TEXAS PRINCIPALS' DATA USE: ITS RELATIONSHIP TO LEADERSHIP STYLE AND STUDENT ACHIEVEMENT

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This study applies an empirical research method determine whether Texas public school principals' leadership styles, coupled with their use of real time data in a data warehouse, influenced their leadership ability as measured by student achievement. In today's world of data rich environments that require campuses and districts to make data-driven decisions, principals find themselves having to organize and categorize data to help their school boards, campuses, and citizenry make informed decisions. Most school principals in Texas have access to data in multiple forms including national and state resources and a multitude of other data reports. A random sample of principals was selected to take the Multi Factor Leadership Questionnaire (MLQ5x) and the Principals Data Use Survey. The MLQ5x measured principals' leadership styles as transformational, transactional, or passive avoidant. The Principals Data Use Survey measured how principals use data to inform campus decisions on student achievement, shaping the vision of the campus, and designing professional development. Data obtained from the survey were correlated to determine the relationship between principals' use of data warehouses and their leadership styles on student achievement as measured by the Texas Assessment of Knowledge and Skills. The results yielded significant relationships between student achievement, principals' leadership styles, and the principals' data use with a data warehouse. Student achievement scores were highly correlated with the campuses that participated in the study and provided limited differences between those with data warehouses and those without data warehouses.

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CHAPTER 1

INTRODUCTION TO THE STUDY

The global competitiveness index (GCI) identifies competitive economies as the cornerstone to higher productivity in countries and governments. These charts provide the most productive and promising practices (Schwab, 2012) that serve as a benchmark for nations to raise their productivity and economic capital. Several factors promote competitiveness and productivity, and the 12 pillars of competitiveness that countries and governments use to benchmark progress capture these GCI measures.

Pillar 1 includes institutions that provide the structure and framework for governments to work and produce wealth. Pillar 2 is an efficient infrastructure that reduces the effects of regional location and distance between countries' local market places and access to other national and global marketplaces. Pillar 3 refers to macroeconomic stability of governments or countries that is required to make high-interest payments to cover past debts.

Pillar 4 addresses health and primary education as required elements for a population to engage in advanced production processes while leaving more manual tasks to less-educated countries. Pillar 5 promotes higher education and training as paramount to helping countries reach the highest level of competitiveness and innovation. Pillar 6 refers to the efficiency of the goods market. An effective goods market helps countries prioritize the right mix of goods and products in relation to the current supply and demand of world markets. Pillar 7 addresses labor market efficiency that allows for flexible shifts from one area of work to another more profitable area at a low cost with little social disruption.

Pillar 8 includes financial market development, which refers to the money citizens save by investing in entrepreneurial and other projects with the highest rates of return. Pillar 9 refers

to the technological readiness required within countries to capitalize on increased efficiency and enable innovation and competitiveness. Pillar 10 refers to market size, which speaks directly to the size and robustness of the economic market and its proclivity to be open to larger, more beneficial trade opportunities with other countries. Pillar 11 addresses business sophistication, which includes the quality of a country's business network, individual business operations, and strategies applied to gain wealth. Lastly, Pillar 12 concerns innovation and its link to new technological innovations and, on a much smaller scale, non-technological innovations related to expertise, skills, and working conditions in highly populated and sophisticated job sectors within a country's economy.

This current study focused on those pillars related to primary education, technological readiness, and technological innovation. Primary education references the 4th pillar, technological readiness follows as the ninth pillar, and technological innovation addresses the 12th pillar for global competitiveness and productivity. All three identified pillars, including primary education, technological readiness, and technology innovation, promote efficiency in labor pools that improve the standard of living for any country. The use of real-time data influences the degree of technological readiness and innovation in schools and can further affect the progress of primary education. Principals' leadership styles directly affect the positive or negative effect of each pillar (Avolio, 2005).

This study focused on school principals with special attention to their use of data and their leadership styles. Educational administrators collect and have access to large amounts of data. For example, several districts have embarked on creating or purchasing access to data warehouses to give their principals and teachers access to real-time data to make decisions about instruction. The business industry has used data warehouses for decades; however, they are new

to education. The term *data warehousing*, first coined by Bill Inmon, the father of data warehousing, involves more than a product that assembles and manages data from multiple sources to gain a single, detailed view of part or all of a business (Gardner, 1998, p. 52). In school districts, data warehouses are computer servers with software that aggregates all structured and unstructured data in one location. By housing data in a central location, school personnel can access this information through a single website or web address. Once on the website, users see a dashboard that represents a collective view of the stored or input data for the entire district in one area.

Districts engage in professional development efforts for principals to learn how to use information effectively to increase learning opportunities for students and to determine whether the leadership style of the campus principal influences campus activities. Data warehouses provide information to students, teachers, staff members, and administrators about captured school district data that may be relevant and useful for school improvement. The data warehouse provides real-time individual and collective data that educational leaders can evaluate to make decisions about instruction, student achievement, and a host of other questions.

The choice to implement a data warehouse provides a natural solution for schools because principals must hold themselves and their staffs accountable for numerous measures within state and national guidelines. In concert with these requirements, principals may access many individual databases to compile the appropriate datasets for accountability reporting and campus needs. Almost simultaneously, districts work with principals and other leaders on leadership development to ensure they maximize their strengths as leaders to be more helpful to their staff and students (Rath & Conchie, 2008).

This study focused on the identified three pillars, leadership styles, and ways in which school leaders attempt to guide others and matters related to school functioning. Bass (1999) stated that leadership styles determine the type of campus leader and his or her willingness to access data through a data warehouse or other means to drive student achievement. Avolio and Bass (2004) examined leadership styles in a meta-analysis of world leaders; specifically, leadership styles uncovered affirmed prior research on passive-avoidant and transactional styles.

An additional style that Bass and Avolio (2004) defined was transformational leadership, which transcends the transactional leadership style because these leaders can get their followers to become self-motivated and realize greater achievement or production. Transactional leadership became the dominant effective style of the century; however, transactional leaders do not achieve consistent results compared to those with other leadership styles. After analyzing the dominance of transactional leaders in the 21st century, Bass and Avolio found that a continued reliance on developing transactional leadership styles would be grossly inadequate for the leadership challenges that most organizations face (Avolio, 2005; Cascio, 2002).

Statement of the Problem

According to Cascio (1995), "As citizens of the 20th century, we have witnessed more change in our daily existence and in our environment than anyone else who ever walked the planet" (p. 928). Principals must be transparent in their work with teachers and students. Change in education happens constantly, and educators need to stay abreast of these changing expectations. However, many current digital tools available to administrators do not provide information in a timely manner to inform them of assessment procedures or provide course correction options that benefit students. Without the aid of data warehousing to provide real-

time data in conjunction with principals who have leadership styles that promote the effective use of this data, timely correction for student success may not occur.

Equally disconcerting is that students and parents operate in a technological society that gives them personal information in real time; however, they continue to receive academic reporting items aimed to fix or address academic problems in antiquated formats. Current educational practices do not provide seamless information that is easily accessible to each stakeholder in the education continuum. This lack of cohesiveness presents a problem for schools and districts that continue to use antiquated methods to access and distribute information to correct the performance of their students before they get off track, drop out of school, or lose interest in learning.

In a rapidly changing world, where continuous development of the workforce is a prerequisite for staying competitive educationally and economically, both effective and ineffective leaders run organizations. These leaders may possess functional and dysfunctional leadership styles that can improve or hurt an organization. Leadership style can also positively predict staff members' motivations, cohesion, and performance levels (Bass, Avolio, Jung, & Berson, 2003).

The transformational leadership style replaced transactional leadership as the best style to influence school campuses or organizations (Avolio, 2005; Avolio, Bass, & Jung, 1999; Bass & Avolio, 2004; Bass et al., 2003). However, the transactional leadership style continued as the most common style within schools and organizations, even though it has not demonstrated the type of employee performance as transformational leadership (Bass, 1999). Therefore, this study aimed to determine which leadership styles predict the most effective use of data obtained from a data warehouse.

The background of this study requires a discussion on the different leadership styles, primarily transactional, passive-avoidant, and transformational (Bass & Avolio, 2004). Before 1970, researchers considered passive-avoidant leadership as laissez faire and transactional leadership as amalgams of charismatic, inspirational, and passive leadership. Transformational leadership officially became the chosen style in the late 1970s as an answer to the difference between regular transactional leaders and reform or revolutionary transactional leaders (Avolio, 2005; Bass, 1999; Bass & Avolio, 2004).

Transactional leaders in education are those who give something to their followers when they meet specific expectations. Historically, the transactional leadership style has been seen in literature, military, education, and public circles as the most popular because it focuses on leadership through conditional rewards (Avolio, 2005; Avolio et al., 1999; Bass & Avolio, 2004). Most notably, the transactional leadership style is associated with the phrase, "What your country can do for you" (Bass, 1999, p. 9).

The transactional leadership style became especially useful in aligning the interests of an organization and its people (Bass, 1999). Transactional leaders develop goals and structures for individuals to follow and provide corrective actions to those who do not meet their standards, ideas, or requirements. Additionally, transactional leaders differentiate themselves as managers by setting goals for staff based on what they could reasonably expect, and then, they wait for staff to make mistakes before correcting their behaviors.

The passive-avoidant leadership style, also known as laissez faire, occurs when a leader is inattentive, lacking, or not taking action regardless of how pervasive a problem (Bass, 1999). In this study, I used the terms laissez faire and passive-avoidant interchangeably. This leadership style tends to be associated with staff dissatisfaction, ineffective leadership, and conflict (Bass,

1999). Further, this style establishes a loose form of empowerment of staff by letting them decide on things that they know best without direction or alignment to any core mission or goal.

Transformational leadership parallels the phrase, "What can you do for your country" (Bass, 1999, p. 9). Transformational leaders are motivators who move their subordinates beyond their own interests and toward the higher calling of the organization (Bass, 1999). The transformational leadership style shows similarities to the transactional style; however, it moves each follower to enhanced commitment to the overall goal and encourages more involvement produces more loyalty, and yields greater performance (p. 11). Transformational leaders move followers beyond what transactional leaders do through idealized influence and inspirational leadership practices. Idealized influence develops when followers understand the greater vision of the organization and see a path to reach the next level of performance. These leaders set high standards and equip their followers with intangible characteristics that give them the confidence and determination necessary to meet goals in spite of the odds.

Statement of Purpose

The purpose of this study was to determine whether a relationship exists between the surveyed principals' leadership styles, as assessed by the Multifactor Leadership Questionnaire (MLQ-5x) (i.e., transactional, passive-avoidant/laissez-faire or transformational) (Bass & Avolio, 2004), use of real-time data in a data warehouse, as assessed by the Principals' Data Driven Decision Making Survey (Byrd & Eddy, 2010), and student achievement, as measured by scores on the Texas Assessment of Knowledge and Skills (TAKS) tests. The results of the surveys used demonstrate the power of principals' leadership styles and their real-time access to data in affecting student achievement. Research suggests that transformational leaders may realize higher performance in student achievement scores compared to that of transactional

leaders (Bass, 1999, p. 11). Therefore, this study investigated possible differences between data use by principals with different leadership styles.

Research Questions

The following research questions guided this study:

1. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision, and data use to design professional development) influence student achievement?
2. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision and data use to design professional development) vary by leadership style (i.e., transformational, transactional, and passive-avoidant leadership)?

Significance

The results of this study add to the research on leadership style. Findings also inform campus and district decision makers of the potential affects that use of data from a data warehouse has on student achievement as measured by the TAKS. The methods and process provide a framework for continued research.

Assumptions and Limitations

This study had several assumptions and limitations as indicated in the following sections.

Assumptions

The researcher made the following assumptions:

1. The MLQ-5x was an appropriate survey to measure transformational, transactional, and laissez-faire leadership styles (Bass & Avolio, 2004).

2. The MLQ-5x accurately measured transformational, transactional, and laissez-faire leadership styles.
3. The Principal Data Driven Decision Making Survey was appropriate for this study.
4. Participants in the study truthfully answered the questions on each survey.

Limitations

The following limitations applied to this study:

1. The researcher administered only the MLQ5x and Principals' Data Driven Decision Making Survey to obtain data on leadership styles and decision-making processes.
2. Participants' refresh rates of their school districts' data warehouses limited the data.
3. Geography limited the data because the researcher sought responses only from Texas principals about their leadership styles and uses of real-time data from data warehouses.

Definition of Terms

The following provides an understanding of terms as they apply in this study:

Global Competitive Index (GCI). The GCI is a term used in the annual Global Competitiveness Report (GCR) that measures a nation's competitiveness based on 12 pillars that drive economic success (Schwab et al., 2012).

Global Competitiveness Report (GCR). The GCR is an annual report developed by a consortium of economists that ranks international competiveness (Schwab et al., 2012).

Leadership style. Leadership style refers to transformational, transactional, or passive-avoidant (Bass & Avolio, 2004).

Data warehousing. Data warehousing is an electronic system used to gather separate databases in an organization into one or more logically organized dashboards.

CHAPTER 2

REVIEW OF THE LITERATURE

President Obama noted that America's schools have been out educated and out performed in the last 10 years by other countries that graduate more students from college (U.S. Department of Education [DOE], 2010). Once a pinnacle in education, the nation's schools dropped to 10th place in the world (Organization for Economic Co-operation and Development [OECD], 2009). Consequently, the president set an ambitious goal of asking schools to do more to educate all students with a "world-class education" by 2020 (DOE, 2010, p. 1). According to Schmoker (2006), educators have the opportunity to reduce the achievement gap dramatically if they act on what they already know. Specifically, Schmoker stated, "Teaching needn't be exceptional to have a profound effect; continuous commonsense efforts to even roughly conform to effective practice and essential standards will make a life-changing difference for students across all socioeconomic levels" (p. 9).

This study determined whether principals' leadership styles and use of real-time data in a data warehouse affect their decision-making abilities as measured by student achievement. Ultimately, such an assessment of principals' leadership styles (Schmoker, 2006) determines how they influence teachers and make their campuses as effective as possible. Findings from this study demonstrate that principals in Texas care about data-driven decision-making matters as they access data warehouses and obtain information that affects crucial decisions on student performance, teacher and administrator quality, and program evaluation.

