TEACHING IN A POST-STANDARDIZED TESTED WORLD:

PHYSICS AND CHEMISTRY TEACHERS' VOICES

by

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Dedication

This dissertation is dedicated to James and Mary Pearce. Thank you for always believing in me, even when I did not believe in myself. From volleyball games to summers in faraway lands, you have supported my dreams and desires. You have always been there for me no matter what and when things seemed impossible, you were the wind in my sails. Throughout my entire life, you have led by example and shown me how to love unconditionally. I am eternally grateful the Lord chose me to be your child.

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Chapter 1: Introduction

Educational reform, with a focus on improvement through assessment and system evaluation, is universal. In response to the global pressure to create and sustain an educated workforce, many countries including Canada, Great Britain, New Zealand, and the United States have implemented standardized testing to make schools, teachers, and students accountable for student learning (Lesko, 2001; Lipman, 2004; Te Riele, 2006; Thomson, 2002). Although the history of standardized testing in the United States is vast, albeit unique to each state, the passing of No Child Left Behind (NCLB) in 2001 unified all states under an umbrella of accountability (TEA, n.d.a.). This accountability impacted states with absentee standards and assessments. To receive federal funding, NCLB required every state to develop standards and administer standardized exams in basic mathematics and reading skills to students in grades 3-8. Many states expanded standardized testing to include social studies and science. In Texas, standardized exams were administered for social studies in grades 8, 10, and 11 and science in grades 5, 8, 10, and 11.

The purpose of NCLB was to hold the public school systems accountable for student learning; however, students were receiving differing degrees of education across the nation. For instance, Louisiana defined “proficiency” differently than Massachusetts, thus creating an unequal academic playing field for students across the United States. Efforts to rectify this issue by nationally standardizing education resulted in the establishment of the Common Core State Standards Initiative. Launched in 2009 by governors and other state leaders, this state-initiated program seeks to create a more uniform educational experience in English language arts and mathematics that improves preparation for college, career, and life goals (Common Core State Standards Initiative, n.d.). Since education falls within states’ rights, the federal government

cannot demand that states adopt Common Core; nonetheless, the vast majority of states in the nation have embraced the standards. As of September 2016, 42 states and five territories have adopted these standards (Common Core State Standards Initiative, n.d.).

The Texas legislature effectively prohibited Common Core State Standards from entering the Texas public school system by passing House Bill 462 in 2013 (TEA, n.d.b). The law, approved by an overwhelming vote of 140-2 in the House, also reinstated the Texas Essential Knowledge and Skills (TEKS) requirements for Texas school districts and educators. In the same year, the Texas legislature passed House Bill 5, decreasing the number of end-of-course (EOC) exams from 12 to five at the high school level (TEA, n.d.b). With this action, biology became the only standardized science exam administered to students in grades 9-12. Physics and chemistry courses were no longer tied to state exams or high-stakes testing graduation requirements.

Positionality

My 11-year career as an educator began in state tested subjects, and every subsequent year consisted of attempts to avoid teaching state tested subjects. When I graduated in December 2002, I was delighted to find my first job the very same day. January would be the beginning of a remarkable journey teaching 7th grade life science, 9th grade integrated physics and chemistry, and 11th grade chemistry. Going into my first day, I felt confident and prepared. I had a few courses under my belt from my alternative certification program, the content knowledge, and classroom management tips from my mother, a retired teacher. Her motto, “Don’t smile until Christmas…,” was altered to “Don’t smile until Easter…,” since I began teaching January 2003. By mid-afternoon on day one, my confidence was shattered. Teaching was NOT the cakewalk I had expected. I definitely was not prepared! Since the students had caused the former teacher to run for the hills, classroom management was always at the forefront of my mind. In addition, I

was learning how to navigate new grading and attendance systems and crafting three lesson plans per day to the specific guidelines set by the school. If I was not overwhelmed enough, the other teachers kept referring to this "TAKS thing" coming up in April. TAKS, the acronym for the Texas Assessment of Knowledge and Skills, was at the center of every teacher conversation. When I realized I needed to further my efforts for this new standardized test, I turned to my mother, but she was not privy of the TAKS. Therefore, I turned to the only other secondary science teacher who already had a full plate with four courses, coaching, and driving the school bus every morning and afternoon. In between her many duties, she took me under her wing, and I did everything she instructed me to do in an attempt to produce scores that would make my principal proud.

The following decade was punctuated with a couple of moves across the state. As I transitioned into different schools, I noticed that each school had its own testing culture and own method for test preparation. As the new teacher who didn't want to "rock the boat," I typically followed exactly what the science department deemed best testing preparation practices for their students. As a group, we did "what was best for kids," which meant, "get high scores." In some schools, this translated to mandatory, afterschool tutorial programs for those students on the "cusp" of passing and for others, it meant spending 20 minutes per day on test preparation.

With every passing year, I learned more from my colleagues about education and my role as an educator. After a few years, I finally found rhythm and had more time for self-reflection. My reflection and worth as an educator seemed to center around standardized test scores. For fellow teachers and myself, these exams were the focal point of every action and seemed to label who we were as educators. Good test scores equated a good teacher and vice versa. As an educator, the idea of standardized testing created an internal struggle. The benefit of

hypothetically leveling the playing field and having all students learn the same material was enticing; however, the stress and pressure of standardized testing was overwhelming for my students and me.

My interest in standardized testing peaked in the summer of 2013 when news spread like wildfire that the state removed the EOC exams for chemistry and physics courses. Visions of science teachers doing cartwheels down the halls immediately entered my head. Physics and chemistry teachers felt overjoyed, displaying their excitement all over social media. The realist in me deliberated how long the bliss would last. I questioned the level of change in the environment, teachers, and students. I was curious how much the curriculum would relax and if courses would still sufficiently prepare students for college. Would students care as much about subjects that did not accompany a state exam? Was there going to be an immediate surge of passion for science with the removal of the four-letter word (test)? Would teachers still collaborate and analyze data? Would data even matter anymore? Would life really be better for all? These curiosities ignited the passion that would eventually fuel my research questions.

Statement of Purpose

Since the inception of the standardized exam, educators have expressed concerns that preparing for and "teaching to the test" limits the creativity of teachers and steals the fun from learning. Many studies report that teachers feel pressure to change teaching methods and behavior (Avdeniz & Southerland, 2012; Deci, Spegiel, Ryan, Koestner, & Kaufman, 1982; Flink, Boggiano, & Barrett, 1990; Kauffman, Johnson, Kardos, Liu, & Peske, 2002), including reduction of curricular content and discontinuation of activities such as skits, games, science experiments, creative activities, and recess (Barksdale-Ladd & Thomas, 2000). Consequently, frustrations surface as educators spend the majority of their time coaching students on test-taking

skills and teaching a curriculum based on an assessment instead of on content they believe is relevant to the lives of their students (Johnson, Kardos, Kauffman, Liu, & Donaldson, 2004; Kauffman et al., 2002; Tye & O'Brien, 2002). In a study utilizing the CLASS (Classroom Assessment Scoring System) instrument, Plank and Condliffe (2013) reported that classroom quality actually decreased as the pressure of test performance increased.

Due to the numerous studies citing negative effects of standardized testing on teachers and students, popular opinion has grown increasingly opposed to standardized testing. Movements to "opt out" are gaining popularity, and the idea of fewer standardized exams in states throughout the nation is becoming a reality. In Texas, physics and chemistry teachers are now living this reality. The purpose of this research is to examine teachers' perspectives about teaching a state tested subject versus a state non-tested subject.

Research Questions

The following questions drive this research. When high-stakes testing ceases in high school science classes:

what happens to teacher perceptions of administrative support?

what happens to teacher perceptions of student demeanor?

what happens to teacher perceptions of the curriculum?

what happens to teacher perceptions of their instructional practices?

Significance of the Study

Texas is one of the first states to decrease the number of standardized exams administered to students. Without the restrictions imposed by high-stakes testing, educators in subjects no longer state tested may now have the freedom and ability to foster a love for their subject area within their students. This research will examine the changes, or lack of changes, in the post-

standardized tested classroom. To date, no studies have examined Texas high school science teachers' perceptions of change or lack of change in their classrooms due to the transition from teaching a state tested to a state non-tested subject.

Definitions of Key Terminology

Clarification of key terminology is necessary to fully understand the following research. For this study, the following definitions are used.

Adequate Yearly Progress (AYP)

A measurement defined by the No Child Left Behind Act that allows the United States Department of Education to assess the academic performance of every public school and school district in the country according to standardized testing results.

Alternative certification program

A program that offers a nontraditional route to teacher certification. Many of these programs allow people to teach while completing the requirements. Requirements are typically attained at a much faster pace than certification acquired through a university bachelor's program.

Bybee's 5E learning cycle

A research-based, instructional design model proposed by Roger Bybee that incorporates 5Es of instruction: engage, explore, explain, elaborate, and evaluate.

Campus administrator

A person who works in elementary, middle, or high schools whose duties include managing and assisting teachers.

Central administrator

A person who has executive oversight and supervision of every school in a school district. Includes the superintendent, assistant superintendents, and curriculum coordinators.

Common Core State Standards Initiative

An educational initiative in the United States that specifies knowledge that K-12 students should acquire in English language arts and mathematics. The objective of the initiative is to establish consistent educational standards across the country and to ensure students are more prepared to achieve college, work, and life goals.

Criterion-referenced exam

Tests that compare an examinee's performance to a predefined set standard.

Curriculum

The topics, materials, and assessments comprising a course in a school. In Texas, the Texas Essential Knowledge and Skills (TEKS) create a list of topics that teachers must cover during a course.

End-of-Course (EOC) exams

Standardized exams that students must pass to graduate from a Texas public high school. Students who entered the ninth grade in the 2011-2012 school year or later must pass the following five exams: English I, English II, Algebra I, U. S. history, and biology (also known as STAAR end-of-course exams).

Elementary and Secondary Act (ESEA)

A statute that funds primary and secondary education. Passed as part of President Johnson's "War on Poverty," the act also emphasizes equal access to education and aimed to

decrease the achievement gap between students by providing fair and equal opportunities to all children.

Every Student Succeeds Act (ESSA)

The reauthorization of the 1965 Elementary and Secondary Education Act. This law was signed on December 2015 and replaced the No Child Left Behind Act. The ESSA retains the annual standardized testing requirements created by No Child Left Behind; however, it shifts accountability from the federal to state level.

