have taken the responsibility to provide an education to students, and they have done so by creating school districts, almost always local, to educate those students in the area. The systems are all mostly made up of local property taxes to fund education, and thus the issue of wealth of a family of wealth of an area can have a large impact on the ability to finance education and the resources those students will have. State systems are meant to help provide equity by providing additional funds. For my study, I looked at how those changes in equity could relate to outcomes. It also looked at the outputs of the school finance system, how a decrease in funding in 2011 changed the source of funding, and how this changed equity in Texas and led to the local portion increasing.

Relating the Findings to the Literature

A major portion of the literature review for this research examined other equity studies and the importance of equity in education. The literature reviewed the important question on why it is important to consider money and resources when discussing public schools. Early
research looked at the connection between available resources and student outcomes. This focus started with the 1966 report, *Equality of Educational Opportunity*, which found a link between the amount of funding a district spent and the students’ vocabulary scores on a standard test (Coleman). The same paper also noticed that some students, such as economically disadvantaged students and African American students, tended to attend schools that had lower resources, and they also had lower scores. Deeper research has also been done that looked more closely at how the money is used. That research claimed that money alone does not make a difference, it needs to be prioritized and spent wisely based on student needs.

That earlier research set the frame for both the theoretical framework used in this research and also the purpose of this study. The idea that resources matter and that equity in resources matter is due to high needs students typically having less resources to begin with. For this reason, reviewing and understanding equity and how it changes is important to make good policy and resource decisions. This research continued the theme of reviewing equity due to its importance in education, but also reviewed how equity changes over time and attempted to then compare that to an outcome measure.

The findings of this paper are shared by other research that looked at school funding cuts following 2011 in Texas. The Equity Center, a public interest group focused on property poor districts and ensuring equity in school finance in Texas, mapped revenue per student in Texas against state test scores, dropout rates, and graduation rates. For single years, the authors did see schools with lower funding also having lower performance (Lesley 2010, 2013).

Marder and Villanueva (2017) reviewed the funding hole of decreased state support for public education following the funding cuts in 2011 and found it led to fewer teachers and higher class sizes and decreased the availability of full day pre-kindergarten in Texas. The authors
compared how much money was actually spent on education to what they believed would have been the total amount of funding had Texas not cut spending but maintained their current funding levels while accounting for actual property growth. They also found that funding for students with the highest needs were more adversely affected. Funding for bilingual education was also decreased, and funding for special education, although the later started to increase to expected levels at the last years studied. While this paper did not look at funding at the campus level, it did look at the funding source and found similar results to this study. As shown in this paper, funding came more heavily from local sources and less from the state sources that are meant to provide additional resources to high need programs and to equalize funding for all districts.

The nonpartisan public interest group Taxpereancy Texas also looked at changes in school funding and the funding gap following funding cuts in 2011. Taxpereancy Texas noted that increasing property values drove increased local funding. This increase did not truly lead to increased funding for all districts however, as the state was using these increased funds to reduce their own obligations for school funding (Taxpereancy Texas, 2017). In this way, the increased local funding was not only balancing the states need to fund education on the resources raised from local property taxes, they were also using that money on state needs that were not educationally related. Again, this focus on where the funding is coming from was also seen in this paper. The local portion increased while the state portion decreased. This was coupled with increased property values across the state. So local taxpayers were not only the major source of revenue for their local education, but those property wealthy districts were also becoming the major source of state funding, while the state reduced their own share of state revenue going towards education.
Limitations

There were several limitations to this research. These occurred in both the design of the study and in the considerations that were not taken when designing the study and evaluating the results. It is important to review these limitations to better understand what could have influenced the results seen here and help guide later questions for possible future research.

In the design of the research, a few limitations occur. Overall, this paper took a simplified approach to look at both property values, per-pupil funding, and the school finance system in Texas. While small tweaks and changes have been made to the funding formulas, districts may have found new revenue sources or built new property adding to their taxable base without actually having an increase in taxable value; this was not reviewed in this research. Also, the actual needs of a student were not reviewed. The changing demographics in Texas were not reviewed, so it is possible that the student population has become more diverse, including more special education students, English language learners, immigrant students, and other student groups that traditionally require greater resources for their education. These possibilities were not reviewed, but they would influence per-pupil spending and more importantly impact the adequacy of need for students in Texas. Finally, these increased needs would also require the state, who provides a second tier of funding based on student need, to increase simply because of the existing funding formula and not because the state added more money into the system.