The use of real-time data from data warehouses helped the researcher determine that these data influence student performance. For this reason, the literature review is divided into several subtopics: (a) Data-Based Decisions; (b) Data Quality; (c) Data Uses, Availability, and

Consumers; (d) Data-Driven Reform: The Why Factor; (e) The Blueprint for Educational Reform; (f) Perceptions of Texas Superintendents; (g) Education Reform using Data Warehousing as a Solution; (h) Leadership Styles; (1) Theoretical Framework; and (j) Conceptual Framework.

Data-Based Decisions

Public school principals, inundated with the prevalent use of multiple technologies in and out of the classroom, use different leadership styles to construct the roles of their staff members and determine the most effective educational approach for their students. This widespread use of available technology provides numerous data sources and data silos that may or may not have all of the information that principals need in a convenient place to use as resources that drive campus-wide decisions. This study investigated the overall affects of real-time data located in warehouses and its uses based on principals' leadership styles. The researcher focused on the most important factors for Texas principals who use data warehouses to help them make academic, programmatic, and employment decisions.

Vitiello (2006) summarized the conversations and questions that America's regional planning organizations have had on the influence of education on urban planning initiatives. He equated the role of schools as the most prolific reform movement in the United States. Oblinger (2012) stated that education is the game changer that will move the United States to its next great horizon if educational leaders harness the possibilities of new technologies.

Drucker (2000) noted that the knowledge society, referring to the current generation, dominates the current workforce. To this end, principal leadership influences the growth of education significantly. Vitiello (2006) used Superintendent Henry Barnard's sixth annual report to the general assembly of Connecticut in 1851 as a historical framework to support the need of

principals in public schools. He discussed the evolution of past titles of educational planners, which spawned from universities, to become principals and superintendents. Along with Barnard, Vitiello recognized that "schools consume most of the waking hours of the world's populations" (p. 185). He recognized schools as the primary institutions for economic planning and development.

Following research on managerial, transformational, and transactional leadership styles in the 1990s, a shift occurred from principals who had managerial leadership styles to those who had transactional leadership styles (Avolio, 2005; Ibrahim, & Al-Taneiji, 2012). Bass et al. (2003) found that principals in the 1990s often used the transactional model with teachers who complied with their leaders' wishes in exchange for praise, resources, rewards, or to avoid disciplinary action (Bass et al., 2003). According to these researchers, transactional principals provide staff members with the standards they needed to comply with and inform them of what constitutes unacceptable performance. This transactional style of leadership is still seen in teacher and principal performance appraisals.

Pitfalls of early schools include using praise, resources, or rewards, instead of generating intrinsic rewards to increase performance. To avoid a repetition of these pitfalls, principals need to evolve to transformational leadership styles where real-time data availability and its use in schools effectively move school reform to the next level. Shen et al. (2010) examined 16 principals in Michigan to determine the types of data they used most often to achieve positive student outcomes. Their results demonstrated the need for a systematic shift from the limited use of single data streams (i.e., as an accountability measure only) to incorporating various streams of data to guide comprehensive decision-making processes. Their study also highlighted that the

consistent use of data in decision making, along with how principals use the data, help communicate the information needed to change teaching practices.

Data Quality

According to the DOE (2006), almost every educational program requires high quality data collection and reporting. School districts and higher education institutions cannot afford to operate or hope to improve performance without high-quality data. Data quality in schools is a primary indicator to improving school performance, and data accuracy adds to the level of clarity when making decisions. Conversely, poor data quality contributes to the ineffectiveness in an organization, overall, and to decision-making, specifically. Poor data quality makes it more difficult to align organizational goals and is the root of problems that principals and school leaders face in the current education climate. Data quality issues can be associated with the following categories: data views, data values and accuracy, presentation of data, privacy and security (Redman, 1998).

A data warehouse helps organizational leaders make better decisions. Data quality is one of many components reflected in a data warehouse; however, data quality alone does not provide all the answers needed when an organization attempts to transform itself (Ackoff, 1999; Bertalanffy, 1950; Dessoff, 2011). Principals use the information found within the data warehouse as components to make decisions that address leadership issues, teaching styles, and other applications to achieve the best results for students. However, an element of uncertainty exists because so much of the data to improve teaching and learning depends on the application of sound, research-based practices of teachers and the receptiveness of students. Consistent with Kotter and Schlesinger (1997), leaders make decisions based on some uncertainty; however,

decisions based on relevant, accurate, and timely data have better chances of advancing an organization's goals.

Today's typical executives face many problems that include low customer satisfaction, high costs, ineffective decision making, and reduced effectiveness in executing plans and strategy. Ibrahim and Taneiji (2012) argued that a principal's leadership style contributes to similar dissatisfaction among his or her customers. Originally formulated for business management executives, a stark parallel exists between business challenges and those faced in the education sector. Principals might agree with Redman (1998) that educators have a difficult time teaching students effectively because the cost of education continues to rise and customer satisfaction continues to decline among those in the legislative bodies that control spending (Schmoker, 2006). In short, poor data quality is a direct cause of customer dissatisfaction, increased costs, and job dissatisfaction among employees.

According to Redman (1998), "That which doesn't get measured, doesn't get managed" (p. 80). Although some researchers and educational leaders have argued that education is not really a business, it does have many qualities that mirror business practices (Denker & Martocci, 2009). However, a gap exists in the research to show a true correlation between business and education practices.

Data Uses, Availability, and Consumers

Carlson, Borman, and Robinson (2011) examined data-driven reform initiatives across 500 schools within 59 school districts in seven states. Their study focused specifically on the effects of implementing the data-driven reform initiatives by the Johns Hopkins Center for Data-Driven Reform in Education (CDDRE). The CDDRE's 3-D intervention model includes quarterly benchmark assessments, data review, training in leadership and data interpretation,

provision of reviews of research on effective programs and practices, and assistance in selecting and implementing proven programs.

The researchers asked state departments of education in Alabama, Arizona, Indiana, Mississippi, Ohio, Pennsylvania, and Tennessee to nominate districts with large numbers of low-performing schools for participation in the study (Carlson et al., 2011). The benchmark assessment, 4Sight, was created from the same assessment blueprints as those used to construct the state assessments. These assessments monitored student progress in math and reading in Grades 3-8 (AL, AZ, IN, MS, OH) and Grades 3-11 (PA). The researchers administered assessments four to five times a year, and accepted comparable benchmarks administered in the districts prior to the study as part of the treatment. However, the researchers did not include state assessments in lieu of the 4Sight benchmark assessment; thus, without accesses to the 4Sight document, causality for the effectiveness of this treatment alone could not be determined.

The researchers used a cluster randomized design trial and controlled for variability to assess math and reading achievement with an alpha level of .05. Carlson et al. (2011) found a statistically significant positive treatment effect for the model of average school math achievement. However, the findings yielded no statistically significant treatment effects for reading. While this study was "one of the first large-scale efforts to assess the causal effects of data-driven reform on achievement outcomes," (Carlson et al., 2011, p. 394), it is unclear what causal effects, if any, influenced school principals' leadership.

Data-Driven Reform: The Why Factor

Sirotnik (2004) proposed that responsible accountability systems must be as much a focus for continued learning of educators as they are for students. Sanders (2008) conducted a multiple case study of district leaders who used data to inform them about family, school, and community

partnerships. According to Sanders, "data are seen as a means to create school and district cultures that address issues of educational excellence in ways that are continuous and systematic" (p. 531). He also noted the importance of using data to assess the effectiveness of reform strategies.

Sanders' (2008) findings indicated that data could be an important tool for educational reform. Specifically, he found three areas that could enhance the implementation and sustainability of reform: (1) defining data broadly; (2) seeking assistance in the collection, management, analysis, interpretation, and dissemination of data; and (3) making data accessible to a broad audience. Each implication, with an emphasis on professional development, could help districts make informed choices about using data to drive decision-making efforts.

Sanders (2008) expanded on the importance of quality data in the following comment: "Educational programs and departments are being asked to legitimate their existence with the data" (p. 534). However, he also highlighted the fact that "fewer research studies have explored the kinds of data that are used by district-level leaders, how these data are used, and factors that inhibit data use" (p. 530). To this end, why is there such a gap in research about the types of data used by district-level leaders when educators say they engage in data-driven practices?

Equally important is Ankeney's (2011) work that focused on two large urban school districts in the western United States. Both districts received awards 5 years in a row from the National Center for Urban School Transformation (NCUST), and neither had experienced superintendent turnover for a number of years. The researcher analyzed interview responses and documentation from each district on how they used data to inform instruction. Ankeney used responses to make programmatic changes and achieve self-labeled systemic reform. Accordingly, Ankeney examined how each school district leader used data to make decisions

with a primary focus on data used to increase student achievement, but not necessarily to make programmatic or budgetary decisions.

Ankeney (2011) supported Kerr, Marsh, Ikemoto, Darilek, and Barney (2006) concerning three urban school districts from the Institute for Learning (IFL). Kerr et al. focused on leadership practices, professional development, and district interventions based on their data-driven decision making model (DDDM). This focus showed a relationship between data-driven decision-making and supportive practices in professional development to sustain achievement. This work also addressed which data mattered in schools, but did not focus specifically on superintendents. Ankeney said as much, "The relative state of flux that characterized one school district's central office might lead to findings and comparisons that do not readily pertain to other urban school districts" (p. 12).

The Blueprint for Educational Reform

The DOE's (2010) *Blueprint for Reform* outlined the President's initiative to educate the nation's students by (a) ensuring students are college or career-ready, (b) providing highly qualified teachers and leaders in each school, (c) providing equality and opportunity for all students, (d) raising the bar and rewarding excellence, and (e) promoting innovation and continuous improvement. The blueprint expanded each of these factors by broadening their definitions and shaping the implementation practices that may be involved.

The Elementary and Secondary Education Act (ESEA) stipulated that all students graduate from high school without needing remedial classes or training before they enter the workforce or traditional college setting (DOE, 2010). This goal revitalizes the importance of college and career readiness standards as the benchmark for students and schools, and acts as the core reform of the reauthorization of the ESEA. This area also speaks to the current inadequate

training of the nation's high school graduates and calls on educators, patrons, and community members to follow the lead of state governors in challenging students to meet these standards by performing better on state assessments.

State assessment systems provide rigorous and fair accountability that align with college and career readiness standards at every level. Success on these assessments also fosters comparability and equity among students in different states. To drive home the importance of well-aligned state assessment systems, the government provides turn-around grants to help states meet the initiatives and turn around low-performing schools that do not meet these high performance standards. Formula grants, provided to districts, ensure effective teachers and leaders are developed to meet these high-stakes goals.

The ESEA blueprint also covers, in detail, the requirements of highly qualified teachers and leaders to ensure that every student has an effective teacher and a great principal (DOE, 2010; Schmoker, 2006). Specifically, the blueprint references research on effective teachers and their roles in closing the achievement gap among different groups of students. The ESEA document maintains that developing highly qualified teachers occurs through good recruiting, instructional teams, targeted professional development, and fair evaluation systems.

To meet the needs of diverse learners, the blueprint proposes support systems to improve programs for English language learners and boost innovation to meet the needs of students with disabilities. In this regard, formula grants address migrant, homeless, and neglected students to ensure that they also meet rigorous college and career readiness standards.

The blueprint concludes by providing access to a complete education for all students. Specifically, the proposal provides competitive grant funding for literacy and science, technology, engineering, and math (STEM) and, ultimately, ensures a well-rounded education

for all students. To achieve the goals listed in the blueprint, a pathway denotes a way for states to adopt common core standards and realign their funding and commitments to ensure that all students leave high school ready to enter a trade or college without additional coursework (DOE, 2010). The legislative body determines whether the blueprint for reform is the right direction for the country or whether it needs a new set of goals and practices to pick up where No Child Left Behind (NCLB) left off with the last administration.

Perceptions of Texas Superintendents

Research points to an increase in state accountability among public schools nationwide because of NCLB. The National School Public Relations Association (NSPRA) is concerned that using one form of high-stakes testing to make major decisions is not appropriate (Harris, Irons, & Crawford, 2006). Rather, the NSPRA believes that accountability would be more effective if school districts used a variety of assessments including standardized tests, portfolios, and student artifacts to assess achievement.

Harris et al. (2006) collected data from a stratified random sample of 1,026 Texas superintendents on their perceptions of NCLB standards and their use of assessment data. The survey was representative of national demographics of superintendents by gender and school setting (i.e., rural, suburban, and urban). Results suggested that superintendents from rural school districts perceived NCLB standards as curbing schools' effectiveness with advanced placement and multicultural programs. These superintendents also rated their use of assessment data more negatively than did suburban or urban superintendents.

Overall, the researchers found that superintendents felt powerless to oppose accountability requirements, but did not regret or oppose accountability. In general, superintendents' perceptions were neutral to negative on all survey items primarily because of

the (a) lack of funding to make accountability accessible, (b) lack of training to understand and report results, and (c) the rushed speed of implementation that caused more room for error and disrupted the educational environments in their districts and campuses. Because the superintendents surveyed represented multiple demographics across Texas, the results were representative of others in the state.

While not exhaustive, Harris et al.'s (2006) study pointed to the need for a more comprehensive method to make educational decisions. In other words, decisions based only on high-stakes testing are limited and offer educational leaders few options for effective improvement. In response to these limitations in current decision-making methods, researchers support the use of data warehouses that allow leaders to consider multiple data points, or factors, when making educational decisions that will affect the success or failure of today's students.

Education Reform using Data Warehousing as a Solution

Sherman (2008) examined education reform using data warehousing for test score gaps between African American and Caucasian students in Virginia public schools. The literature pointed to a small background in the evolution, goals, and consequences of NCLB legislation and its application in 12 Virginia school districts. Sherman noted that the Virginia Accountability Initiative (VAI), guided by the Virginia Standards of Learning (SOL), was significantly ahead of other states in providing accountability standards at the inception of NCLB; however, schools still lacked policies that dealt with the existing achievement gaps.