High-stakes testing

A test is high-stakes when a school uses the achieved score to make decisions regarding grade promotion or high school graduation.

No Child Left Behind (NCLB)

A reauthorization of the Elementary and Secondary Education Act of 1965. Signed into law by President George W. Bush in 2002, this act increased the federal role in the accountability of student learning. The law mandated that all states would utilize standards and annually test students in grades 3-8 in the areas of English language arts and mathematics.

On-level course

A course that generally adheres to the minimal required curriculum (also known as a "regular" class).

Opting-out

Refusing to take government-mandated standardized exams. To show adequate yearly progress (AYP), states must test 95% of eligible students. Therefore, states that allow opt-out may not meet AYP. In Texas, students are not allowed to opt-out. Students that are absent on the day the standardized exams are administered will be required to take the test at a later date.

Professional development

Specialized training, formal education, or advanced professional learning aimed to equip educators with the professional knowledge and skills necessary to enable student success.

Science composite certification

A teaching certification that allows the holder to teach multiple sciences. For example, a person who acquires an 8-12 science composite certification may teach any science from grades 8-12.

Standardized test

A uniform test for each subject or grade level administered and scored in a consistent manner. The federal government under the Every Student Succeeds Act currently mandates these tests in order for states to receive federal funding.

State of Texas Assessments of Academic Readiness (STAAR)

State-mandated standardized exams used in Texas public primary and secondary schools to assess student achievement in each grade level or subject area.

State tested subject

A subject tested on a state standardized exam. Texas students typically take the exam at the end of April or beginning of May.

State non-tested subject

A subject that is not covered on a state standardized exam.

Texas Essential Knowledge and Skills (TEKS)

State standards for Texas public schools from kindergarten to year 12.

Title I

A section of the Elementary and Secondary Education Act that provides financial assistance to schools with high numbers or high percentages of students from low-income families.

Trimester

A scheduling system comprised of three semesters: fall, winter, and spring. Each course consists of two semesters, totaling 24 of 36 weeks.

Chapter 2: Literature Review

To thoroughly understand the significance of the study and the associated implications, it is necessary to be well versed in many educational areas. The following literature review focuses on: 1) the evolution of assessment policy in the United States with an emphasis on the state of Texas, 2) the impact of testing, and 3) effective science instructional practices as deemed by the research community.

The Evolution of Assessment Policy

In 1845, Horace Mann, the Father of the Common School, persuaded the Boston Public School system to administer formal written exams in place of traditional oral exams (Gallagher, 2003). The common written exams assessed student knowledge, thus indirectly providing objective information about the quality of teaching and learning in Boston schools. By identifying educators with the highest scores and replicating their instructional practices, Mann aimed to improve education for more students throughout the public school system. In addition to examining best teaching practices, the educational pioneer used the common assessment to monitor the quality of instruction and compare schools and teachers (Gallagher, 2003). Mann viewed the common exam as a means to create equal opportunities for all children. Ironically, the educational goals of the mid-19th century mirror the goals of the existing educational system.

Unlike Mann's common exam, the first widely adopted standardized exams measured ability instead of achievement. Upon mandating universal education in France, Binet's test of intelligence was created to identify "slow" children for placement in special education programs (Walsh & Betz, 1995). In World War I, the Army's Alpha and Beta exams helped determine soldiers' job classifications and leadership potential (Hanson, 1993). The previous examples

demonstrate that the establishment of standardized testing is based upon the needs of the human race during a specific time and place.

Standardized testing programs with accountability measures for improved student learning have been implemented across the globe with the ultimate purpose of creating and maintaining a competitive, educated populace (Lesko, 2001; Lipman, 2004; Te Riele, 2006; Thomson, 2002). Prior to 2001, the intensity and frequency of standardized testing in the United States varied by state. The passing of No Child Left Behind of 2001 (NCLB) unified all states under the same accountability measures in an attempt to equalize the playing field for all students in the nation.

The Foundation of NCLB (1950s - 1980s)

NCLB, a collaborative product of civil rights groups, business groups, Congress, and President George W. Bush's administration, seemed contemporary at the time of introduction; however, principles of this law date back to the five separate court cases designated as *Brown v. Board of Education of Topeka* (1954). In this court case, the Supreme Court ruled that even if facilities were equivalent between black and white schools, racial segregation was "inherently unequal," violating the equal protection clause of the Fourteenth Amendment (Hope, 1975). This ruling outlawed racial segregation in the public school system.

The decade following the court case was tinted with racial tensions and massive resistance in the South until the enactment of the Civil Rights Act of 1964. The dire consequences of terminated funding forced most schools to oblige, making the South the most integrated region in the nation by the 1970s (Orfield, Monfort, & Aaron, 1989). Although desegregation led to an increase in achievement for African American students (Coleman et al., 1966; Denmark, 1970; Lunemann, 1973; Stallings, 1959; Sullivan, 1968), Lyndon B. Johnson

recognized the disparity still present in the school system. As part of his "War on Poverty," the Elementary and Secondary Education Act (ESEA), a law responsible for funding primary and secondary schools, emphasized equal opportunities in education and the establishment of high standards and accountability measures. *Title I,* a subsection of the bill, specifically addressed the achievement of disadvantaged children by supplying additional school funding in an attempt to close the achievement gap in reading, writing, and arithmetic. ESEA has been reauthorized approximately every five years since its inception by the federal government.

The end of the 1960s was punctuated with the creation of the National Assessment of Education Progress (NAEP). Described as the "Nation's Report Card," NAEP reported data on student group performance regionally and expanded for national comparisons by the 1980s. For the first time, schools and officials could view and compare academic achievement across the board (National Assessment of Educational Progress, n.d.).

The 1980s proved to be a tumultuous time period for education. In 1983, the National Commission on Excellence in Education released *A Nation at Risk*, a report on the quality of education in private and public schools, colleges, and universities in the United States. The document highlighted areas in desperate need of reform and sternly warned that mediocrity present in the school system threatened the future of the nation and society (National Commission on Excellence in Education, 1983). The alarming report placed education as a top priority for all stakeholders, especially politicians, educators, and parents.

The 1990s

The news of *A Nation at Risk* spread rapidly throughout the nation; however the problems presented were not addressed until 1989 when President George H. W. Bush convened an education summit with 49 governors and his cabinet. At the meeting, an agreement was reached

to establish national education goals (Office of Elementary and Secondary Education, 1998). The Goals 2000: Educate America Act, considered the precursor to NCLB, was eventually signed into law by President Bill Clinton in March 1994. Goals 2000 was based on the premise of goal-oriented education, creating an agenda to measure student progress, provide support to struggling students, and to implement superior academic standards. The goals of the act stated that by the year 2000:

- the high school graduation rate would increase to at least 90%
- all United States children will begin school ready to learn
- students leaving grades 4, 8, and 12 will demonstrate proficiency in areas such as English, science, foreign language, government, economics, art, mathematics, history, and geography
- United States students will be first in the world in mathematics and science
- every adult will be literate and capable to compete in a global economy
- all schools will be free of violence, drugs, and unauthorized firearms
- every school will foster partnerships that increase parent involvement and encourage the emotional, social, and academic development of students
- educators will have access to programs that hone their skills and opportunities to expand knowledge necessary to instruct and prepare students for the future

(Stedman, 1994)

In addition to Goals 2000, the Improving America's School Act (IASA) of 1994 reauthorized ESEA. The combined legislation focused on targeting the improvement of students with special needs and commanded all states to have content and performance standards, assessments aligned with those standards every three years, and an accountability system in

charge of identifying low-performing schools (Redfield & Sheinker, 2004). Although the act demanded more from the educational systems, the federal government gave additional control to the state and school districts to create and maneuver their own federally funded programs. Unfortunately, by the year 2000, none of the eight listed goals from Goals 2000 were met; however, 48 states and two territories had developed content standards and approximately half of those states had also finalized student performance standards (Jorgensen & Hoffmann, 2003).

The 2000s

Leading into the 21st century, states took aggressive action to advance the education quality for all students; however, the reoccurring theme of disparity and inequality continued to exist. In 2001, Congress reauthorized the ESEA, making substantial adjustments and amendments. Amended as the No Child Left Behind Act of 2001, this legislation proposed by President George W. Bush, promoted standards-based educational reform with an underlying theme of high standards and measurable goals through assessment. In addition to stronger accountability, the act also promoted increased flexibility and local control, more options for parents, and an emphasis on effective instructional teaching practices (Jorgensen & Hoffmann, 2003). The expectation was "to see every child in America—regardless of ethnicity, income, or background—achieve high standards" (United States Department of Education, 2003, p. 3) by closing the achievement gap, and thus, leaving no child behind. The bill passed with bipartisan support and was signed into law on January 8, 2002.

Stipulations of NCLB

To receive federal funding, NCLB required every state to create and administer standardized assessments in basic skills of mathematics and reading in grades 3-8. The act allowed states to develop their own standards; however, the federal role was expanded, requiring

enhanced teacher qualifications and annual academic progress reports. To ensure students were receiving a quality education, NCLB required school systems to hire "highly qualified" teachers. The federal government allowed the state to decide what criterion deemed a teacher highly qualified. In Texas, a teacher was considered highly qualified if he or she had obtained full Texas teacher certification, held a minimum of a bachelor's degree, and demonstrated subject matter competency in the area they taught (Texas Education Agency, n.d.a).

In addition to hiring highly qualified teachers, the federal government required schools that received *Title I* funding through the ESEA to demonstrate Adequate Yearly Progress (AYP). AYP objectives were created by the states, with the following requirements:

- must have a goal of proficiency for all students within 12 years (2013-14 school year)
- measurable objectives for improved achievement
- AYP is based predominately on state assessments, but may also include an additional academic indicator
- must establish measurable goals for improved achievement by all students and by subgroups: economically disadvantaged, English language learners, and students with disabilities
- AYP results are reported by the above subgroup of students to determine whether each subpopulation met the AYP objective
- at least 95% of each group must take the state standardized exam
- states may combine up to three years of data in determining if AYP objectives were met
- AYP is assessed at the school level. Schools that failed to meet AYP objectives consecutively for two years are labeled as needing improvement

(Linn, Baker, & Betebenner, 2002)

The AYP system is still utilized today under ESSA. When a school does not exhibit AYP, redemptive measures are taken. The school must first develop a two-year improvement plan for the specific subject that did not meet AYP objectives. During this time, students may transfer to a higher-performing school within the district. If the school does not meet AYP objectives in the third consecutive year, the school must offer supplemental education services and free tutoring to failing students. Four consecutive years of missing AYP targets causes a school to be labeled "corrective action." With this label, dramatic measures are taken including, but not limited to, new curriculum, extension of the school day, or replacement of staff. If a school still cannot meet AYP by year five, it will begin to create a restructuring plan, which will be implemented in the sixth year of failure. The restructuring plan may include closing the school, transforming the school into a charter school, allowing a private company to manage the school, or allowing the state education office access to manage the school directly (Dillon & Rotherham, 2007).