A limitation of the data used in this research is that the variables changed in very small degrees. For NAEP scores, the averages barley changed, nor did they differ much from Texas and the National average. This makes it difficult to compare any testing outcome change to the equity measures. NAEP also only tests every 2 years, so half of the reviewed period did not have
a corresponding outcome measure to compare against. Recall that this study used NAEP because it was a nationally normed test administered to students across the United States whose testing instrument and scoring system have not changed or been altered during the testing period.

This study looked at equity and how it relates to test scores to determine whether changing equity has a relationship with any changes in student outcomes. This paper does look at a total of 8 years, and of that 4 years also have test data, but another limitation of the study is that it does not go into detail on any possible lagging effects that may have occurred. This is important as it would not be expected that any change would necessarily have an effect that reveals itself at the exact time the change takes place, but that it would show up in later years and have a compounding effect from multiple years. The premise of why per-pupil funding, and in turn equity, is important is that students need resources to receive an education. This includes not only paying teachers and staff, but also program offerings, curriculum and instruction, and other resources to be used at a school. If a change is made to funding which would lead to decreased resources for students, it may be expected that the students would not do as well in school and their outcomes may decrease. This effect would lag however and be different for different groups of students. As some students would have already been in a school system both before and after a major funding change, their results may differ and lag longer then a student who started in a school system for the first year following the funding change. To attempt to capture some lag, 8 years was used and only the fourth-grade test was reviewed. Due to this choice, it may be expected that if funding had an influence on outcomes, it would be reflected for the last two NAEP years reviewed as the students would have spent the entirety of the school career following the funding change.
This research also did not look or discuss certain things which create other limitations through omission. First, while this study looked at multiple years following a major change to school funding, it did not look deeply into other changes made to the school finance system following 2011. The state legislators met four times during this study, but changes made were only briefly discussed. While these changes contributed more funds and make tweaks to the formula that allowed some districts to have more funding, they were not studied in more depth as the purpose of study was not to review a series of legislative changes, but just one change. Including all changes would have overly complicated the study and were not necessary for the purpose of looking at how funding changed.

Second, the study did not look at student need and how it compared to similar students. That is a major part of the vertical equity theory from Berne and Stiefel and is based on the idea that some students require more resources in order to provide a basic education compared to other students. While understanding vertical equity is important, this paper looked only at fiscal neutrality and horizontal equity, which were especially relevant as these measures are what Texas court cases have focused on.

Next, this study did not look at other outcome measures to determine if a relationship could be found. While it is possible that a different outcome measure would have been more meaningful to compare against equity, the researcher suggested that such an approach is better suited for future research instead of changing the research design of this program after it had already been proposed.

Finally, while data was pulled on the local, state, and federal contribution of dollars towards the total per-pupil spending, no attempt was made to determine whether or how local districts increased local contributions, either through fund balances or increasing the tax base or
rate. A change in one of these methods could have led to a district receiving greater per-pupil funding that had no relation to the state share of funding of the funding cuts that occurred in 2011.

Overall, this was a strictly quantitative study and did not look at qualitative effects of the funding cuts or how other felt about these cuts. Other research had looked at how schools handled the funding cuts, which can give insight into what changes could happen later through outcomes. Qualitative research could also show how students and families felt that the cuts effected their quality of education and their ability to receive an equitable education. This paper instead focused just on the per-pupil spending and various equity measures using per-pupil spending to determine how that number changed due to funding cuts and what that meant for education.

**Implications for Practice**

While the purpose of this paper was to both determine how equity has changed and compare that to outcomes, a relationship between equity and outcomes was not able to be established. Had such a relationship been shown in this paper, it would add to the research and policy decision focused on equity leading to greater outcomes for all students. Given the limitations described above, this paper does not fully disprove this idea, so it is important that future research be conducted while policy makers and educators continue to ensure that all students have an adequate and equal education.

This paper did produce data that shows both how equity has changed in Texas and how changes in school funding in Texas have shifted the burden of school funding to local sources and the effect that had on equity. Overall the state did see a drop in total funding, but that increased each year and by the end of the period was above the total funding of the first year.
The level of government that was funding the greater portion of the total of school funding also changed from the state to the local school district. With that, equity also changed. As local districts contributed a greater potion, equity decreased. In the last 2 years, state funding increased while local funding also increased, and equity increased at the same time, ending with a greater degree of equity in the last observed year as than the first observed year.