Sherman (2008) interviewed administrators using critical race theory (CRT) because of its legal foundation in working to transform racism and power. Because of the small sample size, the researcher could not generalize the findings to other populations. However, Sherman found that administrators were not opposed to higher accountability as much as they were

opposed to higher accountability standards among students in special education or English as a second language. One interviewed candidate said that the standards would make more sense if they were applied in the same way for other professions. The superintendent explained the statement as follows:

> We pass a law that says in the Congress of the United States 95% of the 150 attorneys have to win 100% of their cases, 95% of the doctors have to heal 100% of their patients, 95% of the business people have to create products that are 100% defect free. (p. 689)

The researcher observed that interview respondents were vehemently opposed to holding students with disabilities accountable because of the definition of the term *disability* used in pre-K-12th grade. Overall, Sherman (2008) found that administrators did not believe the NCLB legislation was an appropriate vehicle to eliminate test score gaps. The researcher also found that interviewees believed NCLB caused them to focus on achievement score gaps by subgroups using databases to disaggregate data.

Furthermore, Sherman found that NCLB legislation led to increased collaboration and professional development in each district researched. Based on these findings, he supported professional development for superintendents, administrators, and teachers to meet students at their levels and increase academic achievement. He also advocated for professional learning communities (PLCs) as the vehicle to open continuous dialogue that focuses on student achievement and begin making the changes necessary to close the achievement gap.

Penuel and Means (2011) reviewed the use of large-scale data warehouses in program evaluation among nonprofits and school districts. The researchers examined case studies in public schools, the National Longitudinal Study of Adolescent Health, and the Youth Data Archive. They found some trends in using large-scale data warehouses in each of these systems

but did not find common data queries requested by primary users of these data systems. Penuel and Means derived most of the importance of their study in using databases as resources to drive instruction and program evaluation. Specifically, the researchers cited the following uses of large-scale data warehouses: (a) highlight issues that need more attention and (b) establish the likelihood that policy or programs may need altering. These uses, in addition to the requirements from NCLB and the reauthorization of ESEA, justify the need for further study in this area.

In addition to the use of databases, Penuel and Means (2011) identified three significant advantages to using data warehouses: (a) most databases collect longitudinal data linked to program participation, (b) data are linked to other data warehouses, and (c) demand for data warehouses prompted a new support infrastructure for researchers and practitioners. The researchers were careful to point out that, although most data warehouses have parts of all three advantages, very few, if any, have all three to support their implementation.

The difficulty in implementing data warehouses on any scale involves the consistency of output variables that are most useful in each district and output variables that guide program evaluation effectively or increase student achievement. Because data warehouses can be complex and ambiguous, they need support in the form of professional development and interpretation to make the information useful or actionable. According to Penuel and Means (2011), data warehouses without this level of support are of little value. Because data warehouse developers want to reach practitioners and clinical users, specific supports, such as user-friendly web queries and data interpretation, may be necessary.

Penuel and Means (2011) also states that the availability of data is necessary, but not sufficient for improvement. They pointed out that an administrator's leadership ability in focusing on equity issues and using statistical processes (M-STAT) were the most important

keys to determining the types of data to examine and use to develop action plans. Administrators' selections of data are critical; therefore, researchers should focus efforts on determining the types of data that administrators have or would like to have to fuel their decisions.

The Education Data Collaborative (EDC) attempted to link research to practice in schools. Their seminal work indicated that two Texas school districts used the EDC dashboard and data warehouse to make academic and programmatic decisions. According to Byrd, Daggett, Silver, and Williams (2011), educators developed the EDC to link data systems with data-driven outcomes and predictions. The Texas comptroller's FAST report supported this work by grouping schools and districts by performance and state dollars spent. The comptroller's report responded to actions taken by the Texas legislature to reduce funding significantly in all districts in Texas for the 2011-2013 biennium budgets. This project was one of the first attempts at transparency between student outcomes and the cost of education in Texas. According to Byrd et al., "When the economic downturn began in 2008, data systems were also seen as a way to help schools cope with the financial crisis. In Texas, millions of dollars were spent trying to link, match, and merge data" (p. 1).

Daggett (2005) created an efficiency and effectiveness model that served as the theoretical core of his rigor and relevance framework research. The framework includes four quadrants based on the dichotomy of high effectiveness or performance versus high efficiency or low cost. Daggett analyzed school and district student achievement and budget data using a series of meta-analysis algorithms. He plotted the results on a continuum charted into one of the four quadrants, and used student performance and resources to determine potential savings by districts to reach optimal results. Byrd et al. (2011) found the following:

> Unfortunately, most existing data systems only supported focusing on state-level aligned assessment data for the purpose of accountability. Few schools and districts had implemented data systems designed as tools for classroom instruction, curriculum, and strong professional development in a real or near real-time data environment. (p. 3)

The EDC uses data derived from a data warehouse to provide "a single source of longitudinal data with user-friendly analytics of relevant real-time information" (Byrd et al., 2011, p. 3). Consequently, Byrd et al. found, "Collecting and analyzing state-level accountability data is important as an audit tool, but it has not helped identify pathways for schools to be both effective and efficient" (p. 3). First, Byrd et al. found that few districts monitored student growth to determine whether their interventions were effective. Second, the researchers found a link between their algorithms to determine student growth and teacher effectiveness. Third, they found that they could link budget expenditures with student performance using state and locally acquired data. The researchers also found that their model was "sustainable when a single data warehouse of all available data creates a longitudinal student record" (p. 7), and real-time or near real-time data gave campus and district administrators' opportunities to correct off-track behaviors.

The latest and most comprehensive attempt to create a statewide data warehouse with data dashboards was through the Texas Student Data System (TSDS). The TSDS provides a large-scale example of a data warehouse and data dashboards that all Texas school districts began using in 2013-2014. The dashboards incorporated in the TSDS are reflective of the data that administrators need to make the best decisions for student achievement and programmatic changes.

The TSDS is a large multi-layered, multi-year project funded by the Michael and Susan Dell Foundation and the Bill and Melinda Gates Foundation to help Texas public school districts, campus administrators, and teachers increase student achievement in pre-Kindergarten through 12th grade. In developing the TSDS, Young, Reddehase, Andrade, and Lambert-Lindley (2011) took a comprehensive look at previous peer-reviewed models, educational research, and consequential gaps to create more comprehensive data dashboards to inform instruction and efficiency in school districts across Texas.

Young et al. devised multi-phase implementations of the data warehouse prototypes and included reflective documentation that identified lessons learned with Prototypes 1 and 2 of the product implementation. The researchers also surveyed more than 2,600 educators across the state of Texas using focus groups to identify basic profiles of student information that should be included in any data warehouse and data dashboard. This work allowed them to identify multiple common indicators including contact information, student demographics, program participation, and historical course and assessment performance.

Young et al. (2011) found, "while most educators have access to student data, this data resides in a number of different places, and few educators have the time or resources to track down this information" (p. 3). To expand the TSDS student profile, Young et al. recommended the following data as valuable student information: cohort year; demographics; enrollment data; extracurricular activities; interventions received; previous schools attended; program participation including English as a second language (ESL), bilingual, career and technical education (CTE), and special education; special accommodations; 504 plan details, and student and parent contact details.

The study and prototype implementation of the TSDS led the researchers into other areas that yielded significant indicators for student achievement and intervention. Young et al. (2011) expanded the data dashboards to include the following factors: attendance and discipline; standardized tests by state; national and international sources; subject area course grades; reading level; benchmark assessments; value added growth measures; repeated courses; language assessments; advanced academics; graduation and promotion rates including elementary, middle, and high school; college readiness; postsecondary success; highly qualified and effective teachers; and school operations. These expanded data reporting dashboards enhanced the reports that educators could view to make decisions for students.

However, the focused input of superintendents and school boards on data components they felt necessary to make decisions for students, staff, and the community was not completely evident in TSDS Prototypes 1 or 2. Young et al. (2011) surveyed 693 school district administrators and superintendents; however, they did not delineate the number or type of administrators who answered these surveys versus administrators in general. Even less evident was the voices of school board members who act as public spokespersons and allocate district resources. The TSDS data warehouse and dashboards seem to be the most promising data source for additional study in surveying superintendents, campus administrators, and school board members concerning their perceptions on information that is most useful in directing districts' limited resources to affect the largest number of students.

Leadership Styles

A final component of this study was the notion that a principal's leadership style (i.e., transactional, transformational, and passive-avoidant) may affect the use of the data warehouse in decision-making. Here, I provide a more in-depth review. Peer-reviewed literature informed

each style as it pertained to school principals. Bass (1999) noted that no leader is purely transformational, transactional, or passive-avoidant. Instead, leaders may exhibit more of one style based on the situation. However, for this purpose of this review, I discuss each leadership style in isolation.

Transactional Leadership

Grounded in the practices of organizational leadership, transactional leadership deals with decision making because these leaders provide rewards for performance based on structured expectations and ideas. Pertaining to this study, transactional leaders receive data and information on staff performance based on tasks and expectations set for each employee. For example, benchmarking factors such as academic testing assesses performance of the teaching staff. Therefore, transactional leaders reward teachers who meet the established performance standards.

Wayman (2005) noted that NCLB spurred the need for teachers to use data in the classroom to more effectively to educate their students. Schools have stored data for years; however, principals have not used these data collectively to improve educational practice. Following NCLB, principals who followed a transactional leadership style took action because of the requirements of the legislation. Still, no collective effort was put forth to capture the many forms of data in one central location beyond what was required (Wayman, 2005).

Passive-Avoidant Leadership

Much like the transactional style, passive-avoidant leadership follows in the practices of organizational leadership. Principals that exhibit more of this laissez faire-type leadership style were motivated and pushed by NCLB (Wayman, 2005). These principals waited for digital

tools, such as data warehouses, before pursuing any action to address student achievement based on collected data.

Transformational Leadership

Principals who exhibit a transformational leadership style operate on research that suggests, "Data use may have a positive effect on the people involved in the educational process" (Wayman, 2005, p. 297). These principals stress that teachers are involved in data-based decision making and push for polices that urge all parties involved to ensure that students receive the most positive effects from the teachers' efforts. Additionally, transformational principals rebuff the idea that taking time to analyze data is too labor intensive and frustrating (Creemers & Reynolds, 1996). Principals with highly transformational leadership styles subscribe to the following nine principles of transformation:

1. Transformation is not synonymous with change.
2. Transformation requires assent to change.
3. Transformation always requires second-order change.
4. Transformation always involves all aspects of an individual's life.
5. Transformational change is irreversible.
6. Transformational change involves letting go of the myth of control.
7. Transformational change always involves some aspect of risk, fear, and loss.
8. Transformational change always involves broadening the scope of one's worldview.
9. Transformation is always a movement toward a greater integrity of identity; it is a movement toward wholeness. (Poutiatine, 2009, p. 192-193)

Transformational principals demonstrate the drive to do more than complete the task of educating students; therefore, they provide the need for data-based decisions using tools such as data warehouses.

The literature suggests that transformational leaders are the most open to using data warehouses. However, determining the effectiveness of a data warehouse to support educational decisions goes beyond data; it also includes the unpredictable nature of those responsible for data input and interpretation to drive decisions at all levels of education. Considering the dynamic nature of this problem, this study used the theoretical framework of complexity theory and the conceptual rigor and relevance framework.

Theoretical Framework

Complexity theory best fits the model for the current study because it uses the power of interrelated systems of general systems theory to determine how things work. Ludwig von Bertalanffy (1950), the father of general systems theory developed complexity theory, which, in relation to this study, examines patterns of self-organization (Pratt & Stringer, 2008). Theoretically, the current study examined how a closed system, the data warehouse, interacts with multiple open systems and the individuals who use those systems to affect the overall leadership in a school.

School principals and teachers are, by definition, open systems. Open systems are organic and cannot be predicted based on scientific cause and effect relationships. According to Bertalanffy (1950), general systems theory, which is the core of complexity theory, illustrates the interconnectedness between all sciences, and explains and addresses problems created by living and nonliving systems. In this study, computer science, in the form of a data warehouse,

connected living science via data warehouse users (i.e., principals) to explain and address the influence of leadership styles on academic achievement.

In contrast to open systems, closed systems are scientific by nature and provide highly predictable outcomes based on cause and effect relationships. The data warehouse is a compilation and reflection of the work that data entry clerks (open systems) enter into the system that yields state-generated data tables. Therefore, while a data warehouse is a closed system, the open system nature of those who manage it affects the data. Researchers can explain this relationship within the frameworks of complexity and chaos theories.

Complexity and chaos theories are mathematical models that originated from general systems theory to model the relationships between open and closed systems. Specifically, complexity theory is a form of scientific research that looks for patterns of self-organization (Pratt & Stringer, 2008). According to Pratt and Stringer (2008), "Complexity theory is one way to investigate webs of relationship patterns of connections and interplay of ideas without eliminating or starting over" (p. 135).

Chaos theory originated from meteorologist, Edward Lorenz, in 1960 after a failed weather report from his computer-generated dataset. Lorenz's computer program was supposed to generate a predictable weather report based on other data, but instead produced a wildly random dataset that led to further implications for his weather prediction, which he referred to as "the butterfly effect." Lorenz found that the data that were input into the computer, which he thought would give a predictable answer, gave a very unpredictable and chaotic result.

Data warehouses for schools should show predictable answers based on student achievement because of their mathematical foundations. However, in this study, the concept of chaos and complexity theories conceptually demonstrated the relationships between data that

should provide predictable results, but that actually produced unpredictable results in patterns of student achievement. Principals and their individual leadership styles are the unpredictable inputs that give rise to the need to apply chaos and complexity theories to understand this phenomenon. Figure 1 provides a conceptual visual of how complexity and chaos theories could inform the results of this study.