Race to the Top

The Race to the Top initiative, created by the Obama administration in 2009, is an existing incentive program for educational reform. The competitive grant, funded as part of the American Recovery and Reinvestment Act of 2009, rewards states with points for fulfilling educational goals such as teacher and principal performance-based evaluations, utilization of data-based systems to inform student progress and instructional practices, adopting rigorous standards and assessments, and the redemption of poorly performing schools (The White House, n.d.).

Based on a grand total of 500 points, Race to the Top encouraged several states to adjust policies, increasing probabilities of additional federal funding. This funding program is a major

contributing factor in the massive adoption of Common Core State Standards. As of April 2016, the grant program has awarded $4 billion to 19 states that have implemented plans addressing the educational goals of Race to the Top (The White House, n.d.). The state of Texas currently does not participate in this initiative.

Every Student Succeeds Act

Signed by President Obama in December 2015, the Every Student Succeeds Act (ESSA) reauthorized the 50-year-old ESEA and replaced NCLB. Passed with bipartisan support in both chambers of Congress, the act retains the annual standardized testing requirements and AYP system stipulated by NCLB, yet narrows the federal government's role in education. Teachers no longer have to be highly qualified to teach in the public school system. In addition, states are able to set their own academic goals and must consider additional factors, other than test scores, when doing school evaluations. In addition, ESSA requires states to acquire input from parents and guardians regarding state education plans, including areas such as standards and improvement.

Common Core State Standards Initiative

Under ESSA, the federal government can no longer "encourage" states to participate in the Common Core State Standards Initiative. Launched in 2009, this state-led program is sponsored by the National Governors Association and the Council of Chief State School Officers. The main objective of the initiative is to create a more uniform, quality educational experience for students throughout the country that improves preparation for college, career, and life goals (Common Core State Standards Initiative, n.d.). Prior to 2009, proficiency looked different in every state. This imbalance hindered many students from states with lower standards. Rectifying this lack of standardization is a major objective of the Common Core State Standards

Initiative. The federal government cannot require states to adopt Common Core; however, 42 states and five territories have adopted the standards. Out of the remaining opposed states, three withdrew from the program and four never opted into the Common Core program (Common Core State Standards Initiative, n.d.).

Common Core State Standards were prohibited in the Texas public school system on June 10, 2013 when Governor Rick Perry signed House Bill 462 (Texas Education Agency, n.d.b). The law forbid the adoption of the Common Core State Standards by the State Board of Education and prolonged the Texas Essential Knowledge and Skills (TEKS) requirements for Texas school districts and educators.

Although the TEKS were utilized in Texas prior to the creation of Common Core State Standards, there is no denying that the Common Core and the TEKS are very similar, even overlapping in many areas. Both initiatives have K-12 standards and college- and career-readiness standards, and although Texas is not technically participating in Common Core, the Texas school system utilizes materials that align with the Common Core standards. This provides an advantage to Texas students academically because national college preparation exams, such as the Advanced Placement (AP), SAT, and ACT, are being aligned with Common Core standards.

Texas Science Education Policy and Accountability

Texas began the era of accountability in 1979 with the implementation of the Texas Assessment of Basic Skill (TABS), which was administered in grades 3, 5, and 9 (see Appendix A). The exam covered reading, writing, and mathematics, and although students did not have to pass the ninth-grade exam for graduation, they still had to take the exam until they passed or graduated from high school. Since grade promotion occurred regardless of test performance and

high school graduation was not in jeopardy based on test scores, the exams were not considered "high-stakes." These exams started in the fall of 1980 (see Table 1) and the results were published in 1983. The launch of high-stakes accountability for large-scale assessment in Texas began once the campus and district results became public knowledge (Cruse & Twing, 2000).

Table 1

Timeline of Administered Texas Standardized Assessments

Texas Assessment of Basic Skills (TABS)	1980-1985
Texas Educational Assessment of Minimum Skills (TEAMS)	1986-1989
Texas Assessment of Academic Skills (TAAS)	1990-2002
Texas Assessment of Knowledge and Skills (TAKS)	2003-2011
State of Texas Assessment of Academic Readiness (STAAR)	2012-current

TABS continued until 1985 when it was replaced with the Texas Educational Assessment of Minimum Skills (TEAMS). This test was administered every other year from grades 1 through 11 in the areas of reading, writing, and mathematics. For the first time, students were required to pass the exams for high school graduation. The state of Texas decided students needed to acquire more than "basic skills" and increased academic standards by incorporating the Texas Assessment of Academic Skills (TAAS) in schools across the state from 1990-2002. From 1990-1993, the test assessed students in grades 3, 5, 7, 9 and 11 in three areas: reading, writing, and mathematics. In 1993, the administration of the TAAS was moved to the spring, and the assessed grades and subjects were adjusted. Students in grades 3-8 and 10 were then assessed in reading and mathematics. Students in grades 4, 8, and 10 were assessed in writing. In addition to writing, students in eighth grade were also assessed in science and social studies. Passing the exit level

(grade 10) exams in reading, writing, and mathematics were a requirement for graduation. Throughout the "TAAS era," additional exams were created to assist students in fulfilling graduation requirements. In 1994, a biology end-of-course assessment was administered to students who completed the course at the end of the fall semester. From 1995-2002, content-based, end-of-course exams in Algebra I and biology were offered and in 1998, English II and U.S. history end-of-course exams were also added. The administration of end-of-course exams came to a halt with the introduction of the Texas Assessment of Knowledge and Skills.

Although already created by the time NCLB was enacted, the Texas Assessment of Knowledge and Skills (TAKS) complied with every part of the new national legislation. This criterion-referenced test was utilized from 2003-2009 and was meant to put an end to social promotion, although there were many loopholes. The TAKS was the first exam based on the new state standards, the Texas Essential Knowledge and Skills (TEKS). It was mandatory for teachers to teach every standard in their subject area, and for the first time in Texas history, science and social studies joined mathematics and English language arts as subjects linked to high school graduation requirements. During TAKS, students in grades 3-8 were assessed in mathematics and reading. Grades 4 and 7 were assessed in writing, and grade 5 and 8 in science. Grade 8 was also assessed in social studies, bringing the total number of assessments for eighth graders to four. Stipulations regarding grade promotion also arouse for many students (see Table 2).

Table 2

TAKS Linked to Grade Promotion

Grade 3	Reading
Grade 5	Reading, Mathematics
Grade 8	Reading, Mathematics

The TAKS assessed students in science for grades 5, 8, 10, and 11. While the fifth and eighth grade exam focused primarily on topics covered that school year, the TAKS in grades 10 and 11 were an accumulation of biology, chemistry, and physics concepts. This proved challenging for teachers specialized in one subject area. For instance, a tenth grade biology teacher would have to find the time and resources to review students over chemistry and physics concepts supposedly taught in junior high school. Unfortunately, many of the concepts were new to both students and teachers.

In the spring of 2007, Senate Bill 1031 repealed and replaced TAKS with End of Course (EOC) exams once again in Texas high schools (Texas Education Agency, n.d.c). Students in all grades would continue to take TAKS until the 2011-2012 school year. Beginning that school year, students entering the ninth grade would be administered twelve EOC exams over their high school career. Three EOC exams were given for each core subject: English, mathematics, science, and social studies. The science EOC exams were biology, chemistry, and physics. In addition to the exam, a portion of a student's average for the course being state tested was adjusted based on his or her EOC exam performance.

TAKS was officially replaced with the State of Texas Assessments of Academic Readiness (STAAR) during the 2011-2012 school year. Like its predecessor, the STAAR was a criterion-referenced test that complied with all the provisions of NCLB. Although considered more challenging than TAKS, STAAR replaced TAKS with ease in grades 3-8. However, once the EOC exams were implemented in grades 9-12, parental backlash over student anxiety relating to the number of state assessments created problems for policymakers in Austin. House Bill 5, passed by the Texas Legislature in 2013, decreased the number of EOC exams from 12 to five at the high school level (TEA, n.d.b). Currently, biology is the only state-mandated science

standardized exam administered in grades 9-12; however, other STAAR science exams are administered in grades 5 and 8.

Science Assessment and Reform

As shown throughout the history of assessment, the emphasis on reading and mathematics for accountability has far exceeded the attention given to science. With the exception of a brief stint in the 1950s when Russia defeated the United States in the space race (Van den Akker, 1998), the significance of science in education was vastly overlooked in the 20th century.

In the beginning of the 2000s, the STEM (science-technology-engineering-mathematics) initiative created a resurgence of the importance of science in education. STEM, an acronym initially used in debates to address concerns of a technologically, unqualified populace, incorporated multiple subject areas into an integrated curriculum. With the popularity of STEM in schools, the acronym has been altered many times to STEAM, STREM, STREAM, STEMM, and STEAM to incorporate additional subjects such as art, robotics, multimedia, and medicine. Although efforts across the country have been made to incorporate STEM or an altered version of STEM into the public school system, the realities are still very disheartening as few people have a deep understanding of science.

The Programme for International Student Assessment (PISA), known for its ability to assess literacy in areas of knowledge and skills needed in everyday life, found that the United States student population is scientifically illiterate (Hassard, 2012). Despite monetary funding from the National Science Foundation and reform documents such as *Science for All Americans* (Rutherford & Ahlgren, 1990), *Benchmarks for Science Literacy* (American Association for the Advancement of Science, 1993), the *National Science Education Standards* (National Research

Council, 1996), and *A Framework for K-12 Science Education* (National Research Council, 2012), science continues to take a backseat to reading, writing, and mathematics. In a 2006 study, Renter et al. discovered that schools were diminishing the amount of science and social studies instruction because these subject areas did not accompany a high-stakes test. Unfortunately, the "it's only important if it is tested" mentality exists in every part of our testing culture; therefore, the impacts of testing, both positive and negative, cannot be ignored.