This would conform with what one would expect with basic understanding of the Texas school finance system. The current system started in 1993 to ensure that equity was considered in school funding and that local government and property wealth were not the sole determinants of the amount of funding spent. In 2006, the system was mostly finalized, with the state limiting the amount of local taxes that could be levied and providing formula funding to all districts in an attempt to create greater equity between all districts.

While the tax rate that could be levied by local governments were limited, the amount that would be brought in was determined by property values. When property values increased, the tax levy brought in higher revenue. The school finance system was created for the state to provide funding on top of local funding to both ensure equity between districts but also to ensure districts had an adequate or basic level of funding based on student need.

With this understanding of the school finance system, it would seem to be expected that as local funding increased due to increases in property values that the state portion would decrease proportionally. While this study did not compare those two movements, overall, it does show that local revenue increases and state revenue decreases. If property values were to take sudden drops across the state, it would then be expected that the state requirement would increase.
Policy makers, tax experts, and Texans need to decide if this is the system that is needed for Texas Schools. When property values go up, the burden will be felt harder on property owners who will see their property taxes increase. If property values fall, the state would be required to fund more, and that revenue most come from a state source or a new revenue source found. This is also true if the state would try and find a way to limit the reliance on property taxes. If it wishes to maintain a similar level of funding while still funding growth, which it failed to do in 2011, the state would need to find a new funding source to make up the difference or cut funds from other state programs. The state is limited on how it could fund this growth. Current law does not allow for new statewide taxes without a vote of the public (Texas Const. art. 8). The state would need to establish a new tax, increase an existing tax or fee, or decrease services elsewhere in order to fund an increase that could be sustainable.

The state used the revenue brought by property wealthy districts to help pay part of the state share of school funding. These property wealth system funds go into the state’s general budget, however, so it thus is a revenue stream for the state. The state could bring in more through recapturing property wealth than they pay out to other districts through the state finance system. This would also lead to wealthy districts seeing their local tax revenue increase, but their overall budget or revenue to the district would not increase because the state would be “recapturing” those funds. Policy makers should decide if the state needs to find additional revenue, through new taxes or cutting services elsewhere, to provide relief for property taxes and increase funding for schools, or if they need to make minor fixes to the existing system to ensure adequacy and transparency to taxpayers on how the system works.

In 2016, the Texas Supreme Court ruled that the state finance system was constitutional, although it could be better (Collier, 2016; Morath v. Texas Taxpayer, 2015). The court ruled that
the current public school finance system meet the minimum requirements of the Texas constitution (Morath v. Texas Taxpayer, 2015). The research in this paper and other research can assist in understanding what system Texas needs to ensure the state is providing an appropriate education for Texas students while also ensuring it has appropriate revenue sources to fund education and that no one source is relied on to heavily to create an extended burden. The model used in this paper could be replicated for future studies or in modeling a new finance system to determine if that system will produce more equitable results.

This decrease in state funds and increase in local funds, yet also decrease in equity, may be due to the state formula not fully understanding the unique needs of individual students and funding accordingly. The state should review its funding weights, or additional funding provided for students with different needs, to ensure they are relevant and ensure an adequate and equal opportunity for students with additional needs. The formula should also be reviewed to ensure it still considers the unique situations of certain districts, such as increased cost of living and prices within this district. These differences could explain why increased overall funding had not necessarily seen a corresponding increase in equity.

When states constantly change their accountability system it is difficult to determine how student performance is improving or not improving. The focus of this paper was not on the state’s accountability system, but this paper demonstrates that constant changes, both small and large, create difficulty for research and evaluation purposes to understand how Texas’s student outcomes change over long periods of time. Texas needs a better way of reviewing data long term to make worthwhile observations of student performance in the state. Changes in the method of measuring outcomes or changing the criteria on what is considered “passing” when
measuring outcomes, makes the current school accountability system difficult for multi-year comparison.

Federal measures, like those used in this paper for NAEP scores, provide a good comparison, but are only administrated every 2 years. While this is done to reduce the burden of testing on districts and students, it also creates gaps in the understanding of student outcomes nationally year to year.