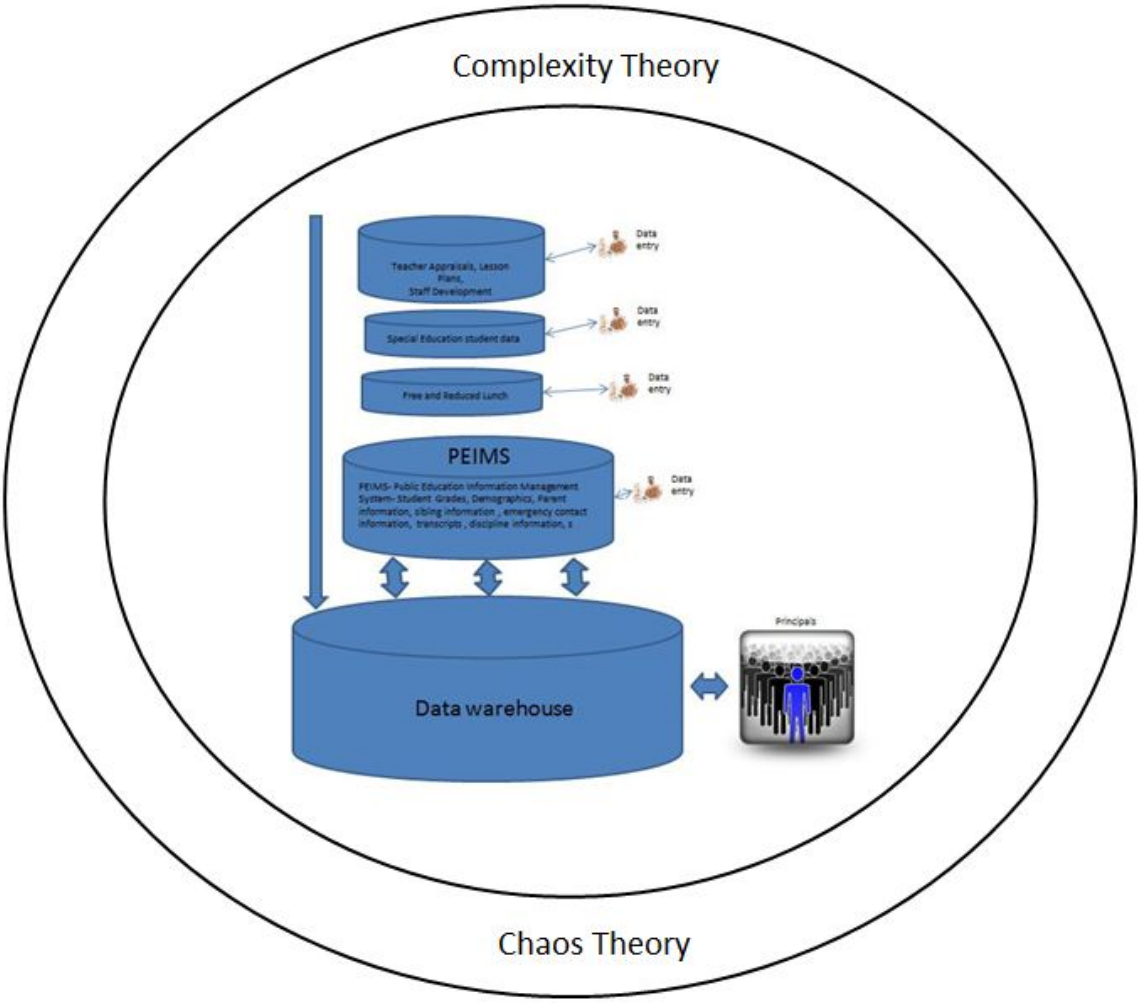

Figure 1. Graphical model of how complexity and chaos theories guide the work of the data warehouse.

Conceptual Framework

The Daggett (2005) designed the rigor and relevance framework, Bloom's taxonomy, to examine curriculum, assessment, and instruction. The knowledge taxonomy has six levels of

knowledge with the lowest level being acquisition and the highest level being assimilation. Bloom's taxonomy of educational objectives in the cognitive domain provides a cumulative hierarchy of a thinking framework to synthesize and evaluate decision-making processes.

Adding to this taxonomy, Daggett (2005) created the application model with five levels in ascending order: (1) knowledge in one discipline, (2) apply in one discipline, (3) apply across disciplines, (4) apply to real-world predictable situations, and (5) apply to real-world unpredictable situations. The model demonstrates how individuals use the knowledge they acquire. Concerning this model, Daggett stated, "while the low end is knowledge acquired for its own sake, the high end signifies action; use of that knowledge to solve complex real-world problems and to create projects, designs, and other works for use in real-world situations" (p. 1).

Daggett (2005) found the optimum framework by putting the knowledge taxonomy, the application model, and their individual components on opposing sides of a table. Both the knowledge taxonomy and application model present components on their respective sides of the table in ascending order from the lowest level of knowledge awareness and specific knowledge in a discipline to evaluation and application of that knowledge in real-world unpredictable situations. The table includes four specific and separate quadrants with varying levels of complexity based on their ascending letter value. Quadrant A is acquisition, Quadrant B is application, Quadrant C is assimilation, and Quadrant D is adaptation. According to Daggett, "Quadrants B and D represent the action or high degrees of application" (p. 2). The other quadrants (A and C) represent ascending levels of knowledge from simple recall to knowing how something works and evaluating its benefits and challenges (see Figure 2).

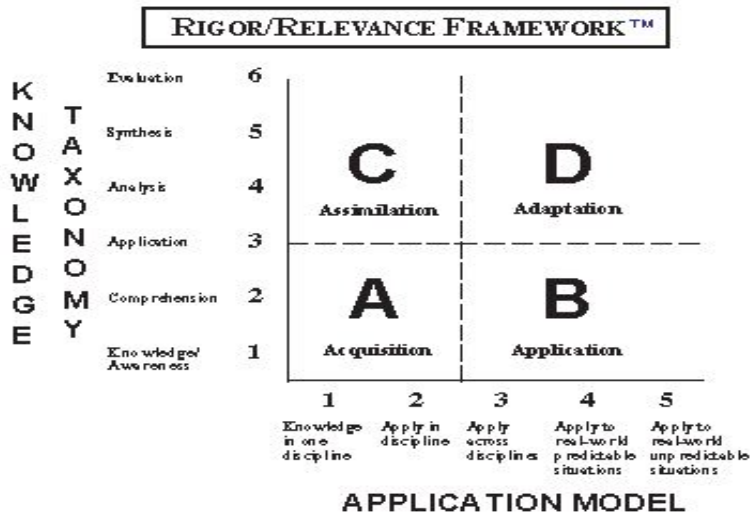

Figure 2. Graphical representation of the rigor and relevance framework (Daggett, 2005, p. 2).

In this framework, Daggett (2005) defined *academic rigor* as "learning in which students demonstrate a thorough, in-depth mastery of challenging tasks to develop cognitive skills through reflective thought, analysis, problem-solving, evaluation, or creativity" (p.4). The researcher used the knowledge taxonomy verb to determine the level of rigor based on where the verb fell within the list. Of note, each level of rigor requires a different level of thinking. Daggett (2005) proposed that "levels four through six require more complex thinking than levels one through three" (p. 4).

Furthermore, Daggett (2005) defined *relevance* as "learning in which students apply core knowledge, concepts, or skills to solve real-world problems" (p. 5). Thus, the application model helps plot the level of relevance of learning tasks, and users drive the model by applying the decision tree. The decision tree helps define the "desired level of expected student performance in application" (Daggett, 2005, p.5). This model applies to the current study as it provides a core to determine data usage as a driving factor in assessing student achievement. The limitations of this model occurred when the researcher added principals' leadership styles as factors that may affect student achievement to make decisions on instruction.

Summary

The professional literature is full of information on leadership styles of principals and other organizational leaders. The literature also captures the value of each leadership style in context to other styles and provides suggestions and implications for use on campuses. Likewise, the literature is supportive, and somewhat instructive, on data warehousing, data usage, and its importance in education. Peer-reviewed texts suggested a relationship between leadership styles and student performance and the use of data in real time to inform instruction at the lowest level possible as potential predictors of success in student achievement. However, this literature was not as expansive in terms of making connections between the effectiveness of particular leadership styles and the use of data warehouses to improve student achievement.

CHAPTER 3

MATERIALS AND METHODS

This study examined the leadership styles of Texas principals and their data usage in relation to student performance data on the Texas Assessment of Knowledge and Skills (TAKS). I used the Multifactor Leadership Questionnaire (MLQ-5x; Bass & Avolio, 2004) and the Principals' Data Driven Decision Making Survey (Byrd & Eddy, 2010) as data collection tools (see Figure 3). This chapter describes data collection, target population, research methodology, and data analysis.

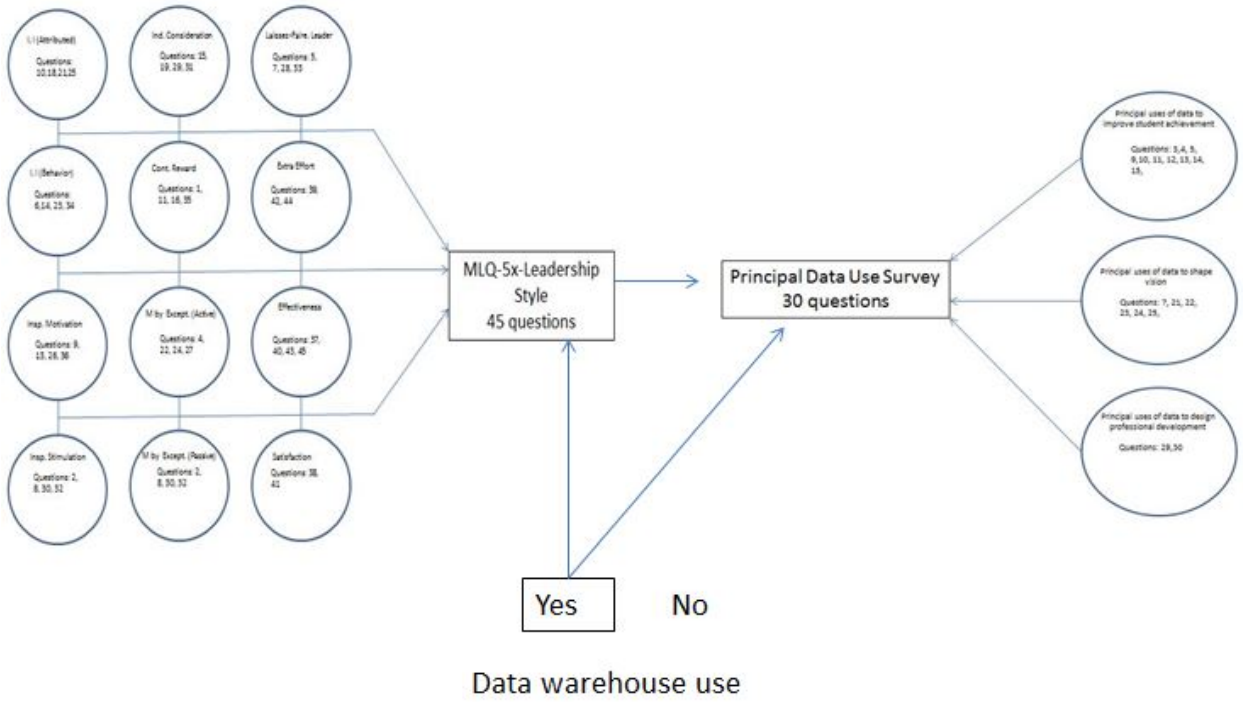

Figure 3. Graphical representation of the Principal Data Use Survey and MLQ-5x (Bass & Avolio, 2004; Byrd & Eddy, 2010).

Research Design

This study used a quantitative cross-sectional research design to examine principals' leadership styles and their perceptions of using data warehouses at a single point in time. The researcher used a quantitative approach to collect data on both surveys from a sample of Texas

principals who had access to or had used a data warehouse. Findings from this study serve to inform senior-level and campus leadership about leadership styles coupled with student achievement and data usage. This work also adds to the body of literature and knowledge about data warehousing and data-driven decision making in public schools.

Participants

The researcher administered surveys to a stratified random sample of 8,468 principals in Texas. The strata of principals included groupings of elementary, elementary/secondary, junior high, middle school, and high school. According to the Texas Education Agency (TEA, 2011), the state has 4,517 elementary principals, 815 elementary/secondary principals, 1,507 high school principals, 321 junior high principals, 1,295 middle school principals, and 13 labeled as other. The researcher calculated the sample size using a confidence interval of 5.48 with a confidence level of 95% ($p < .05$). The calculated sample size was 308 principals from the targeted population.

Sample selection included 1,248 school districts and charters schools in Texas. The researcher contacted principals from these school districts and asked 308 principals from the identified districts to participate in this study. The researcher expected that the sample population would reflect the demographic components in the state reporting tool for demographic information. The sample demographics included gender, ethnicity, and campus type.

The targeted population included all public and charter school principals in Texas who led campuses of students in pre-kindergarten through 12th grade. Student enrollment varied by campus type and location. Principals held at least a master's degree or higher. No distinction

was used to determine whether principals received their master's degree from a traditional (i.e., university campus) or alternative degree-issuing institution.

The sample selection included 1,248 school districts and charters schools in Texas. Of these school districts and charter schools, 200 (16.02%) unique districts participated in the study. The population included 8,468 public and charter school principals from Texas who received the two-part survey. Principals received digital copies of the IRB permission form as well as unique survey links that were associated to their personal email addresses. Principals could opt in or opt out of the survey. Principals who did not respond received emails requesting their participation one week following the initial participation emails. The survey response rate was 24.67%.

A stratified random sample of the population of campus principals made up the sample population. Of the 308 principals, 240 responded that they had a data warehouse. The sample included 58.3% women and 41.7% men as well as various ethnicities (see Table 1). Two participants opted not to answer the question on ethnicity. The majority of participants (n = 210; 68.6%) were Anglo, with Latino as the second highest group (n = 49; 16%). Participants who selected other (n = 6; 2%) or other, please specify (n = 7; 2.3%) were more than one ethnicity or did not choose one of the labeled ethnicities.

Type of campus varied across survey participants with the majority originating from elementary schools (n = 144; 46.8%). High schools had the second largest percentage (n = 60; 19.5%) of respondents, and middle schools (n = 53; 17.2%) followed closely behind. Survey participants who answered 'other' on the survey (n = 45; 14.6%) included principals from alternative schools, early childhood centers, junior high schools, K-12 schools, intermediate schools, ninth-grade centers, and juvenile justice alternative education sites.

Length of principal certification ranged from 0 to 34 years. The majority of the respondents (*n* = 105; 34.4%) had 6-10 years of experience as certified principals. The second largest group of respondents (*n* = 84; 27.4%) had 11-15 years of experience as certified principals.