Impact of Testing

Positive Effects of High-Stakes Testing

Media coverage and searches in the literature associated with standardized testing typically emphasize the negative effects of assessment on children and teachers; however, studies that have positive views and outcomes of this form of evaluation do exist. Proponents of standardized testing will argue that utilization of high-stakes testing increases standards, holds public schools accountable for meeting these standards, and enhances the stakeholder's confidence in the public school system (Heubert & Hauser, 1999). In many states, the implementation of standardized testing alone has increased the quality and amount of professional development for teachers (Cizek, 2001; McMillan, 2005; Stecher, 2002), led to alignment of instruction with state content standards (Stecher, 2002; Yeh, 2005), increased student motivation to learn (Roderick & Engel, 2001; Stecher, 2002; Walker, 2000), and provided more remediation opportunities for students (Barnes, 2005; Walker, 2000).

Implementation of improvement strategies. With the enactment of high-stakes testing, schools are more apt to pinpoint areas of weakness in test results. These highlighted areas, available to public view, often prompt schools to refocus their investment of resources and efforts into areas that most need them. This "refocusing" redirects resources towards a subject

area, topics within that subject, or a subset of children in need of assistance. Since the teacher is the heart of the classroom, the changing focus often comes in the form of professional development. Prior to the stakes being raised, professional development was often indifferent towards results and not empirically based (Cizek, 2001). In the 1990s, teachers often knew little about standardized assessment due to lack of assessment training (Impara & Plake, 1996; O'Sullivan & Chalnick, 1991; Stiggins; 1999). In 2001, the introduction of high-stakes testing throughout the nation caused an entire paradigm shift among the educational system, and professional development received a facelift. With graduation rates and school ratings in jeopardy, many school districts turned to professional development as a remedy for low scores. Professional development in the new era of high-stakes testing is "curriculum relevant and results oriented" (Cizek, 2001, p. 23). Researchers have identified high-stakes testing as the catalyst for more focused teacher professional development (Cizek, 2001; McMillan, 2005; Stecher, 2002). These professional development opportunities not only keep teachers abreast of standardized testing information, they also introduce innovative, quality teaching pedagogy that is aligned with state standards in each subject area, including science.

Data-informed decisions aligned to standards. Many studies have reported the positive effects of high-stakes testing on instruction. To ensure student mastery of essential content and skills needed to pass the exam, teachers are coerced to improve alignment of their instruction with state content standards (Stecher, 2002; Yeh, 2005). In addition to making educators more aware of student outcomes, Ohio teachers reported that high-stakes testing caused the school system to identify weaknesses in the curriculum and align curriculum between grade levels (DeBard & Kubow, 2002). Buck, Ritter, Jensen, and Rose (2010) found that teachers believed that standardized testing provided useful data, created a roadmap for the year's instruction, did

not decrease creativity in the classroom, and led to collaboration among teachers. In a study consisting of 722 K-12 educators, McMillan (2005) reported increased collaboration among teachers and that most teachers used testing data to make instructional and assessment decisions, promoting higher cognitive skills and deepened learning. These findings echo those of Cizek (2001), who revealed that high-stakes testing has the ability to increase focus on higher-order thinking and depth of understanding.

Au (2007) suggested that the structure of the standardized exam could influence teacher instructional practices. When high-stakes tests focused more on writing than social studies content knowledge, tenth grade teachers responded by expanding the curriculum to incorporate literacy instruction (Vogler, 2002). Educators in Minnesota reported that well-designed standardized exams did not affect their pedagogy because the exams did not require drill and remote memorization skills (Yeh, 2005). These well-designed exams supplied educators with the information necessary to identify areas for instructional improvement and individual student weaknesses.

Diagnoses of weaknesses and remediation opportunities. With student test results affecting school ratings and the public's view on the quality of teaching, failure is no longer an option. Schools across the nation have implemented systems to identify student weaknesses and created programs to ensure students are successful on the high-stakes exam. Many of these support programs include remediation and failure prevention programs for low-achieving students (Barnes, 2005; Walker, 2000). In fact, Roderick and Engel (2001) discovered that students, especially those with a history of failure, reported that high-stakes testing had prompted their teachers to focus more attention towards them. This additional effort motivates teacher and student to work towards a common goal.

Student motivation. Typically, attaining goals is considered a positive measure in one's life. Whether it's on the basketball court or a science classroom, students are often motivated extrinsically by accolades. Motivation theory claims that students will be motivated to achieve a goal if they value the goal and consider the goal to be attainable (Ames, 1992). Intense preparation resulting in an acceptable or exemplary performance on a standardized test is no different. Researchers have found that attaching consequences to test scores, such as grade promotion or graduation, encourages students to put more effort towards their courses (Barnes, 2005; Roderick & Engel, 2001; Stecher, 2002; Walker, 2000). In a study of 102 low-achieving student in the Chicago Public School system, students reported that the risks associated with the high-stakes exam caused them to study more outside of school and pay more attention in class (Roderick & Engel, 2001).

Negative Impacts of High-Stakes Testing

The negative effects of high-stakes testing are undeniably more prevalent in the literature. High-stakes testing has received blame for: 1) anxiety among teachers, 2) narrowing the curriculum, 3) lowering teacher morale, 4) non-student "cheating," 5) an increase in student dropout rates among disadvantaged students, 6) increasing test anxiety among students, and 7) rising test expense. Although many studies focus on the negative impacts standardized testing has on students, no one can deny that the stress trickles from the top down.

Educator anxiety and pressure. High stress and anxiety in educators are especially prevalent in grades administering high-stakes exams (Barksdale-Ladd & Thomas, 2000), and the pressure increases dramatically when states link high-stakes testing results to salary increases, job retention, or restructuring of the school (Barnes, 2005; Walker, 2000). Teachers report feeling relieved, rather than proud, when their students score high, and ashamed if their students

score low, eliminating their sense of efficacy and competence (Charlesworth, Fleege, & Weitman, 1994; McNeil, 2000). To avoid these feelings of inadequacy and to relieve pressure, many teachers often go against their own teaching philosophies and engage in dramatic changes to their instructional practice, such as narrowing the curriculum, to increase test scores.

Narrowing the curriculum through instructional changes. The narrowing of curriculum can occur in four ways: the exclusion of non-tested subject areas from the school day, the exclusion of non-tested topics within subject areas, adapting teaching style to the testing format, or excessive test preparation. Facing high-stakes testing, many schools have reduced or eliminated the time allotted for physical education, foreign language, social studies, and music (Nichols & Berliner, 2008; Renter et al., 2006). Instead, students are being forced to focus more time and energy in state tested subjects such as reading, writing, mathematics, and in some instances, science. In fact, a middle school in California forced students to take two periods of each core subject while dropping the funding for non-tested subjects such as music, Spanish, art, and industrial design (Zastrow & Janc, 2006). Actions such as these communicate to students that their other talents and abilities are insignificant.

Smith (1991) revealed that with the introduction of standardized testing, teachers began to discard non-tested topics within their subject area. Realizing the gravity of the situation, many teachers rushed through a curriculum considered to be too broad and shallow. Lack of in-depth exploration of topics was a major teacher concern highlighted in a study by Jones and Engley (2004). This study, which examined teacher perspectives in Florida, also found that teachers were frustrated at the timing of test administration. In Florida, the standardized test is administered in February and March, so teachers must expedite instruction through an entire year's curriculum into five or six months to ensure students are adequately prepared.

The pressure that accompanies high-stakes testing often causes a change in teaching style. Plank and Condliffe (2013) discovered that test pressure correlated with classroom quality. As the pressure of the test amplified, classroom quality decreased. This finding is not surprising since many studies suggest teachers feel pressure to change teaching methods and behavior (Avdeniz & Southerland, 2012; Deci et al., 1982; Flink et al., 1990; Kauffman et al., 2002), including reduction of curricular content and discontinuation of activities such as skits, games, science experiments, creative activities, and recess (Barksdale-Ladd & Thomas, 2000). Jones and Egley (2004) revealed that the most frequent complaint among teachers was the pressure to "teach to the test." Some researchers suggest that organizing instruction to mirror released or similar test questions provides an advantage to students whose teacher taught to the test (Halayna, Nolen, & Haas, 1991). In a qualitative metasynthesis examining 49 studies regarding high-stakes testing and curriculum, Au (2007) posited that 75% of the studies reported an amalgamation of narrowed curriculum aligned to the standardized exam, fragmented content geared toward test-related topics, and an increase in teacher-centered pedagogy.

Excessive test preparation also narrows curriculum by reducing the available time for instruction (Jones, Jones, & Hargrove, 2003). Many schools across the nation engage in "drill-and-kill" test preparation throughout the year and/or extensively during test-taking season. Jones et al. (1999) reported that 80% of elementary teachers spend more than 20% of their total instructional time practicing for standardized exams. Over 28% admitted that their students spend more than 60% of instruction on test preparation. The Texas State Reading Association surveyed every member, including classroom teachers, reading specialists, curriculum supervisors, and those with other leadership position. The returned surveys suggested that educators spend eight to 10 hours a week on test preparation (Hoffman, Assaf, & Paris, 2001).

Narrowing of instruction can also be dependent on the time of year. Smith (1991) discovered that the curriculum took a dramatic turn as the test grew closer. She noticed that teachers altered instruction from hands-on activities to worksheets and choral reading, if they taught science at all. Jones et al. (1999) reported that teachers in North Carolina minimally address science and social studies at the elementary level. Teachers at one school reported that their principal would not support the teaching of science since it was a non-tested subject, and the principal would only observe lessons during reading, math, or writing. This constant pressure and focus on testing, as demonstrated by the principal's actions in the previous example, has caused many educators to reevaluate their career decisions.

Lower teacher morale and increased turnover. The pressure to motivate students to perform and the change in instructional practice that often negates one's own teaching philosophy result in lower morale throughout the teaching profession. Taylor, Shepard, Kinner, and Rosenthal (2002) revealed that 81% of teachers reported a decrease in faculty morale following the implementation of a high-stakes testing program. In a similar study, Jones et al. (1999) reported that 77% of elementary teachers felt morale had lowered with the implementation of the ABCs program, a program intended to increase standardized test scores. Researchers found these extreme changes in teaching methods and beliefs to be the primary reason experienced educators left the profession (Hoffman et al., 2001; Tye & O'Brien, 2002). Eighty-five percent of Texas teachers believed that many of the best teachers were leaving the profession because of the constraints high-stakes testing places on their instructional practices and the overall pressure placed on their students and themselves (Hoffman et al., 2001). The same pressures placed on educators have caused others to make poor decisions regarding students.