**Recommendations for Future Research**

This study looked at measuring equity in Texas by measuring changes in equity and its relationship to student outcomes through fourth-grade NAEP. While this study found no evidence supporting the basic premise of this study, that the change in funding and the resulting changes in equity led to decreased outcomes for students, future research could continue to look at these issues. As a result of these issues and the study overall, it is recommended that future research focused on equity and changes from House Bill 1 in Texas focus on the following ideas:

- As stated earlier, the constant change to the state accountability system makes it difficult to use the Texas accountability system as the method to determine if changing equity has changes in outcomes. Other outcomes could be used however that are replicable across all districts and administrated or conducted at least once a year to provide a suitable time frame. A replication study could be conducted using equity measures compared against another indicator that would provide more data points. Student outcomes such as federal graduation rate, SAT test scores, ACT test scores, attendance, direct to college enrollment, reading proficiency, or similar measures. The study should also consider historical data through a multi-year period to account for a lagging effect of changes in funding to the services provided to
students. The study could also compare outcomes for students during a period of time before the change, and then outcomes for students during a period of time after the change to account for any lagging effects.

- It is possible that other states would have an accountability system that would allow for multiyear observation to determine changes in accountability and how it compares to any changes in equity in that state’s school funding system. Another replication study could be conducted to review other states’ changes.

- A quantitative study could be conducted to focus on adequacy of funding following the budget cuts in 2011.

- A mixed-methods study could be utilized to calculate changes of equity in a state and a qualitative portion to seek descriptive feedback on how teachers, principals, educators or policy makers made changes to their own behavior on education policy due to the possible changes in equity through the years.

**Conclusion**

This research looked at equity in Texas following funding changes in 2011 that provided over $5 billion less in state aid for education and attempted to see if this funding created less equity, and if any observed change in equity could be correlated with a change in student outcomes. These questions are important as education is not only a requirement for states, but equitable education improves all student’s chances at being successful later in life. Funding of school is thus an important input in determining if a system has the resources it needs to provide both a quality and fair education for these and all other students.

The overall question was: Were schools equitable during the observed 8 years and how did that change relate to any change in outcomes? The research did successfully review how
A noted decrease occurred as state funding dropped, but then per-pupil funding began to increase again in the later years while equity also increased. This was coupled with decreases in state funding until small tweaks to the funding system provide slightly increased state funding. At the same time, local funding continued to raise and now makes up the largest portion of overall funding.

Questions remain on how meaningful measuring the connection between funding and outcomes, and in this case measuring the degree of school funding equity and student outcomes, truly is and additional research and new research designs are needed to more carefully review this idea. Also, for Texas, the state should consider what is expected from our school finance system, what is expected regarding adequacy and equity, and should the burden for funding be placed on local districts or spread more evenly across the whole state with increase state funding.

While this research failed to find a connection between equity and outcomes, it has helped build the body of research and provide suggestions for new ideas while provide a method that could possible both measure equity and then compare it to an outcome. Hopefully, future research will allow others to look at this subject so that lawmakers and educators can have more serious discussions around providing all students a basic education and preparing them for life despite any demographic or financial indicators that sometimes related to lower successes for students.

Personally, this research has encouraged me to continue to look at equity in school finance. At the start of this journey I had hoped to gain a better understanding of how to successfully measure equity changes and possible draw a link to student outcomes. While this paper could not meaningfully make those correlations, it did provide meaningful data on school funding and how equity has changed due to those changing funding sources. The policy
decisions that drive school finance, school equity, and in turn ensuring that students have the resources necessary to be successful can be meaningful measured.
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doi:10.1016/S0047-2727(00)00177-8


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Texas Const. Article 8.


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Appendix

Figure A1. 2008-09 Lorenz Curve

Figure A2. 2009-10 Lorenz Curve
Figure A3. 2010-11 Lorenz Curve

Figure A4. 2011-12 Lorenz Curve
Figure A5. 2012-13 Lorenz Curve

Figure A6. 2013-14 Lorenz Curve
**Figure A7.** 2014-15 Lorenz Curve

**Figure A8.** 2015-16 Lorenz Curve
Figure A9. Texas Enrollment 2005-06 to 2015-16. Adapted from Enrollment in Texas Public Schools, 2015-16 by Texas Education Agency, 2016, Austin, TX: TEA.

Table A1

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Note. NAEP = National Assessment of Educational Progress

Table A2

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### Table A3

**t-Test: Two-Sample Assuming Unequal Variances**

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*Note.* NAEP = National Assessment of Educational Progress, CV = Coefficient of Variation

### Table A4

**t-Test: Two-Sample Assuming Unequal Variances**

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t-Test: Two-Sample Assuming Unequal Variances

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Note. NAEP = National Assessment of Educational Progress

Table A6

t-Test: Two-Sample Assuming Unequal Variances

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Note. NAEP = National Assessment of Educational Progress
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*Note. NAEP = National Assessment of Educational Progress, CV = Coefficient of Variation*