The tenure of participants on their campuses as principals ranged from 1 to 25 years. There was no requirement for participation concerning time served on the same campus in the role of principal. The largest group of participants (*n* = 215; 70.2%) had been assigned to their campuses for 1-5 years. The second largest group (*n* = 66; 21.6%) had been assigned to the same campus for 6-10 years. Teaching experience ranged from 1 to 31 years. The majority of participants (*n* = 113; 38%) had 6-10 years of teaching experience prior to becoming principals (see Table 1).

Research Questions

The following research questions guided this study:

1. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision, and data use to design professional development) influence student achievement?
2. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision and data use to design professional development) vary by leadership style (in the areas of transformational.

Table 1

Principal Demographics

Demographic		N	%
Ethnicity			
	Anglo	210	68.6%
	African-American	27	8.8%
	Latino	49	16.0%
	Native American	3	1.0%
	Asian/Pacific Islander	4	1.3%
	Other	6	2.0%
	Other (please specify)	7	2.3%
	Total	306	99.8%
Campus Type			
	High School	60	19.5%
	Middle School	53	17.2%
	Elementary School	144	46.8%
	K-12	6	1.9%
	Other	45	14.6%
	Total	308	100.0%
Years Certified			
	1-5	56	18.2%
	6-10	105	34.4%
	11-15	84	27.4%
	16-20	37	12.0%
	21-25	18	6.0%
	26-30	4	1.2%
	31-35	2	0.6%
	Total	306	99.8%
Tenure			
	1-5	215	70.2%
	6-10	66	21.6%
	11-15	16	5.30%
	16-20	6	2.0%
	21-25	3	1.0%
	Total	306	99.8%
Teaching Experience (years)			
	1-5	70	23.0%
	6-10	113	38.0%
	11-15	72	25.0%
	16-20	31	10.0%
	21-25	14	5.0%
	26-30	2	1.0%
	Total	302	98.1%

Variables Examined

The researcher examined principals' uses of data warehouses as the independent variable and principals' leadership styles, perceptions of data warehouses, and student achievement scores as the dependent variables. Principals self-reported their perceptions of leadership styles, use of a data warehouse, and data warehouses in general. The researcher coded all personal information to mask participants' identities.

The researcher examined student achievement data from the TAKS to determine whether a relationship existed between the independent and dependent variables. The researcher obtained all information concerning student achievement scores from the TEA's publicly accessible website. The researcher divided principals by gender, ethnicity, and campus type.

Instrumentation

The researcher collected data using a two-part survey that consists of 75 questions. Part 1 of the survey, Principals' Data Driven Decision-Making Survey, is a 30-item questionnaire that aimed to examine principal data use (Byrd & Eddy, 2010). This instrument captured the dependent variable of principals' perception of data use.

For the purpose of the current study, I altered the instrument to incorporate Educational Leadership Constituent Council/National Council for the Accreditation of Teacher Education (ELCC/NCATE) leadership program standards (Rogers, 2011). The survey instrument comprised of 11 questions related to participant demographics and 19 questions related to data-driven decision making. The survey requested that participants self-report their levels of agreement in the following areas: (a) use of data to improve student achievement, (b) use of data to shape their campus' visions, and (c) used of data to plan professional development. Principals

rated their agreement or disagreement to each survey item using a 4-point Likert scale with a range of 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, and 4 = *strongly agree*.

Part 2 of the survey was the MLQ, which is a 45-item questionnaire that examines principals' leadership styles (Bass & Avolio, 2004). This instrument collected data on the independent variables as defined in this study as principals who use a data warehouse and principals who do not use a data warehouse. The MLQ-5X was designed to assess the leadership styles in the areas of transformational, transactional, and laissez-faire leadership (Avolio, 2005; Bass & Avolio, 2004). This instrument includes 45 items in which participants provide self-rated responses. Principals rated their agreement or disagreement with the survey items using a 4-point Likert scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, and 4 = *strongly agree*). The researcher analyzed data from both surveys to determine whether a correlation existed between principals' leadership styles, their use of data warehouses, and student achievement scores on the 2011 TAKS.

Data Analysis

Initially, data were collected through an online survey tool called Survey Monkey and transferred to an electronic spreadsheet that imported data into the IBM Statistical Package for the Social Sciences (SPSS). The researcher reviewed data for inaccurate entries, and categorized strata within the data to observe connections or differences between groupings. The survey captured univariate, bivariate, and multivariate data. Univariate analysis calculated the mean, median, mode, and standard deviation along with other continuous and categorical variables to determine averages of survey results, common factors in the survey responses, and how close or spread out the scores were in the survey data. The shape of the data determined whether transformations were required to complete the analysis.

The researcher conducted bivariate analysis for correlations using the Pearson product-moment correlation coefficient to determine the relationship of how closely survey results of principals' leadership styles and student achievement covaried. Researchers measure covariance from -1 for a perfect negative correlation, 0 for no correlation, to +1 for a perfect positive correlation. If variations among correlations existed, the researcher analyzed the data using a principal component analysis (PCA) to determine the strongest to weakest variations. The researcher conducted multivariate analysis using multiple regression to determine whether causal-comparative relationships existed between the independent (data warehouse usage) and dependent variables (principals' leadership styles and student achievement).

Ethical Considerations

This quantitative study followed the guidelines of the Institutional Review Board (IRB) of the University of North Texas (UNT). Each participant completed an independent online survey. The survey results from participants were anonymous and followed all written policies of UNT. Participants received consent forms that provided an overview of the study and requested their informed willingness to participate. The researcher gave each school district that provided access to their campus principals a copy of the study proposal.

Summary

The importance of data-based decisions in school districts is a constant theme discussed in every educational circle nationwide. However, the review of the literature failed to give any true direction on national or statewide guidelines to determine which data are important. The literature points to how data have been used in several districts and community organizations to increase performance; however, failed to provide exemplars of data gathering models that

promoting principals' leadership styles and data warehouse use with any consistency across organizations or school districts to increase student achievement.

The researcher considered principal leadership style in isolation throughout the literature and, in some cases, coupled with other factors. However, no research showed a connection to using principal leadership styles and data warehouse use to make informed decisions that result in positive student performance. The researcher reviewed the significance of school leaders and principals as data users with individual leadership styles, yet the literature offered no guidance in terms of benchmark expectations on the type of leaders needed to guide districts as they make program changes and other important decisions that drive student achievement.

CHAPTER 4

RESULTS

This study determined whether a correlation existed between the surveyed principals' leadership styles, as assessed by the Multifactor Leadership Questionnaire (MLQ-5x; Bass & Avolio, 2004); their use of real-time data in a data warehouse, as assessed by the Principals' Data Driven Decision Making Survey (Byrd & Eddy, 2010); and student achievement, as measured by scores on the Texas Assessment of Knowledge and Skills (TAKS). Schwab (2012) noted that to raise the competiveness of a nation, one must look toward the 12 pillars of the global competitive index (GCI), which serves as a framework to benchmark a country's progress against best practices in other countries. America can get ahead in education by focusing on three of the 12 pillars of the GCI. These pillars include primary education, technological readiness, and technology innovation. In line with these pillars is current NCLB legislation, which added requirements for principals to use data to improve school achievement. Chapter 1 offered a brief introduction to principals' leadership styles and the benefits of leadership style on performance.

Chapter 2 provided supporting literature to explain the three leadership styles (transformational, transactional, and passive-avoidant) and their effects on student achievement. Chapter 2 also discussed the importance of principals using data warehouses to increase student achievement. The theoretical framework for this study included complexity theory and chaos theory and their direct links to computers in data warehouses as theoretically predictable systems that sometimes produce unexpected student achievement results. Chapter 3 detailed the research methods used for the current study, specific data collected, and demographic profiles of the surveyed principals. Two research questions served as the focus of the data collection and analysis. Chapter 4 includes three major sections that report the descriptive, bivariate, and

multivariate results to answer the research questions. Each required some in depth exploration using tables, figures, and summary paragraphs to explain the results and other information that added relevancy to the research.

Research Questions

The following research questions guided this study:

1. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision, and data use to design professional development) influence student achievement?
2. Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision and data use to design professional development) vary by leadership style (in the areas of transformational

Descriptive Statistics

The majority of participants (n = 241; 78.8%) self-reported having access to a data warehouse (see Table 2). Of those surveyed, 65 (21.2%) self-reported that they did not have access to a data warehouse.

Table 2

Do You Have a Data Warehouse?

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	241	76.8	78.8	78.8
No	65	20.7	21.2	100.0
Total	306	97.5	100.0	

Table 3 displays the descriptive statistics of the 2010 and 2011 TAKS reading and math scores, as reported on the Texas Academic Excellence Indicator System (AEIS) report for all

campuses that reported having a data warehouse. The researcher did not separate these scores by campus type; rather, scores represent all campuses with data warehouses that participated in the study. The mean math score for participating campuses was .85 (n = 225, SD = .111) in 2010 and .85 (n = 229, SD =.103) in 2011. The mean reading score for participating campuses was .91 (n = 225, SD =.118) in 2010 and .85 (n = 231, SD =.068) in 2011.

Table 3

Descriptive Statistics of 2010-2011 TAKS Scores of Campuses with a Data Warehouse

	N	M	*SD*
Math 2010	225	.85	.111
Math 2011	229	.85	.103
Reading 2010	225	.91	.062
Reading 2011	231	.90	.068

Table 4 displays the descriptive statistics of the 2010 and 2011 TAKS reading and math scores, as reported on the Texas AEIS report for all campuses that reported that they did not have a data warehouse. The mean math score for participating campuses was .91 (n = 50, SD = .134) in 2010 and .86 (n = 54, SD = .106) in 2011. The mean reading score for campuses that did not have a data warehouse was .90 (n = 50, SD = .093) in 2010 and .91 (n = 54, SD =.062) in 2011.

Table 4

Descriptive Statistics of 2010-2011 TAKS Scores of Campuses without a Data Warehouse

	N	M	*SD*	Min	Max
Math 2010	50	.85	.134	0	1
Math 2011	54	.86	.106	1	1
Reading 2010	50	.90	.093	0	1
Reading 2011	54	.91	.062	1	1

Table 5 provides the descriptive statistics including means and standard deviations for all campuses in math and reading for 2010-2011. Also included are leadership style descriptives for each of the three styles and principals' data use. Mean scores for the TAKS math 2010-2011 showed little difference (.01). Mean scores for TAKS reading showed no difference (0). Transformational, transactional, and passive-avoidant leadership means were compared to mean scores in math and reading and yielded a difference of .78 between all three leadership styles.

Table 5

Descriptive Statistics for Math, Reading, Leadership Style, and Principal Data Use

	Mean	*SD*	N
Math TAKS 2011	.85	.10	285
Reading TAKS 2011	.90	.07	287
Math TAKS 2010	.84	.12	277
Reading TAKS 2010	.90	.07	277
Transformational Leadership	2.88	1.01	308
Transactional Leadership	2.10	.84	308
Passive-avoidant Leadership	2.48	.90	308
Data to Improve Student Achievement	2.65	.59	308
Data to Shape Vision	3.03	.85	308
Data to Design Professional Development	2.89	.81	308

Table 6 indicates the number of participants in each stratum sampled by campus. The category of other (n = 44; 14.3%) indicates participants who did not chose a campus type from those listed on the questionnaire. Elementary school (n = 144; 45.9%) had the largest number of participants. High school (n = 60; 19.5%) had the second largest number of participants followed by middle school/junior high (n = 53; 16.9%), and then K-12 (n = 7; 2.2%).

Table 6

Type of Campus

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other	44	14.0	14.3	14.3
	High School	60	19.1	19.5	33.8
	Middle School/ Jr. High	53	16.9	17.2	51.0
	Elementary School	144	45.9	46.8	97.7
	K-12 School	7	2.2	2.3	100.0
	Total	308	98.1	100.0	
Missing	System	6	1.9		
Total		314	100.0		

Table 7 reports the descriptive statistics for achievement scores by campus type for the 2010 and 2011 TAKS. The researcher did not collect student achievement scores after 2011 because the state of Texas changed its assessment to the State of Texas Assessment of Academic Readiness (STAAR) and had not reported those scores on the AEIS at the time of this study. The mean scores among high schools ranged from .92 (*SD* = .062) to .83 (*SD* = .122). The mean scores for middle and junior high schools ranged from .91 (*SD* = .055) to .87 (*SD* = .73). The mean scores for elementary schools ranged from .90 (*SD* = .081) to .84 (*SD* = .131). The mean scores for school self-labeled as other ranged from .90 (*SD* = .068) to .83 (*SD* = .119). K -12 schools, which accounted for the smallest sample population (*n* = 7), had mean scores from .90 (*SD* = .074) to .80 (*SD* = .116). The results do not include student gender or ethnic data.

Table 7

TAKS Math and Reading Scores by Campus Type

	Other			High School			Middle/Jr. High			Elementary School			K-12			Total		
	N	M	*SD*	N	M	*SD*	N	M	*SD*	N	M	*SD*	N	M	*SD*	N	M	*SD*
Math10	39	.83	.112	52	.85	.119	48	.87	.077	131	.84	.131	7	.80	.116	277	.84	.118
Math11	40	.83	.119	53	.83	.122	50	.87	.073	135	.86	.100	7	.81	.129	285	.85	.104
Reading10	39	.90	.068	52	.92	.062	48	.91	.055	131	.90	.081	7	.90	.079	277	.90	.072
Reading11	40	.89	.067	53	.91	.075	50	.90	.063	137	.90	.066	7	.90	.074	287	.90	.068

Table 8 reports the descriptive statistics of each leadership style based on the MLQ-5x questionnaire. This table also includes the data use totals from the Principals' Data Driven Decision Making Survey, which included principals' use of data to improve student achievement, to shape vision, and to design professional development. The mean score for participating campuses (n = 308) was 2.88 (SD = 1.01) for transformational leadership, 2.10 (SD = .84) for transactional leadership, and 2.48 (SD = .90) for passive-avoidant leadership. On the Principals' Data Driven Decision Making Survey, the mean score was 2.65 (SD = .59) for principals' use of data to improve student achievement, 3.03 (SD = .85) to shape vision, and 2.89 (SD =.81) to design professional development.