Manipulation of students. Nichols and Berliner (2008) suggested that high-stakes testing encourages teachers to view students as "test-score increasers or suppressors" (p. 16). Unfortunately, some schools, where stakes are the highest, have resorted to unprofessional measures such as rigorous test preparation or finding ways of dropping students from testing completely. "Cusp students" and "bubble students" are labels given to students that tend to score near the minimal passing level. Because a "few marked bubbled answers" are typically the deciding factor for success or failure of a bubble student, they often draw the attention of the teacher, causing neglect of the highest- and lowest-performing students (Booher-Jennings, 2005; Diamond & Spillane, 2004).

Researchers conducting a study of Chicago Public Schools found that teachers purposely retained low-achieving students, postponing testing for a year to allow for maturation and additional learning (Jacob, 2005). Researchers reported an increase in suspension during tested days for low-achieving students and the reclassification of students as disabled or limited English proficient in an attempt to subtract the students from the testing population (Amrein & Berliner, 2003; Jacob, 2005; Stecher, 2002). Orel (2003) reported that 500 low-scoring students in Alabama were administratively removed from school a few days before state testing occurred. This action, to the detriment of many disadvantaged students, caused scores to rise, and the principals received considerable bonuses for a "job well done."

Disadvantaged students and the dropout rate. As shown in the previous examples, none can deny the damaging effects of high-stakes testing on minority or low-socioeconomic students. Although an underlying purpose for implementation of standardized testing through NCLB was to close the achievement gap between races and socioeconomic groups, ironically, research studies have exposed that this form of assessment can unintentionally impair the

students it is attempting to assist (Groves, 2002; Kearns, 2011; Madaus & Clarke, 2001; Orfield, Losen, Wald, & Swanson, 2004; Te Riele, 2006). Dropout rates correlate with an increase in stakes for economically disadvantaged students and minority students (Groves, 2002; Madaus & Clarke, 2001). Haney (2000) found that dropout rates increased with the introduction of the exit exam in Texas, with the probability of African-American and Hispanic students being 50% more likely to not complete school than Caucasian students. In less than a decade, between 100,000 and 200,000 minority students would have completed school if the minority passing rates were equivalent to Caucasian students on the state exam.

Although many studies cite that high-stakes testing increases student motivation (Barnes, 2005; Roderick & Engel, 2001; Stecher, 2002; Walker, 2000), numerous research studies contrast these results, especially in disadvantaged students. Critics state that high-stakes testing damages students' intrinsic motivation, shifting their focus from the learning process to test performance. Students in fear of failure often surrender easily, while those who are confident in their ability to pass the exam lose interest due to decreased intellectual stimulation.

States that require students to pass standardized exams for graduation have noticed an increase in the student dropout rate. Despite meeting all other graduation requirements, many students, especially those in special education or English language learning programs, find the test to be an overwhelming obstacle (Amrein & Berliner, 2003; Marchant & Paulson, 2005; Nichols & Berliner, 2008). The chronic failure associated with the constant remediation and retaking of the exam causes many students to dropout, become increasingly cynical about school (Nichols & Berliner, 2008), and/or become anxious at the possibility of failure.

Test anxiety. In 1984, Hill and Wigfield estimated that 25% of United States primary and secondary students suffered from test anxiety, leading to lower academic performance.

During this era, most testing anxiety occurred on classroom exams or low-stakes standardized testing such as the Iowa Test of Basic Skills (ITBS). With the introduction and implementation of NCLB, the stakes were dramatically raised. Researchers have repeatedly found that an increase in stakes associated with a standardized test correlates with an increase in test anxiety among students (Casbarro, 2005; McDonald, 2001; Putwain, 2008), and female students are significantly more affected than males (Hembree, 1988; Seipp & Schwarzer, 1996).

Listed as one of the most common sources of student stress, test anxiety is defined as "the set of phenomenological, physiological, and behavioral responses that accompany concern about possible negative consequences or failure on an exam or similar evaluative situation" (Zeidner, 1998, p. 17). Test anxiety is associated with depressed levels of academic performance, inferior study skills, and the development of avoidance behaviors (Lufi, Okasha, & Cohen, 2004). Besides interfering with the students' ability to perform during a test or even the days and weeks leading up to the test, test anxiety can cause increases in blood pressure and respiration, heightened body temperature, headaches, insomnia, muscles spasms, and gastrointestinal issues. Researchers estimate that test anxiety is prevalent in 20 to 33 percent of the student population (McCaleb-Kahan & Wenner, 2009). A Californian study revealed that 61% of students report test anxiety prior to taking the state's graduation exam (Bradley et al., 2007); however, this hindrance is not limited to only those with graduation at stake.

Connor (2003) publicized that test anxiety can affect students as young as seven years old. When comparing test anxiety differences on high-stakes standardized exams versus low-stakes classroom testing in an elementary school, 335 third, fourth, and fifth graders reported significantly more testing anxiety and associated physiological symptoms when taking the

standardized exam than classroom exams (Segool, Carlson, Goforth, Von der Embse, & Barterian, 2013).

Test expense. Prior to the enactment of No Child Left Behind (NCLB), standardized testing costs throughout the nation were collectively $423 million. After the law was enacted, the price tag dramatically increased to around $1.1 billion in the 2007-2008 school year (Vu, 2008). The overwhelming majority of high-stakes testing costs reside at the local level, with a tiny fraction of total cost accruing for test development and administration. The major "hidden" expenditures for school districts include reconstructing instruction to prevent failure, professional development to upgrade teaching skills, and remediation programs for students (Rose & Myers, 2004). Zellmar, Frontier, and Pheifer (2006) reported that monetary resources necessary to improve student achievement in Wisconsin were diverted from teaching and learning and reinvested into testing preparation, test administration, and reporting test results. In addition, the extra costs of aiding students with disabilities and English language learners to pass exit exams are extremely significant (Illich, 1970).

As shown above, a search of literature associated with standardized testing yields ardent studies siding with the advantages or disadvantages of high-stakes assessments. While many studies capture the view of teachers directly affected by standardized testing, a research study comparing the same teacher's instruction, curriculum changes, administrative support, and student behavior in state tested and state non-tested subjects is missing from the current body of knowledge. In order to meticulously examine changes or lack of changes in the post-standardized tested classroom, it is imperative to be cognizant of effective instructional practices in science education.

Effective Instructional Practices in Science Education

When Paul Hurd coined the phrase *science literacy* in 1958, he was simply trying to brand the notion that scientific knowledge was essential for everyday life. Throughout the years, the meaning of science literacy has evolved, with recent explanations recognizing the value in expanding the traditional focus on scientific concepts to incorporate cognitive abilities, connections among ideas, and communication (American Association for the Advancement of Science, 2001; National Research Council, 2012). Although the definition is continuously under debate, the *Nation Science Education Standards* define scientific literacy as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (National Research Council, 1996, p. 22). Regardless the definition, researchers can agree that scientific literacy is an essential component of an informed society, and that the major goal of science education should be developing students' scientific literacy (Hurd, 1970; Klopfer, 1971; Rubba & Anderson, 1978). Recently, researchers from multiple fields of study have collaborated to create a framework with the potential of rectifying the lack of scientific literacy throughout the nation.

Guiding Effective Science Instruction: A Framework for K-12 Science Education

Established by the National Research Council (NRC), *A Framework for K-12 Science Education* is based on a large and growing body of research, attempting to direct science education towards a unified vision that accepts learning as a developmental progression continuously building on prior knowledge. The foundation of this framework is based on six ideas: 1) children's ability to learn science, 2) a focus on core concepts, 3) the development of authentic understanding over time, 4) the consideration of knowledge and practice, 5) the connection between science education and the students' interest and experience, and 6) the

promotion of equity (NRC, 2012).

The ultimate goal of *A Framework for K-12 Science Education* is scientific literacy. The charge is to ensure by graduation that all students appreciate science, know enough information to engage in public discussions on topics in science and engineering, have the ability to continue their love of science outside school grounds, are vigilant patrons of scientific and technological information related to their lives, and have the skills necessary to enter any career field they chose (NRC, 2012).

Created by a committee of experts across diverse fields, *A Framework for K-12 Science Education* is based on significant and developing research centered on three dimensions: scientific and engineering practices, crosscutting concepts, and disciplinary core ideas. Dimension one focuses on *practice*, not knowledge. The hope in this dimension is that students will have an inquiry-based science education full of experimentation and observation. "Students cannot comprehend scientific practices, nor fully appreciate the nature of scientific knowledge itself, without directly experiencing those practices for themselves" (NRC, 2012, p. 30). Dimension two discusses crosscutting concepts, which link subject areas through common themes when learning science. Dimension three focuses on the core ideas, which many find more concise than expected. While some teachers may be extremely upset by the deletion of their favorite topic(s), the committee believed that "an important role of science education is not to teach 'all the facts' but rather to prepare students with sufficient core knowledge so that they can later acquire additional information on their own" (NRC, 2012, p. 31).

A Framework for K-12 Science Education serves as an extensive description of the content and arrangement of learning in the areas of science, engineering, and technology for students in K-12 education. Though not a step-by-step guide of standards and instruction, the

framework acts as a general map for those in authoritative positions dictating the future for science education. If utilized properly, this document can help educators revolutionize the future of science and science education. However, the framework itself is not sufficient enough to create a productive learning environment; successful science instruction begins with the teacher.

Teacher Knowledge

As the facilitators of knowledge acquisition, educators have a profound effect on student learning (Nye, Konstantopoulos, & Hedges, 2004; Rivkin, Hanushek, & Kain, 2005). In a study of upper elementary students, Wright, Horn, and Sanders (1997) examined the effects of classroom size, classroom heterogeneity, and teacher effects on academic achievement. The researchers unearthed that teacher effectiveness is the dominant factor affecting student academic growth. The degree of teacher effectiveness lies in his or her knowledge.

Multiple forms of teacher knowledge are necessary to create a classroom conducive to learning. As lead navigator on the learning journey, it is imperative that the educator has both content knowledge and pedagogical content knowledge. Merely being abreast of scientific concepts is not sufficient for educating others. In addition to understanding scientific phenomena, an educator must be able to transmit information to developing minds in a fashion worthy of recollection and application.