Table 8

MLQ-5x Questionnaire and Principals' Data Driven Decision Making Survey Mean Scores

	N	Mean	*SD*
Transformational Leadership	308	2.88	1.01
Transactional Leadership	308	2.10	.84
Passive-Avoidant Leadership	308	2.48	.90
Data use:			
To improve student achievement	308	2.65	.59
To shape vision	308	3.03	.85
To design professional development	308	2.89	.81

Table 9 reports the descriptive statistics for leadership styles and principals' data use based on whether schools had data warehouses. Results include the means and standard deviations in response to the following: "Do you have a data warehouse?" Among campuses with data warehouses (n = 241), the mean leadership score was 2.87 (SD = 1.01) for transformational leadership, 2.08 (SD = .85) for transactional leadership, and 2.49 (SD =.88) for passive-avoidant leadership. Among these campuses, the mean score for principals using data to

improve student achievement was 2.66 (*SD* = .52), to shape vision was 3.05 (*SD* = .82), and to design professional development was 2.91 (*SD* = .76).

Among campuses that did not have data warehouses (*n* = 65), the mean leadership score was 2.96 (*SD* = .97) for transformational leadership, 2.19 (*SD* = .79) for transactional leadership, and 2.42 (*SD* = .98) for passive-avoidant leadership. Among these campuses, the mean score for principals using data to improve student achievement was 2.66 (*SD* = .73), to shape vision was 2.99 (*SD* = .92), and to design professional development was 2.82 (*SD* = .90).

Table 9

MLQ-5x Questionnaire and Principals' Data Driven Decision Making Survey Mean Scores by Data Warehouse Use or Nonuse

Do You Have a Data Warehouse?		N	M	*SD*	Min	Max
Yes	Transformational Leadership	241	2.87	1.01	.00	4.00
	Transactional Leadership	241	2.08	.85	.00	3.75
	Passive-Avoidant Leadership	241	2.49	.88	.00	3.88
	Data to Improve Student Achievement	241	2.66	.52	.00	4.00
	Data to Shape Vision	241	3.05	.82	.00	6.50
	Data to Design Professional Development	241	2.91	.76	.00	4.00
No	Transformational Leadership	65	2.96	.97	.00	3.90
	Transactional Leadership	65	2.19	.79	.00	3.75
	Passive-Avoidant Leadership	65	2.42	.98	.00	3.78
	Data to Improve Student Achievement	65	2.66	.73	.00	4.00
	Data to Shape Vision	65	2.99	.92	.33	6.50
	Data to Design Professional Development	65	2.82	.90	.00	4.00
Other	Transformational Leadership	2	1.40	1.98	.00	2.80
	Transactional Leadership	2	1.19	1.68	.00	2.38
	Passive-Avoidant Leadership	2	2.46	.15	2.35	2.56
	Data to Improve Student Achievement	2	1.33	1.89	.00	2.67
	Data to Shape Vision	2	1.33	1.89	.00	2.67
	Data to Design Professional Development	2	1.50	2.12	.00	3.00

Bivariate Statistical Analysis

The bivariate statistics in this section cover correlations between variables on the survey and include TAKS math and reading 2010-2011, leadership styles, and principals' data use results. The researcher conducted a Pearson product-moment correlation to determine the correlational value of each statistic. Table 10 details the results of the Pearson's correlation between principals' leadership styles and data use.

For transformational leadership, the analysis yielded positive correlations between the following variables: transactional leadership ($r = .829$, $n = 308$, $p < .01$); principals' use of data to improve student achievement ($r = .143$, $n = 308$, $p = .012$); principals' use of data to shape vision ($r = .403$, $N = 308$, $p < .01$); and principals' use of data to design professional development ($r = .453$, $N = 308$, $p < .01$). For transactional leadership, the analysis yielded positive correlations between the following variables: principals' use of data to improve student achievement ($r = .190$, $N = 308$, $p = .001$); principals' use of data to shape vision ($r = .295$, $N = 308$, $p < .01$); and principals' use of data to design professional development ($r = .400$, $N = 308$, $p < .01$). No correlations existed between assessed variables and passive-avoidant leadership.

The analysis yielded a positive correlation between principals' use of data to improve student achievement and to shape vision ($r = .181$, $N = 308$, $p = .001$). A positive correlation existed between principals' use of data to shape vision and to design professional development ($r = .412$, $N = 308$, $p < .01$). Finally, a positive correlation existed between principals' use of data to design professional development and to improve student achievement ($r = .267$, $N = 308$, $p < .01$).

Table 10

Correlations of 2010-2011 TAKS Math and Reading, Leadership Styles, and Principals' Data Use

		1	2	3	4	5	6	7	8	9	10	11	12
Math TAKS 2011	1	1.00											
Reading TAKS 2011	2	.679**	1.00										
Math TAKS 2010	3	.875**	.615**	1.00									
Reading TAKS 2010	4	.622**	.795**	.733**	1.00								
Transformational Leadership	5	-.027	-.037	-.032	-.025	1.00							
Transactional Leadership	6	-.066	-.059	-.044	-.038	.829**	1.00						
Passive-avoidant Leadership	7	.056	.080	-.009	.023	.014	-.010	1.00					
Improve Student Achievement	8	.024	-.049	.062	-.038	.143*	.190**	-.015	1.00				
Data to Shape Vision	9	.096	.049	.072	.074	.403**	.295**	-.026	.181**	1.00			
Data to Design Professional Development	10	-.121*	-.083	-.106	-.042	.453**	.400**	-.033	.267**	.412**	1.00		
Do you have a data warehouse?	11	.033	.036	.001	-.044	.038	.052	-.031	.003	-.028	-.047	1.00	
Type of Campus	12	.101	-.008	-.006	-.051	-.017	-.048	-.061	-.012	.020	.093	-.070	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

In sum, a strong positive correlation existed between transformational leadership and transactional leadership. Additionally, moderate to small positive correlations exists between transformational leadership and principals' use of data to shape vision and to design professional development. Moderate to small positive correlations also existed between transactional leadership and principals' use of data to shape vision, and between principals' use of data to shape vision and to design professional development.

A Pearson product-moment correlation coefficient assessed the relationship between 2010-2011 TAKS math and reading scores of campuses without data warehouses. The analysis yielded positive correlations between TAKS math 2011 and TAKS reading 2011 ($r = .671$, $n = 54$, $p < .01$), TAKS math 2010 ($r = .864$, $n = 54$, $p < .01$), and TAKS reading 2010 ($r = .601$, $n = 54$, $p < .01$). The analysis yielded positive correlations for TAKS reading 2011 and TAKS math 2010 ($r = .601$, $n = 54$, $p < .01$) and TAKS reading 2010 ($r = .682$, $n = 54$, $p < .01$). Finally, the analysis yielded a positive correlation between TAKS math 2010 and TAKS reading 2010 ($r = .861$, $n = 50$, $p < .01$) (see Table 11).

A Pearson product-moment correlation coefficient also assessed the relationships between 2010-2011 TAKS math and reading scores of campuses with data warehouses. The analysis yielded positive correlations between TAKS math 2011 and TAKS reading 2011 ($r = .674$, $n = 229$, $p < .01$); TAKS math 2010 ($r = .886$, $n = 229$, $p < .01$); and reading 2010 ($r = .627$, $n = 229$, $p < .01$). Positive correlations also existed between TAKS reading 2011 and TAKS math 2010 ($r = .609$, $n = 231$, $p < .01$) and TAKS reading 2010 ($r = .853$, $n = 231$, $p < .01$). Finally, a positive correlation existed between TAKS math 2010 and TAKS reading 2010 ($r = .660$, $n = 50$, $p < .01$) (see Table 12).

Table 11

TAKS 2011-2010 Correlations of Campuses without a Data Warehouse

		1	2	3	4
Math 2011	1	1.00			
Reading 2011	2	.671**	1.00		
Math 2010	3	.864**	.601**	1.00	
Reading 2010	4	.616**	.682**	.861**	1.00
Do You Have a Data Warehouse?		54	54	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Table 12

TAKS 2011-2010 Math and Reading Correlations of Campuses with a Data Warehouse

		1	2	3	4
Math 2011	1	1.00			
Reading 2011	2	.674**	1.00		
Math 2010	3	.886**	.609**	1.00	
Reading 2010	4	.627**	.853**	.660**	1.00
Do You Have a Data Warehouse?		229	231	225	225

**. Correlation is significant at the 0.01 level (2-tailed).

A Pearson product-moment correlation coefficient was computed to assess the relationships between leadership styles and principals' data use to improve student achievement, to shape vision, and to design professional development. For campuses with a data warehouse, a positive correlation existed between transformational leadership and transactional leadership (r = .836, n = 243, p < .01); data use to shape vision (r = .342, n = 243, p < .01); and data use to design professional development (r = .405, n = 243, p < .01).

Transactional leadership was positively correlated with data use to improve student achievement (r = .146, n = 243, p < .01); data use to shape vision (r = .246, n = 243, p < .01), and data use to design professional development (r = .353, n = 243, p < .01). Data use to improve student achievement was positively correlated with data use to shape vision (r = .172, n

= 243, $p < .01$) and to design professional development ($r = .200$, $n = 243$, $p < .01$). Finally, the analysis yielded a positive correlation between data use to shape vision and data use to design professional development ($r = .366$, $n = 243$, $p < .01$).

Table 13 also presents the computed Pearson product-moment correlation coefficients for those campuses that did not have data warehouses in the categories of leadership style and principals' data use. Positive correlations existed between transformational and transactional leadership ($r = .797$, $n = 65$, $p < .01$); data use to improve student achievement ($r = .340$, $n = 65$, $p < .01$); data use to shape vision ($r = .635$, $n = 65$, $p < .01$); and data use to design professional development ($r = .638$, $n = 65$, $p < .01$).

The analysis also revealed positive correlations between transactional leadership and data use to improve student achievement ($r = .334$, $n = 65$, $p < .01$), data use to shape vision ($r = .488$, $n = 65$, $p < .01$), and data use to design professional development ($r = .587$, $n = 65$, $p < .01$). Data use to improve student achievement as positively correlated with data use to design professional development ($r = .435$, $n = 65$, $p < .01$). Finally, data use to shape vision was positively correlated with data use to design professional development ($r = .551$ $n = 65$, $p < .01$).

Multivariate Statistical Analysis

The researcher computed a regression for Research Question 1 to evaluate the relationship between principals' data use and student achievement. The grouping variable was campuses with or without data warehouses. Tables 14-16 detail the findings for campuses with data warehouses; the dependent variable was the 2011 TAKS math scores. The variables entered were gender and campus classification types (high school, middle/junior high school, elementary, and K-12). The variables entered for principals' indicated data use included to improve student achievement, to shape vision, and to design professional development.

Table 13

Correlation between Leadership Styles and Principal's Data Use Grouped by those with or without a Data Warehouse

Do You Have a Data Warehouse			1	2	3	4	5	6
Yes	Transformational Leadership	1	1.00					
	Transactional Leadership	2	.836**	1.00	-.028	.146*	.246**	.353**
	Passive-Avoidant	3	.016	-.028	1.00	-.030	-.057	-.032
	Data use to Improve Student Achievement	4	.079	.146*	-.030	1.00	.172**	.200**
	Data use to Shape Vision	5	.342**	.246**	-.057	.172**	1.00	.366**
	Data use to Design Professional Development	6	.405**	.353**	-.032	.200**	.366**	1.00
No	Transformational Leadership	1	1.00	.797**	.012	.340**	.635**	.638**
	Transactional Leadership	2	.797**	1.00	.065	.334**	.488**	.587**
	Passive-Avoidant	3	.012	.065	1.00	.022	.067	-.041
	Data use to Improve Student Achievement	4	.340**	.334**	.022	1.00	.208	.435**
	Data use to Shape Vision	5	.635**	.488**	.067	.208	1.00	.551**
	Data use to Design Professional Development	6	.638**	.587**	-.041	.435**	.551**	1.00

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The model explained 8.3% of the variance in the 2011 TAKS math scores (r^2 = .083, n = 228). Model fit was significant, $F(9,219) = 2.206$, p= .023, and the coefficients were examined. Principals' use of data to shape vision (p = .018) and principals' use of data to design professional development (p = .046) were significant. Additionally, elementary campus type was significant (p = .027).

Table 14

Model Summary for Campuses with Data Warehouses for TAKS Math 2011

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.288[b]	.083	.045	.101

Table 15

ANOVA for Campuses with Data Warehouses for TAKS Math 2011

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.203	9	.023	2.206	.023[c]
	Residual	2.236	219	.010		
	Total	2.439	228			

Table 16

Coefficients for Campuses with Data Warehouses for TAKS Math 2011

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	.827	.054		15.391	.000
	Gender	-.022	.015	-.104	-1.488	.138
	High school	.011	.024	.042	.457	.648
	Middle/ Junior high school	.044	.025	.155	1.751	.081
	Elementary school	.045	.020	.220	2.233	.027
	K12 school	-.018	.054	-.023	-.333	.739
	Data use to Improve Student Achievement	.005	.014	.025	.383	.702
	Data use to Shape Vision	.021	.009	.164	2.389	.018
	Data use to Design Professional Development	-.019	.009	-.137	-2.010	.046

Tables 17-19 detail the findings for campuses that did not have data warehouses; the dependent variable was 2011 TAKS math scores. The variables entered were gender and

campus classification type. The variables entered for principals' data use included to improve student achievement, to shape vision, and to design professional development. This finding explained 26% of the variance in 2011 TAKS math scores (r^2 = .258, n = 50). Model fit was not significant (p > .05); however, principals' use of data to design professional development was significant (p = .003). Model fit was also computed using math TAKS 2010, reading TAKS 2011, and reading TAKS 2010 using an ANOVA; no significance was found (p > .05).

Table 17

Model Summary for Campuses without Data Warehouses for TAKS Math 2011

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.508[b]	.258	.096	.102

Table 18

ANOVA for Campuses without Data Warehouses for TAKS Math 2011

ANOVA						
Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	.148	9	.016	1.587	.152[c]
	Residual	.425	41	.010		
	Total	.573	50			

The researcher computed a regression for Research Question 2 to evaluate the relationship between principals' data use and leadership style. The grouping variable was campuses that did or did not have data warehouses. Tables 20-22 detail the findings of campuses that had data warehouses on the dependent variable data use to shape vision. The variables entered were length of tenure on a campus, gender, and campus classification type. The variables entered for leadership style were transformational, transactional, and passive-avoidant.

The model explained 16% of the variance in data use to shape vision (r^2 = .16, n = 240). Model fit was significant, $F(9,231) = 4.882$, $p < .01$. The analysis of the coefficients revealed that length of tenure on a campus (p = .001) and transformational leadership ($p < .01$) were significant.

Table 19

Coefficients for Campuses without Data Warehouses for TAKS Math 2011

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	.875	.088		9.980	.000
	Gender	.020	.034	.093	.587	.560
	High school	-.004	.057	-.013	-.066	.948
	Middle/ Junior high school	.037	.048	.156	.769	.446
	Elementary school	-.023	.045	-.104	-.511	.612
	K12 school	-.104	.086	-.190	-1.203	.236
	Data use to Improve Student Achievement	.030	.023	.189	1.308	.198
	Data use to Shape Vision	.028	.023	.234	1.209	.234
	Data use to Design Professional Development	-.067	.022	-.541	-3.103	.003

Table 20

Model Summary for Campuses with Data Warehouses for Data Use to Shape Vision

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.400[b]	.160	.127	.7633

Table 21

ANOVA for Campuses with Data Warehouses for Data Use to Shape Vision

Model		ANOVA Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	25.602	9	2.845	4.882	.000[c]
	Residual	134.600	231	.583		
	Total	160.202	240		160.202	

Table 22

Coefficients of Campuses with Data Warehouses for Data Use to Shape Vision

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	*t*	Sig.
1	(Constant)	2.227	.307		7.254	.000
	Gender	-.032	.108	-.020	-.298	.766
	length of time on a campus	.048	.014	.216	3.505	.001
	High school	.097	.181	.047	.538	.591
	Middle/ Junior high school	.230	.188	.102	1.223	.223
	Elementary school	.066	.153	.040	.432	.666
	K12 school	.277	.409	.043	.678	.498
	Transformational Leadership	.369	.088	.458	4.175	.000
	Transactional Leadership	-.152	.105	-.158	-1.441	.151
	Passive-Avoidant Leadership	-.091	.057	-.098	-1.593	.112

Tables 23 and 24 detail the findings for those campuses that did not have data warehouses for the dependent variable of data use to shape vision. The variables entered were length of tenure on a campus, gender, and campus classification type. The variables entered for leadership style were transformational, transactional, and passive-avoidant. The model explained 61% of the variance in data use to shape vision (r^2 = .609, N = 61). Model fit was

significant, $F(9, 52) = 9.004$, $p < .01$. The analysis of the coefficients revealed that length of tenure on a campus ($p < .01$) and transformational leadership ($p < .01$) were significant.

Table 23

Model Summary for Campuses without Data Warehouses for Data Use to Shape Vision

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.780[b]	.609	.541	.6334

Table 24

ANOVA for Campuses without Data Warehouses for Data Use to Shape Vision

ANOVA						
Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	32.517	9	3.613	9.004	.000[c]
	Residual	20.865	52	.401		
	Total	53.382	61			

Table 25

Coefficients of Campuses without Data Warehouses for Data Use to Shape Vision

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	.154	.443		.348	.729
	Gender	.224	.189	.121	1.188	.240
	length of tenure on a campus	.070	.016	.387	4.303	.000
	High school	.199	.299	.085	.664	.509
	Middle/ Junior high school	-.236	.261	-.109	-.902	.371
	Elementary school	.167	.243	.085	.687	.495
	K12 school	-.514	.517	-.098	-.994	.325
	Transformational Leadership	.542	.143	.572	3.805	.000
	Transactional Leadership	.126	.177	.108	.711	.481
	Passive-Avoidant Leadership	.097	.089	.098	1.084	.284

Tables 26-28 detail the findings for campuses that had data warehouses for the dependent variable of data use to design professional development. The variables entered were length of tenure on a campus, gender, and campus classification type. The variables entered for leadership style were transformational, transactional, and passive-avoidant. The model explained 17% of the variance in data use to design professional development ($r^2 = .169$, $n = 240$). Model fit was significant, $F(9,231) = 5.237$, $p < .01$. The analysis of the coefficients revealed that transformational leadership was significant ($p = .001$).

Table 26

Model Summary for Campuses with Data Warehouses for the Data Use to Design Professional Development

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.412[b]	.169	.137	.7082

Table 27

ANOVA for Campuses with Data Warehouses for the Data Use to Design Professional Development

ANOVA						
Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	23.642	9	2.627	5.237	.000[c]
	Residual	115.864	231	.502		
	Total	139.506	240			

Table 28

Coefficients for Campuses with Data Warehouses for the Data Use to Design Professional Development

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	2.043	.285		7.175	.000
	Gender	-.021	.101	-.014	-.209	.835
	length of tenure on a campus	.016	.013	.079	1.297	.196
	High school	-.030	.168	-.016	-.181	.856
	Middle/ Junior high school	.199	.175	.095	1.141	.255
	Elementary school	.091	.142	.060	.643	.521
	K12 school	.630	.380	.106	1.659	.098
	Transformational Leadership	.266	.082	.354	3.248	.001
	Transactional Leadership	.038	.098	.042	.389	.697
	Passive-Avoidant Leadership	-.045	.053	-.052	-.853	.395

Tables 29-31 detail the findings for campuses that did not have data warehouses for the dependent variable of data use to design professional development. The variables entered were length of tenure on a campus, gender, and campus classification type. The variables entered for leadership style were transformational, transactional, and passive-avoidant. The model explained 41% of the variance in data use to design professional development ($r^2 = .409$, $n = 61$). Model fit was significant, $F(9,61) = 5.682$, $p < .01$. The analysis of the coefficients revealed that transformational leadership was significant ($p = .021$).

Table 29

Model Summary for Campuses without Data Warehouses for the Data Use to Design Professional Development

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.704[b]	.496	.409	.7044

Table 30

ANOVA for Campuses without Data Warehouses for the Data Use to Design Professional Development

ANOVA						
Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	25.375	9	2.819	5.682	.000[c]
	Residual	25.802	52	.496		
	Total	51.177	61			

Table 31

Coefficients for Campuses without Data Warehouses for the Data Use to Design Professional Development

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	.395	.493		.801	.427
	Gender	.175	.210	.096	.836	.407
	length of tenure on a campus	.017	.018	.099	.968	.338
	High school	.434	.332	.189	1.307	.197
	Middle/ Junior high school	.395	.291	.186	1.358	.180
	Elementary school	.460	.270	.239	1.702	.095
	K12 school	-.021	.575	-.004	-.037	.971
	Transformational Leadership	.378	.158	.406	2.383	.021
	Transactional Leadership	.344	.197	.301	1.746	.087
	Passive-Avoidant Leadership	-.056	.099	-.059	-.568	.572

CHAPTER 5

DISCUSSION

Chapter 5 summarizes the findings by research question as stated in Chapter 1. The researcher draws important inferences and relevant conclusions based on the data in terms of possible influences on research and practice. This chapter also presents recommendations for future research. Sample size played an important role in this research, and localized the findings to those participants who completed the survey.

Principals' leadership style, as assessed by the Multifactor Leadership Questionnaire (MLQ-5x), influenced their effectiveness on campus (Bass & Avolio, 2004). Principals' use of real-time data in data warehouses, as assessed by the Principals' Data Driven Decision Making Survey (Byrd & Eddy, 2010), provides a way for schools to address campus data use and the technological readiness and innovation pillars found in the global competitive index (GCI) report (Schwab, 2012). Student achievement, as measured on the Texas Assessment of Knowledge and Skills (TAKS) addresses the GCI pillar of primary education and the No Child Left Behind (NCLB) legislative mandate to ensure that all students receive a "world-class education" by 2020 (DOE, 2010, p. 1). However, it is not clear how principals' leadership styles coupled with their use of a data warehouse affect student achievement in Texas. This study determined whether a relationship existed between the surveyed principals' leadership styles, their use of real-time data in data warehouses, and student achievement scores as reported on Texas' Academic Excellence Indicator System (AEIS) for the 2010 and 2011 testing years.

The researcher used a quantitative research design to examine average test scores, data warehouse use, principals' leadership styles, and principals' data use. Variables included average test scores over a 2-year period on the state mandated assessment for reading and math.

The TAKS reading and math scores indicated student performance that aligned with NCLB requirements and were a part of the TAKS battery of tests that counted for overall student performance. The grouping variable for principals who completed the questionnaire was data warehouse use. The researcher assessed principals' leadership styles in the areas of transformational, transactional, and passive-avoidant (laissez-faire). Finally, principals' data use was assessed in the areas of data use to improve student achievement, to shape the schools vision, and to design professional development. The researcher assigned equal importance to the three areas to assess their connections with student achievement.

Results Related to Research Question 1

Research Question 1 was as follows: Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision, and data use to design professional development) influence student achievement? The researcher compared the results of the sample between each participant based on access to a data warehouse. The majority of participants (n = 241; 78.8%) self-reported having access to a data warehouse, with 65 participants (21.2%) who self-reported that they did not have access to data warehouses. The researcher did not provide participants with a formal definition of data warehouses. Additionally, participants received no instruction or information about data warehouses on the questionnaire. It is possible that some participants had different interpretations of the definition of data warehouses.

The types of campuses represented in the sample included high school, middle and junior high school, elementary, and K-12 school. The majority of participants were from elementary (n = 144; 46%), followed by high school (n = 60; 19%), and K-12 schools (n = 7; 2%). These campus types were proportionately representative of the population of principals in Texas.

Middle and junior high school principals (n = 53; 17%) were not proportionately representative of the population of principals in Texas.

Mean scores were calculated for TAKS reading and math across the campus for all students regardless of ethnicity, and no subpopulation scores were analyzed. Among campuses with data warehouses, the mean scores for the 2010 and 2011 TAKS math were .85 (SD = .111) and .85 (SD = .103), respectively. Among campuses without data warehouses, the mean scores for the 2010 and 2011 TAKS math were .86 (SD = .111) and .91 (SD=.103), respectively. As expected in the comparison of means ($p < .01$), very little difference existed between scores of campuses with and without data warehouses.

The lack of a significant difference points to the general push in Texas for all schools to perform well on state assessments. The 80%-89% mean value garnered from the campuses surveyed in math would earn each school a respectable state label of being a recognized school. If the mean percentage scores were between 90-100%, campuses would earn an exemplary rating, which is the highest rating in the state.

Among campuses with data warehouses, the mean scores for the 2010 and 2011 TAKS reading were .91 (SD = .062) and .90 (SD = .068), respectively. Among campuses without data warehouses, the mean scores for the 2010 and 2011 TAKS reading were .90 (SD = .093) and .91 (SD = .062), respectively. Again, as expected in the comparison of means ($p < .01$), very little difference existed between mean reading scores between campuses that did and did not have data warehouses.

The sample means for math and reading were very similar between participants, with a 5% difference between the two groups. The standard deviation showed a 4.1% difference between the two groups. A larger sample size may reveal differences in the mean score and

standard deviation. In any case, the results using a larger sample size would be more representative of the population of principals in Texas (Barker, 2002).

After examining the data for TAKS math and reading scores, the researcher computed a Pearson product-moment correlation coefficient. Figures 4 and 5 illustrate the shape of the data for 2010 ad 2011 TAKS reading and math mean scores, respectively. The shapes of the data in both scatterplots indicated the possibility of positive linear relationships between the variables.

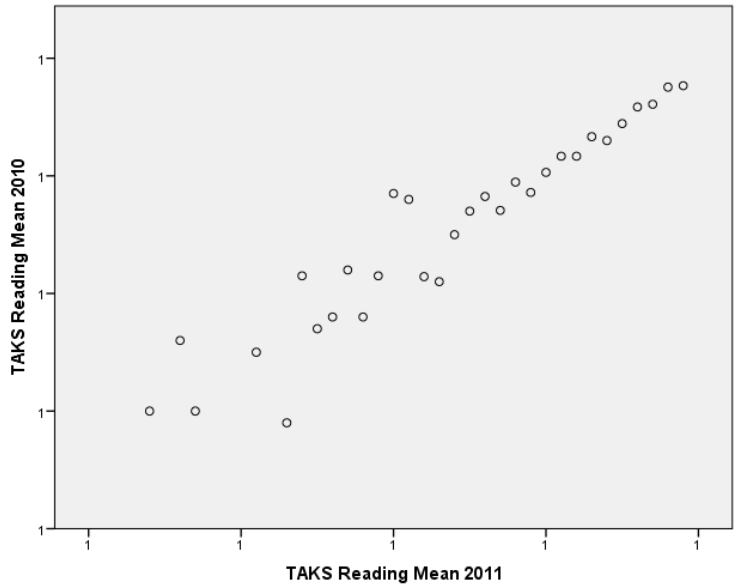

Figure 4. Scatterplot for 2010 and 2011 TAKS reading mean scores.

Both figures justify the statistical correlation test and illustrate the strength of the linear relationships in conjunction with their positive directions. The researcher examined the Pearson product-moment correlation coefficient at significance levels of $p \leq .01$ and $p \leq .05$. All correlations reported were at $p = .00$. The analysis yielded a positive relationship between all questionnaire respondents regardless of their self-designations as having or not having data warehouses. This finding supports Penuel and Means' (2011) finding that having a data warehouse, in and of itself, has very little value without the professional development needed or required to interpret the TAKS scores.

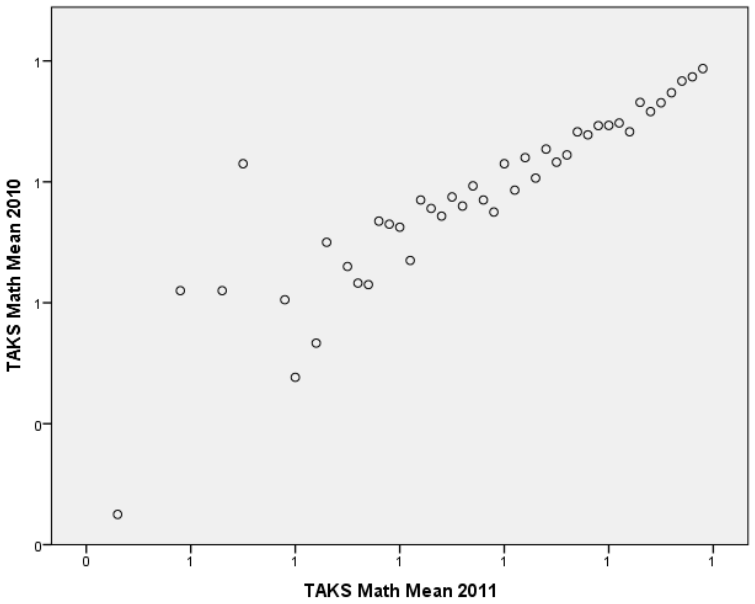

Figure 5. Scatterplot for 2010 and 2011 TAKS math mean scores.