Content knowledge. According to Shulman (1986), it is necessary for the teacher to "not only understand *that* something is so; the teacher must further understand *why* it is so, on what grounds its warrant can be asserted, and under what circumstances our belief in its justification can be weakened and even denied" (p. 9). Since the area of science is ever-evolving, science educators must have a current and thorough understanding of scientific phenomena and process (Davis, Petish, & Smithey, 2006; Grossman, Schoenfeld, & Lee, 2005; National Research

Council, 1996). Ginns and Watters (1995) found that preservice elementary teachers held scientific misconceptions similar to those identified in students, describing the future teachers in their study as holding "a range of inaccurate scientific concepts" (p. 219). In a national study of elementary teachers, Weiss (1994) discovered that less than a third of the educators felt they were qualified to teach science due to lack of content knowledge.

While inadequate content knowledge may seem like a reoccurring theme exhibited by elementary preservice and inservice teachers, Haider (2010) has consistently found scientific misconceptions prevalent among prospective secondary science teachers. In the data collected from 67 preservice chemistry teachers, the researcher identified six major misconceptions about thermodynamics. Although much of the research points toward a perpetuating cycle of teacher inadequacy in subject-matter content, Gess-Newsome and Lederman (1993) report that scientific conceptual understanding increases with teaching experience. While having confidence in presenting scientific phenomenon is a step in the right direction, the capability to transmit knowledge to another human being is also necessary for effective teaching. Knowledge of effective teaching mechanisms is referred to as pedagogical content knowledge.

Pedagogical content knowledge (PCK). In addition to staying abreast of current scientific events, an effective science educator has sufficient pedagogical content knowledge. Shulman (1986) described pedagogical content knowledge as:

> the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the ways of representing and formulating the subject that make it comprehensible to others. Since there are no single most powerful forms of representation, the teacher must have at hand a veritable armamentarium of alternative forms of representation, some of which derive

from research whereas others originate in the wisdom of practice. (p. 9)

While Shulman's definition seems direct, the research community has debated the components of PCK for numerous years. Many researchers describe PCK as a mixture of several types of knowledge needed for teaching while others describe PCK as the synthesis of all knowledge elements necessary to effectively teach (Cochran, DeRuiter, & King, 1993). Loughran, Milroy, Berry, Gunstone, and Mulhall (2001) define PCK as "the knowledge that a teacher uses to provide teaching situations that help learners make sense of particular science content" (p. 289).

Although the definition of PCK is still undetermined and the existing literature on PCK does not provide a complete and consistent theoretical framework, the significance of PCK in developing teacher effectiveness in the classroom cannot be denied. Geddis, Onslow, Beynon, and Oesch (1993) reported that PCK plays a critical role in the transformation of preservice science teachers' subject-matter knowledge into teachable content knowledge. The development of PCK in preservice teachers occurs in a variety of fashions including reflections on practice (Dietz & Davis, 2009), action research (Justi & Van Driel, 2005), connecting course material to teaching experience (De Jong, Van Driel, & Verloop, 2005), and examining curricula thoroughly (Beyer & Davis, 2012). In a 14-week study of three preservice chemistry teachers, Aydin et al. (2013) revealed that PCK develops over time and that all of the components of PCK coherently integrate with each other. In addition, the preservice teachers started to view the PCK construct as professional pedagogical knowledge. Hackling, Peers, and Prain (2007) found that teachers who have stances on pedagogical knowledge practices incorporate personal teaching philosophies and theory-practice connections such as Bybee's 5Es, a learning cycle based on constructivist principles.

Pedagogical strategies tend to vary amongst the elementary and secondary classroom. A

study of 49 elementary teachers reported immense value towards hands-on activities in science due to increases in student motivation and interest (Abell, Bryan, & Anderson, 1998). A similar study discovered that a major strength of preservice elementary teachers was a propensity for inquiry (Howes, 2002). In contrast, secondary science teachers are more inclined to view instruction as a transmission process. Since content knowledge and pedagogical content knowledge are both necessary for effective science teaching at all levels, preservice and inservice teachers must have a thorough understanding of the foundation of effective science teaching.

Constructivism: The Heart and Soul of Effective Science Teaching

The science education research community presently advocates science classrooms based on constructivist principles. Utilizing the works of Dewey (1938/1997), the constructivist viewpoint values natural experiences as crucial to the development of cognition. Constructivism, one of the most important learning theories in modern education, incorporates students' prior knowledge and experiences, encourages students to develop their own understandings, ask questions, express thoughts, and contribute in investigation design (Bransford, Derry, Berliner, Hammerness, & Beckett, 2005; Davis et al., 2006; Ginns & Watters, 1999; Harlen, 1999).

According to Atkinson (2007), individuals do not experience the world through the eyes of a scientist, but as people searching for meaning to our unique experiences. Unlike teacher-centered, traditional approaches to science education, student-centered, constructivist teaching consistently allow students to use these experiences to demonstrate knowledge through investigations and scientific practices (Harlen, 1999). The constructivist teacher, acting as a guide, views learning as an exploratory journey of knowledge acquisition.

Taylor, Fraser, and White (1994) examined essential elements of effective constructivist learning environments. They found that a classroom centered on constructivism has the

following criteria: making science relevant to the outside world, engaging students in reflective negotiations collaboratively, student input and shared control in their learning, encouraging students to express critical concern about the quality of classroom activities and teaching, and allowing students to experience the tentative nature of scientific knowledge. In order to acquire a more effective classroom by utilizing constructivist instructional strategies such as the ones mentioned above, science educators are encouraged to have a classroom centered on inquiry-based instruction, contextualized teaching, cooperative learning, and effective questioning techniques (Bateman, 1990; Keys & Bryan, 2000).

Inquiry-based instruction. Advocating for effective, constructivist-based instructional strategies such an inquiry and exploration based on student interest, the introduction of the National Science Education Standards (NSES) of 1998 created a paradigm shift in science education instruction (Anderson, 2002; NRC, 1996). The NSES emphasized "a new way of teaching and learning about science that reflects how science itself is done, emphasizes inquiry as a way of achieving knowledge and understanding about the natural world" (NRC, 1996, p. 9). These principles, now transformed into the Next Generation Science Standards (NGSS), describe scientific learning as an experiential, active process. In authentic activities with inquiry as center focus, students act as scientists, experiencing the process and justification of knowledge obtained.

Atkins and Karplus (1962) introduced the initial learning cycle during the development of the Science Curriculum Improvement Study (SCIS). Their learning cycle model consisted of exploration, concept introduction, and concept application. Since the initiation of the first learning cycle in the early 1960s, numerous forms of inquiry instruction have been established and utilized in science classrooms around the globe. The Learning Inquiry Cycle Model

(Bevevino, Dengel, & Adams, 1999), based on Piaget's theory of cognitive learning, is a procedural teaching strategy consistent with natural learning. Several versions of this teaching model exist, including the 4E, 5E, and 7E. The 5E learning cycle, proposed by Bybee et al. (2006), is currently the most popular model used in science education courses and throughout primary and secondary science classrooms.

Bybee's 5E design incorporates five components: engagement, exploration, explanation, elaboration, and evaluation. In the engagement phase, the teacher gauges students' prior knowledge and engages the class in a new topic through the use of mini-exploratory activities that promote curiosity and draw from students' prior knowledge and experiences. Students are provided with a variety of activities that elicit previous knowledge and allow students to discover new concepts and skills in the exploration phase. In the explanation phase, students focus on a particular component, utilizing classroom activities and past experiences to understand a new concept, process, or skill. During this phase, students will have the opportunities to display their conceptual understanding of the new notion. Students have the opportunity to further their knowledge in the elaboration phase. After students have a strong grasp of the current topic, students are engaged in more experiences that extend the concept, facilitating the application of the new information into different situations. Although the teacher may have been performing informal evaluations throughout the entire process, in the evaluation phase, students have the opportunity to utilize developed skills into demonstrating their current understanding. This is also an opportunity for educators to assess student understanding, making decisions to possibly reteach concepts or address reoccurring misconceptions. This model provides students multiple opportunities to engage in the material and with each other, making learning engaging and communal (Bybee et al., 2006).

Students educated by the inquiry-based 5E learning cycle have higher achievement levels than those educated by traditional methods (Abdi, 2014; Anderson, 2002; Bevevino et al., 1999; Cardak, Dikmenli, & Saritas, 2008; Lord, 1999; Seyhan & Morgil, 2007; Sungur, Tekkaya, & Geban, 2001). In a quasi-experimental study examining academic achievement in 40 fifth grade students, teachers either instructed students utilizing traditional methods or the 5E model. In this study, Abdi (2014) found that students instructed through inquiry-based learning achieved significantly higher scores on posttest scores of the academic achievement exam. A similar study by Cardak, Dikmenli, and Saritas (2008) utilized traditional methods and the 5E instructional approach over the circulatory system in sixth grade. The researchers revealed that the 5E approach was more effective when comparing the posttest scores. Lord (1999) examined college students in an environmental science class to assess the effects of teacher-centered versus student-centered learning. Students in two classes were presented material in traditional lecture fashion twice a week. Two other classes were instructed in a constructivist manner, allowing students to work in small groups on scenarios focused on critical thinking skills. Students in the constructivist classes not only performed significantly better on exams; they also thought the class was more enjoyable and participated in more campus and regional environmental projects.

Contextualization. As noted in multiple stages of the 5E model, eliciting prior knowledge and experience is imperative in the learning process. Rivet and Krajick (2008) found that educators who fostered an effective science classroom contextualized instruction, utilizing students' previous knowledge and experiences to guide the learning process. In order to help facilitate the connection between experience and new scientific information, effective educators used numerous strategies including problem-based learning, project-based learning, and guided inquiry (Rivet & Krajick, 2008). The contextualization of instruction promotes the transfer of

prior scientific knowledge into other situations, allowing students to relate scientific ideas to their everyday life.

Collaborative learning. Deeply rooted in the works of Vygotsky (1987), social constructivism highlights learning as a social process, yielding knowledge within an environment emulating real world situations (Lave & Wenger, 1991). This theory describes learning as a collective effort where students co-construct meaning through shared experiences (Marlowe & Page, 2005). Proponents of social constructivism agree that discourse between learners is of great importance in constructing knowledge (Svinicki, 2004). Social constructivism is thus the foundation of the classroom interpretation: collaborative learning (Barkely, Cross, & Majro, 2005; Cracolice & Tautmann, 2001).

Based on the social interdependence theory (Johnson & Johnson, 2009; Slavin, 1990), the definition of collaborative learning is ever-changing and varies among researchers; however, at the basis, collaborative learning can be defined as working together to achieve common learning goals. Five features of collaborative learning are imperative to ensure high student engagement and success: positive interdependence, individual accountability, social interaction, group processing, and communication (Johnson & Johnson, 2009; Johnson, Johnson, Ortiz, & Stanne, 1991; Johnson, Johnson, & Smith, 1998; Kagan, 1992; Slavin, 1990; Smith, 2010; Smith, Sheppard, Johnson, & Johnson, 2005). Johnson et al. (1991) investigated interdependence on achievement, interaction, and attitudes. Thirty undergraduates enrolled in two sections of the course were randomly assigned into two groups: one group with positive goal interdependence and one without goal interdependence. The study found that students associated with positive goal interdependence had higher achievement, higher retention of learned material, greater perceptions of peer and instructor support, and promoted more task-oriented and maintenance-

oriented interaction.

A meta-analysis by Johnson, Maruyama, Johnson, Nelson and Skon (1981) reviewed 122 studies comparing the effectiveness of cooperation, cooperation with intergroup competition, interpersonal competition, and individualistic goal structures in promoting achievement and productivity. Utilizing the voting method, z-score method, and effect-size method to evaluate 286 findings, the researchers discovered that cooperation is more effective than interpersonal competition and individualistic efforts. In addition, cooperation with intergroup competition is superior to interpersonal competition and individualistic efforts.

A key goal of collaborative learning is the shift of classroom authority from the teacher to the students (Bruffee, 1995). With students as the focus, shared learning gives them an opportunity to engage in discussion, develop critical thinking skills, and take responsibility for their own learning (Totten, Skills, Digby, & Russ, 1991). Curran, Carlson, and Celotta (2013) investigated content mastery and disposition of 46 undergraduate students in an applied statistics course. Half of the students volunteered to participate in peer-led team learning (PLTL), a collaborative learning technique highlighting problem-solving and discussion guided by a facilitator. Although all course components were held constant, those that opted to participate in PLTL had statistically higher content mastery than their non-participating peers. Researchers have consistently found that collaborative learning has a positive impact on student achievement, student self-perception, and relationships with others (Johnson & Johnson, 1994; Johnson, et al., 1981; Johnson et al., 1998). Although collaborative learning can enhance the learning process for all, this method works best when coupled with inquiry-based techniques such as effective discourse.

Discourse. Gee (2001) defined discourse as an interplay between "words, acts, values, beliefs, attitudes, and social identities" (p. 526) within a group of individuals constructing meaning. Given this definition, it is easy to conclude that discourse is more than classroom chatter; it is an intricate dance among students and teacher that has a profound effect on the learning environment.

Early research highlighted the significant role of effective questioning in classroom learning (Dillon & Dillon, 1988); however the impact questioning has on the learning process is dependent on teacher approach. Discourse can be categorized into authoritative or dialogic functions (Scott, 1998). Authoritative discourse consists of one-way teacher knowledge transmission. Communication typically involves the teacher stating factual information with occasional instructional questions. In return, student response usually consists of memorized words or short phrases. The purpose of this type of questioning is to find out what students know or have memorized. In contrast, dialogic discourse encourages students to critically think about ideas and debate different points of view. The teacher's intent is centered on discovering what students believe based on their previous experiences and guiding them into constructing conceptual knowledge.

Inciting these critical thinking skills has profound effects on scientific learning. In a study of 10 middle school science classrooms, Smart and Marshall (2013) investigated the link between student cognitive level and classroom discourse. Utilizing the Electronic Quality of Inquiry Protocol (EQUIP), the researchers found positive correlations between students' cognitive engagement and aspects of classroom discourse such as questioning level, question complexity, questioning ecology, communication patterns, and interactions within the classroom. While training educators on successful questioning techniques may seem like an easy fix to

increasing student cognition, factors beyond pedagogy impact effective discourse.

Teacher content knowledge plays a substantial role in classroom discourse. A case study examining a teacher's questioning strategies in a grade 4/5 classroom involving open-inquiry engineering curriculum found that a teacher's competence in questioning was directly related to his or her competence in the subject-matter content (Roth, 1996). This study also provided evidence that discourse is a complex practice not easily adopted.

Conclusion

Determined to develop scientific literacy throughout the nation, science education reformers encourage science teachers to acquire more effective classrooms. Ultimately, reform begins with the educator. Utilizing a constructivist point of view, educators have the ability to foster a love and interest of science in their students. Successful science instruction has proven to be inquiry-based with an emphasis on contextualization, collaborative learning, and effective discourse. Instruction of this manner sets educators and students up for success; however, with the implementation of high-stakes testing, a detrimental effect on teaching is change in instructional practice. With pressures to teach to the test, many educators have diverted from best instructional practices to drill-and-kill teaching in order to increase test results. Once the accountability measure is removed, will teachers revert to best instructional practices?

Chapter 3: Methodology

This study examined teachers' perceptions about administrative support, student demeanor, covered curriculum, and their instructional practices as they transitioned from teaching a state tested course to a state non-tested course. The research methodology used for this investigation was a case study. In addition to providing an explanation of the case study methodology, this chapter also describes the recruitment and selection of the two participants, data collection procedures, the data analysis process, and establishing credibility.

Case Study Methodology

The definition of the case study remains a subject of debate. Yin (2003) defines *case* as "a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context" (p. 13). Miles and Huberman (1994) simply describe a *case* as "a phenomenon of some sort occurring in a bounded context" (p. 25). Given this definition of the research process, the case study is an investigation into the *how* or *why* of a phenomenon of interest. Merriam (1988) defines *case study* as "an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (p. 21). Stake (2000) adds that a *case study* is "both a process of inquiry about the case and the product of that inquiry" (p. 436). Regardless of the researcher, the common denominators of the *case* and *case study* definitions include a bounded system and a phenomenon specific to a time and place. The case study should capture the essence and complexity of a single case, the case being the object of study. In this study, I examined a *bounded system* between the years of 2014 and 2015 in a large, urban school district in the Southwest.

Context

Pseudonyms were assigned to protect the confidentiality of the teachers, school, and district. The subsequent paragraphs offer a brief introduction to the school, the recruitment techniques, and the two participants in this study.

Madison High School in Monroe Independent School District, the site for this 18-month study, is a large 6A urban school in the Southwest. This school utilizes a trimester scheduling system, which divides courses into two parts: A and B. Students take the courses for a total of 24 of the 36 weeks of the school year unless they fail. Because of the arrangement, students may have the same or different teachers for each half of the course. Table 3 shows an example of a trimester course with five sample students.

Table 3

Trimester Schedule for Five Sample Students During the 2015-16 School Year

	1st Trimester 8/24/15- 11/13/15	2nd Trimester 11/16/15- 2/26/16	3rd Trimester 2/29/16- 5/25/16
Student 1	Chemistry A		Chemistry B
Student 2	Chemistry A	Chemistry B	
Student 3		Chemistry A	Chemistry B
Student 4	Chemistry A (failed)	Chemistry A	Chemistry B
Student 5	Chemistry A	Chemistry B (failed)	Chemistry B

Recruitment

Year 1 (2014-2015). The recruitment of participants began in the fall of 2014. Due to the specific population needed to address the research question, purposeful sampling (Patton, 1990) was used. To participate in the study, individuals were required to (a) hold a teaching certificate,

(b) have taught TAKS or EOC tested students in on-level physics or chemistry during or prior to the 2012-2013 school year, (c) teach students in on-level physics or chemistry during the 2014-2015 school year, (d) be projected to teach students in on-level physics or chemistry during the 2015-2016 school year, and (e) work in the same school environment. Having worked closely with teachers and administrators from Monroe Independent School District, the professional relationships with former district faculty and knowledge of teachers' backgrounds were used to recruit participants for this study.

Recruitment began with an email invitation to participate in a study examining teacher perspectives about teaching state tested versus state non-tested subjects. Initially based on a single, lengthy interview, the study examined five teachers who met the criteria and agreed to participate in the interview conducted in the winter trimester.

Year 2 (2015-2016). The results of the initial interview intrigued me. In order to gain more insight, I decided to continue examining the teachers for an additional year. Only two of the five teachers met the study's criteria in Year 2. In order to gain a deep, thorough data set from the two teachers, additional interviews, artifacts, observations, and post-observation conferences occurred throughout the winter and spring trimesters of 2016.This study only examines the data from the two teachers that met the criteria throughout the entire 18-month period. The final interview was conducted in August 2016, one week prior to the start of the 2016- 2017 school year. Since collecting data on school grounds was crucial to the research, the principal was contacted via email to gain permission. In addition, the principal signed a permission form (see Appendix B) prior to the study, allowing observations, photographs of the environment, and teacher interviews in classrooms.

Participants

Laura is a female high school science teacher in her mid-twenties. Laura has a bachelor's degree in biomedical science and received alternative certification. Although she has an 8-12 Science Composite certification permitting her to teach multiple sciences, her specialty and preference is teaching chemistry and biology (see Table 4). Depending on the needs of the school year, Laura is known to teach International Baccalaureate (IB) Biology, Chemistry, and Pre-Advanced Placement (AP) /IB Chemistry. In 2011-2012, Laura began her career as an educator teaching chemistry, a course that had a state-mandated, standardized exam. She taught under state-mandated conditions for two years, learning testing strategies to help her students pass the TAKS and the EOC chemistry exam. Although standardized exams are no longer administered in her current chemistry classes, Laura still teaches IB courses, which require students to take worldwide exams for possible college credit if set scores are achieved. During this study, Laura was in her fourth and fifth year as an educator.

Table 4

Laura's Teaching History

Year in Education	Courses	Standardized Exam
1st (2011-2012)	Chemistry	10th grade TAKS
	Pre-AP/IB Chemistry	10th grade TAKS
2nd (2012-2013)	AP Biology	AP
	Chemistry	Chemistry EOC
3rd (2013-2014)	IB Biology	IB
	Chemistry	None
4th (2014-2015)	IB Biology	IB

	Chemistry	None
	Pre-AP/IB Chemistry	None
5th (2015-2016)	IB Biology	IB
	Chemistry	None
	Pre-AP/IB Chemistry	None
6th (2016-2017)	IB Biology	IB
	Chemistry	None
	Pre-AP/IB Chemistry	None

Cris is a male high school teacher in his mid-thirties**.** Cris holds bachelors' degrees in psychology and biology, and has received alternative certification. He received his master's degree in educational leadership and policy studies in 2014. Although he also has an 8-12 Science Composite certification, Cris currently prefers to teach physics and integrated physics and chemistry (IPC) because they are not bound to a state-mandated, standardized exam. Cris began his teaching career instructing biology, a course that required students to take the TAKS exam, bringing his total number of tested years to five (see Table 5). Chris was in his seventh and eighth year as an educator during this study.