Very strong positive linear relationships were found between TAKS math 2010 and TAKS math 2011 (r = .88), between TAKS reading 2010 and TAKS reading 2011 (r = .80), and between TAKS reading 2010 and TAKS math 2010 (r = .73). Strong positive relationships were seen between TAKS reading 2011 and TAKS math 2011 (r = .68); between TAKS math 2010 and TAKS reading 2011 (r = .62); and between TAKS reading 2010 and TAKS math 2011 (r = .62). It is important to note that random sampling used to gather data from the population might explain the very strong positive relationships between TAKS math 2010 and TAKS math 2011 and between TAKS reading 2010 and TAKS reading 2011. It is also important to note the strong positive correlations between TAKS reading 2010 and 2011 and TAKS math 2011, r = .68 and r = .62, respectively.

These high, positive linear correlations make sense after the centralized, focused push from federal and state governments some years ago required principals to examine their student achievement scores to obtain better results. Smoker (2006) said that schools could reduce the achievement gap dramatically if they acted on what they already know. What he did not offer

was strategies to focus on what they already know or how a data warehouse factors into focusing those data analysis efforts. The scores in this sample indicate that principals act on what they already know about their data regardless of their access to a data warehouse. The findings also support the need for additional professional development on interpreting the scores and the combination of data views within the data warehouse to see student achievement gains.

To further define the relationship and answer Research Question 1, the researcher computed multiple regressions. The regression model explained 8.3% of the variance in 2011 TAKS math, but not in the other assessments. Therefore, TAKS math 2011 was the only set of student achievement results that showed a significant relationship. The 2011 math TAKS results were regressed against the predictor variables of principal gender, campus type, and principals' data use. The regression findings in this case suggest that principals across the state continue to mature in their use of data to drive decisions.

Campuses with Data Warehouses

The results of student achievement scores on TAKS math and reading, when split between those with data warehouses (n = 231) and those without (n = 65) paralleled many of the results indicated in the overall samples for the Pearson product-moment correlation coefficient. A very strong positive linear relationship was found between TAKS math 2010 and TAKS math 2011 (r = .89), which paralleled the results of the overall study. Similarly, a very strong positive linear relationship was found between TAKS reading 2010 and TAKS reading 2011 (r = .85).

When those assessment scores were regressed against the predictor variables, TAKS math 2011 was the only set of student achievement scores that yielded a significant relationship. The most significant relationship was between data use to shape vision (p = .018) and 2011 TAKS math. Vitiello (2006) noted that principals shape the vision of their campuses, and those

who use the data warehouse to shape their visions realize positive effects in student outcomes. Additionally, the most significant relationship was between elementary campuses with data warehouses (p = .027) and 2011 TAKS math. Finally, the most significant relationship was between data use to shape professional development (p = .046) and 2011 TAKS math. This finding offers additional support of Penuel and Means' (2011) concept that professional development supports the use of a data warehouse and had the most significant effect on the 2011 TAKS math scores.

Campuses without Data Warehouses

The results of student achievement scores on TAKS math and reading at campuses without data warehouses (n = 54) paralleled those at the campuses with data warehouses. In this case, the small sample size may have contributed to the closeness between scores. A very strong positive linear relationship was found between TAKS math 2010 and TAKS math 2011 (r = .86), which paralleled the results of campuses with data warehouses, but with a .03 difference between the two types of campuses. However, the multiple regression revealed that the relationship to the model fit was not significant.

Results Related to Research Question 2

Research Question 2 was as follows: Does principals' data use (in the areas of data use to improve student achievement, data use to shape campus vision and data use to design professional development) vary by leadership style (in the areas of transformational leadership, transactional leadership, and passive-avoidant leadership)?

The researcher compared the results between each participant based on having or not having data warehouses. Results yielded that the majority of participants (n = 243; 78.9%) had a data warehouse, and 65 participants (21%) did not have data warehouses. Because the researcher

used the same participants to answer Research Questions 1 and 2, it is possible that participants had differing definitions of data warehouses, which may have affected their responses.

Participants were surveyed using questions from the MLQ 5x and the Principals' Data Driven Decision Making Survey to examine whether principals' leadership styles varied by their data use. The leadership style results were organized in subtotals in one of three leadership style categories (transformational, transactional, and passive-avoidant). Each leadership style yielded a scale score that measured respondents' self-assessed values of how much of a leadership trait they exhibited for each question. The Principals' Data Driven Decision Making Survey results were organized in subtotals on three data use categories (data use to improve student achievement, data use to shape vision, and data use to design professional development).

Mean scores were calculated for the MLQ-5x across all participants regardless of campus type. The researcher analyzed mean scores for campuses with and without data warehouses. Among campuses with data warehouses, the transformational leaderships mean was 2.87 (*SD* = .101), followed by 2.49 (*SD* = .88) for passive-avoidant leadership, and 2.08 (*SD* = .85) for transactional leadership. Among mean campuses without data warehouses, the transformational leaderships mean was 2.96 (*SD* = .97), followed by 2.42 (*SD*=.98) for passive-avoidant leadership, and 2.19 (*SD* = .79) for transactional leadership.

The analysis yielded a 9% mean score differences between those with data warehouses and those without data warehouses for transformational leadership, a 7% difference for passive-avoidant leadership, and an 11% difference for transactional leadership. Because participants self-rated their leadership styles, the findings may not have revealed a more aligned view of leadership style without the addition of other scoring methods. To ensure an accurate assessment of principals' leadership styles, research can include additional rater forms submitted by staff

members who work with the principal at various levels (e.g., superiors, colleagues, and subordinates) (Bass & Avolio, 2004). Mind Garden LLC owns the MLQ-5x, and charges fees for each participant; including more participants went beyond the scope and budget of this research. The information collected was valid for this research, but localized to those participants studied.

The researcher collected mean scores for the Principals' Data Driven Decision Making Survey across all participants regardless of campus type, and analyzed mean scores for campuses with and without data warehouses. Among mean scores for campuses with data warehouses, the mean for data to shape visions was 3.05 (*SD* = .82), followed by 2.91 (*SD* = .76) for data to design professional development, and 2.66 (*SD* = .52) for data to improve student achievement.

Among mean scores for campuses without data warehouses, the mean for data to shape visions was 2.99 (*SD* = .92), followed by 2.82 (*SD* = .90) for data to design professional development, and 2.66 (*SD* = .73) for data to improve student achievement. The connection between these two groups of datasets is noted primarily by the lowest mean score difference in the dataset that was noted by a zero difference calculation in mean scores for data use to improve student achievement, but a 21% difference in the standard deviation scores. The mean score differences between those with and without data warehouses were 6% for data use to shape vision and 9% for data use to design professional development.

The researcher examined the Pearson product-moment correlation coefficient at significance levels of $p \leq .01$ and $p \leq .05$. The analysis yielded one significant correlation between transformational and transactional leadership ($r = .829$; $p = .00$), which was very strong positive relationship. Bass and Avolio (1999) noted that transactional and transformational leaders have very similar characteristics. The results of this study solidify those statements.

Moderate to strong positive relationships existed between data to design professional development and transformational leadership (r = . 453; $p \leq .01$); data to design professional development and transactional leadership (r = .412; $p \leq .01$); data to shape vision and transformational leadership (r = .403; $p \leq .01$); and data to design professional development and transactional leadership (r = .400; $p \leq .01$).

The researcher computed a multiple regression to further define the relationship and answer Research Question 2. The results for data use to shape the campus vision and data use to design professional development were regressed against the predictor variables of principal gender, campus type, length of time on a campus, and leadership style.

Campuses with Data Warehouses

The results of principals' data use, coupled with principals' leadership styles, and split between those with data warehouses (n = 243) and those without data warehouses, paralleled many of the results indicated in the overall Pearson product-moment correlation results. The highest correlation was with the MLQ-5x questionnaire, which yielded a very strong positive relationship between transformational and transactional leadership (r = .836; $p \leq .01$). Bass and Avolio (1999) found that transactional leadership explained 69.8% of the variance of transformational leadership.

The correlation between the MLQ-5x and the Principals' Data Driven Decision Making Survey paralleled the study results, and revealed a strong positive relationship between data use to design professional development and transformational leadership (r = .405; $p \leq .01$). This result is interesting because using data to design professional development explained 16% of the variance in transformational leadership. Most principals in Texas, with data warehouses and who self-rated as transformational, would concur that they use data to design their professional

development. Moderate positive relationships were observed between data use to design professional development and data to shape vision (r = .366; $p \leq .01$); data use to shape vision and transactional leadership (r = .353; $p \leq .01$); and data use to shape vision and transformational leadership (r = .342; $p \leq .01$).

When assessment scores were regressed against the predictor variables, data use to shape the campus vision and data use to design professional development yielded significant relationships. Primarily, transformational leadership and data use to shape the campus vision were significantly related ($p < .01$). Additionally, the length of tenure of the campus principal was significantly related to data use to shape the campus vision (p =.001). Finally, a significant relationship was found between data use to design professional development and transformational leadership (p = .001).

Campuses without Data Warehouses

The results of principals' data use, coupled with principals' leadership styles, and split between those without a data warehouse (n = 65) paralleled the results of campuses with a data warehouse in some areas. As noted, the small sample size may have contributed to the closeness between scores. A very strong positive relationship was seen between transactional and transformational leadership (r = .797; $p \leq .01$). Additionally, the researcher observed strong positive relationships between data use to design professional development and transformational leadership (r = .638; $p \leq .01$); data use to shape vision and transformational leadership (r = .635; $p \leq .01$); data use to design professional development and transactional leadership (r = .587; $p \leq .01$); and data use to design professional development and data to shape vision (r = .551; $p \leq .01$).

Much like campuses with data warehouses, when the assessment scores were regressed against the predictor variables, data use to shape the campus vision and data use to design professional development were the only scores that yielded significant relationships. Chiefly, transformational leadership yielded a significant relationship to data use to shape the campus vision ($p < .01$). Furthermore, the length of tenure of the campus principal was significantly related to data use to shape the campus vision ($p < .01$).

Conclusion

For Research Question 1, the data partially supported data use, coupled with a data warehouse to influence student achievement scores among campuses where 2011 TAKS math scores were collected. Specifically, a significant positive relationship existed between data use to shape the campus vision, data use to shape professional development, and elementary campuses with data warehouses. The data did not support that data use, when coupled with a data warehouse, had an effect on student achievement scores on the 2010 TAKS math and 2010 and 2011 TAKS reading tests. The results of the study show that more focused professional development with principals in analyzing data to design campus visions could lead to gains in student achievement scores. Researchers should also analyze university partnerships with school districts, such as the initial work by the University of North Texas, in helping districts interpret data to determine whether stronger positive relationships exist with campuses that have data warehouses.

For Research Question 2, the data did not support the idea that principals' data use significantly varies by leadership style. Campus principals reported similar data use and leadership style regardless of whether their campuses had data warehouses. Data use to shape the campus vision and data use to design professional development yielded significant

relationships for campuses with and without data warehouses. Research Question 2 showed that more focused professional development in leadership style training and development could yield different results.

Future Research

Certain parts of this study merit further investigation. Although this study surveyed principals in Texas' public and charter schools, it may be useful to obtain a larger sample size with varying demographics (e.g., percentages of free and reduced lunch campuses) to increase the generalizability of the findings. While this study focused on TAKS scores for the 2010 and 2011 school years, it would be useful to complete this study using the new State of Texas Assessment of Academic Readiness (STAAR) exam scores to determine similarities in the results.

Data warehousing, coupled with data use and its effect on schools, is still in its infancy and requires more campus-level training, specifically, on the definition of data warehouses, on using data effectively to shape campus visions, and on designing professional development. Although regression was a proper test for these research questions, discriminant function analysis may be another way to statistically compare the classification of leadership styles and data use. Discriminant analysis results provide hit rate calculations by questionnaire items or categories that could provide more direction on specific data analysis techniques and help principals shape specific staff development to obtain better student achievement scores. To this end, future research should explore a series of best practice models for use with data warehouses in schools to determine how implemented best practices could affect overall student achievement.

APPENDIX

PERMISSION LETTER TO USE INSTRUMENT

mind garden

www.mindgarden.com

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material;

Instrument: *Multifactor Leadership Questionnaire*

Authors: *Bruce Avolio and Bernard Bass*

Copyright: *1995 by Bruce Avolio and Bernard Bass*

for his/her thesis research.

Five sample items from this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any other published material.

Sincerely,

Robert Most
Mind Garden, Inc.
www.mindgarden.com

MLQ Multifactor Leadership Questionnaire Rater Form (5x-Short)

Name of Leader: _____ Date: _____

Organization ID #: _____ Leader ID #: _____

This questionnaire is to describe the leadership style of the above-mentioned individual as you perceive it. Please answer all items on this answer sheet. **If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.** Please answer this questionnaire anonymously.

IMPORTANT (necessary for processing): Which best describes you?

___ I am at a higher organizational level than the person I am rating.
___ The person I am rating is at my organizational level.
___ I am at a lower organizational level than the person I am rating.
___ I do not wish my organizational level to be known.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits the person you are describing. Use the following rating scale:

Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
0	1	2	3	4

THE PERSON I AM RATING. . .

1.	Provides me with assistance in exchange for my efforts	0	1	2	3	4
2.	Re-examines critical assumptions to question whether they are appropriate	0	1	2	3	4
3.	Fails to interfere until problems become serious	0	1	2	3	4
4.	Focuses attention on irregularities, mistakes, exceptions, and deviations from standards	0	1	2	3	4
5.	Avoids getting involved when important issues arise	0	1	2	3	4

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