Table 5

Cris's Teaching History

Year in Education	Course(s)	Standardized Exam
1st (2008-2009)	Biology	10th TAKS
2nd (2009-2010)	Biology	10th TAKS
3rd (2010-2011)	Biology	10th TAKS
4th (2011-2012)	Biology	10th TAKS

5th (2012-2013)	Physics	11th TAKS
6th (2013-2014)	Physics	None
7th (2014-2015)	Physics	None
	IPC	None
8th (2015-2016)	Physics	None
	IPC	None
9th (2016-2017)	Physics	None
	IPC	None

As shown in Tables 4 and 5, each alternatively certified teacher in this study entered his or her educational career during high-stakes testing. Both taught courses linked to state standardized exams and reported feeling pressured to increase student test performance, since the public and school system often view scores as a reflection of the teacher. To fully understand the teachers' perspectives during this study, consideration of each teacher's course assignment is necessary. Table 6 shows teaching responsibilities per trimester of the study.

Table 6

Courses Taught Per Trimester of this Study

	Winter 2014-2015	Winter 2015-2016	Spring 2016
Laura	IB Biology 3A	Chemistry A	Chemistry B
	Chemistry B	IB Biology 2A	IB Biology 2B
		IB Biology 2B	
Cris	IPC B	IPC B	Physics B
	Physics B	Physics B	

Data Collection

The data collection for this multi-year study was divided into three phases: data collected during the winter 2015 trimester (phase one), data collected during the winter and spring 2016 trimesters (phase two), and data collected during the professional development week prior to beginning of the 2016-2017 school year (phase three).

In an effort to acquire sufficient and reliable data during this study, multiple sources were utilized. The primary data sources for this study included the following from each teacher: 1) six audio-recorded interviews, 2) field notes from 14 observations 3) 13 audio-recorded post-observation conferences, and 4) artifacts collected during lessons. Table 7 summarizes the data collection techniques per phase.

Table 7

Data Sources Utilized Per Phase of the Study

Phase & Timeframe	Data Source
One (January/ February 2015)	Interview 1
Two (January 2016- May 2016)	Interviews 2, 3, 4, & 5
	Field Notes from 14 Observations
	Post-observation Conferences from 13 Observations
	Artifacts from 14 Observations
Three (August 2016)	Interview 6

Data Collection: Phase One. Interviews were the first data collected for this study. Considered an essential data source for case study research (Yin, 2003), interviews are often

described as “finding out what is in and on someone else’s mind…. to allow us to enter into the other person’s perspective” (Patton, 1990, p. 278). More recently, Denzin and Lincoln (2005) describe qualitative interviewing as “capturing the individual’s point of view” (p. 12). Defined by Berg (2007) as simply “a conversation with purpose” (p. 89), the objective of the interviews in this study was to gain insight into the minds of educators undergoing significant classroom change.

The setting of the interview is key in acquiring a rich data set (Glesne, 2006). In order to provide a trusted environment free of distractions, the first interview was conducted at a local library near the school campus. Since the quality of evidence gained through the interviewing process is largely dependent on the questions and skills of the researcher (Patton, 1990), the main questions and potential follow-up questions were prepared prior to the interview (see Appendix C). In preparation, the researcher must be cognizant of possible leading questions, which may reveal a bias or an assumption from the researcher (Merriam, 1998). These views may or may not be held by the participant. To avoid leading questions, care was taken in structuring the open-ended questions in a way that avoided bias. A qualitative research expert reviewed and approved the questions prior to every interview, ensuring the questions possessed minimal bias and had the ability to elicit authentic responses. In addition to limiting bias, preparing the questions prior to the interview allowed for consistency between participants.

The intent of the open-ended questions was to provoke reflection by the participant in an attempt to acquire rich data on instructional practices and the classroom environment during the state tested years, transition year, and the current year. Although questions were prepared prior to the interview, the semi-structured interview format (Merriam, 2009) allowed flexibility for additional probing and the occasional journey “down the rabbit trail.” The follow-up questions

were omitted or altered as needed. Since the study began after TAKS and EOC exam had been removed from physics and chemistry courses, a main purpose of the first interview was to elicit prior feelings and perspectives during the state tested era. In addition, teachers were asked to compare administrative support, student demeanor, the covered curriculum, and their instructional practices during state tested years, the year immediately following the removal of the state exam from their course (transition year), and the current state non-tested year. The responses to this interview were utilized for subsequent interviews.

Data Collection: Phase Two. Phase two served as the bulk of the research. During the time from January 2016 to May 2016, four interviews, field notes from 14 observations, 13 post-observation conferences following the observations, and artifacts gained during the observations were employed for each teacher. To be efficient with the participant's time, interviews were conducted in the school during the teacher's conference period. The second interview (see Appendix D), which took place during January and February of 2016 (approximately one year after the first interview), focused on administrative support, student demeanor, the curriculum, and their instructional practices one year later. The interview questions resembled the first interview questions, which reflect an attempt to evoke a summary of the changes or lack of change in the past school year. The purpose of this interview was to begin to identify patterns and possible discrepancies.

The third interview (see Appendix E) was conducted at the end of February 2016 and concentrated on teachers' perceptions of the previous winter trimester and predictions for the final trimester. The fourth interview (see Appendix F), given during the EOC testing week, focused on prior and current feelings about the testing environment and testing regulations. The fifth interview (see Appendix G), conducted during finals week, completed the interview portion

of phase two. This interview asked participants to reflect on the amount of curriculum they covered during the school year, the overall student behavior, and the teachers' role as an educator.

During phase two, each participant was observed in his/her classroom 14 times. During observations, my stance was that of an onlooker (Patton, 1990), making direct observations of instructional activities, human interactions, and gaining a sense of the classroom atmosphere. Cognizant that my presence alone might disrupt the classroom dynamic (Bogdan & Biklen, 1998; Miles & Huberman, 1994) and "create social behaviors in others that would not have occurred ordinarily" (Miles & Huberman, 1994, p. 265), care was made to minimize classroom distractions by sitting behind the students. To make students more comfortable and to acquire authentic data, observations occurred on a consistent basis and often during the same class period. Initially, the students were keenly aware of my presence in the classroom; however, their interest in me subsided after the second week.

Classroom observations were crucial to the study by serving as a "check and balance" of the information acquired in the interviews. By viewing the classroom atmosphere, evidence was gained that confirmed or refuted the interview data, specifically regarding the teachers' beliefs about their own instructional practices and classroom environment. Although impromptu observations are ideal for obtaining authentic data, the ever-changing school calendar made it difficult to ensure that every trip to the school would result in efficient data collection. In an effort to be efficient in data acquisition and to lessen teacher anxiety about the observation process, I decided to schedule observations with the teachers instead of arriving unannounced.

The observations were scheduled at the beginning of phase two; however, due to unforeseen conflicts in school scheduling and the classroom calendar, the observation dates were

often adjusted the week prior to my visit. Since Laura's third trimester class schedule was undetermined with a possibility of teaching only advanced courses, I observed her twice a week for seven weeks in the latter part of the second trimester. Cris knew his third trimester class schedule would consist of on-level classes; therefore, I was able to spread his observations over a 14–week period, observing him once a week for the latter part of the second trimester and most of the third trimester (see Appendix I).

During each 75-minute observation, pen and paper field notes were recorded regarding the lesson, teacher practice, and classroom discourse. By not using technology that typically accompanies school and district administrators, I physically established to students that I was a classroom observer and not a district administrator. This allowed for greater ease of blending into the classroom environment.

The field notes were divided into observations, researcher notes/feelings, and follow-up questions (see Table 8). At the top of the paper, I recorded the date, class period, and lesson topic. On the front of the paper, I recorded the time, activity, and event pertinent to my research. On the back of the paper, I recorded my feelings and follow-up questions for the teacher pertaining to specific events. The teacher was questioned about these events during the post-observation conference. During data analysis, these field notes were used to validate or compare data obtained from other sources.

Table 8

Sample Field Note

(Front of the Paper)

01/28/16 Lesson: Light Period: 3

12:28 Students are working on a worksheet over energy

12:39 Male student said, “Why do we need to know about light? Why can’t we learn about waffles?”

(Back of the Paper)

How often does Laura get questions like this from students? Do students only care if they are [state]tested?

Post-observation Conference Questions:

Do students often ask why they need to learn particular topics? Did they do this when tested?

According to classroom calendar, they are 6 days behind. *Why?*

Post-observation conferences (Hatch, 2006) occurred at the conclusion of each observation. In an attempt to acquire authentic data, conferencing occurred in a location away from student ears and typically lasted less than four minutes during a passing period. The participants were briefly asked a few questions about their lesson, focusing on the comparison of the current lesson to similar lessons during state tested years. This time period was also used to inquire about student interactions during the observation and the pacing of course topics. The post-observation conferences were recorded and transcribed within one day at a different location. Appendix J depicts a post-observation conference that occurred immediately after a lesson on the periodic table.

Artifacts, such as photographs, handouts, and lesson plans, were obtained during the observations. Photographs included the daily agenda, activities to examine the teacher's instructional practices, and posted grades for evidence of student apathy. Posted grades with many zeros for missing assignments could possibly indicate a lack of concern towards the subject or class. In addition, photographs of teacher instructional practices and the agenda helped me, as the researcher, recall feelings about the lesson and classroom environment on a particular day of observation.

Data Collection: Phase Three. The final phase of data collection occurred in the middle of August 2016. Given during the inservice week, days prior to the new 2016-17 school year, the sixth interview (see Appendix H) focused on the professional development received during that week, new professional goals for the year, and changes to the district/school curriculum. The goal of phase three was to elicit feelings about professionalism, students, and the teachers' overall outlook for the new school year.

Data Analysis

The interviews, field notes, and post-observation conferences were transcribed and each line of a document was assigned a number. Each document was read multiple times and meaningful data were underlined. Utilizing open coding methodology (Corbin & Strauss, 2014) allowed for the identification and tentative naming of conceptual categories. Each category resulted from the organization of similar words, phrases, and events that occurred in the classroom. If a data unit belonged to two or more categories, the phrase or word would be placed in each category.

Utilizing the axial coding method (Corbin & Strauss, 2014), the conceptual categories were then reexamined to determine if relationships existed between each category. The

conceptual categories were then collapsed into themes. This selective coding method served to further develop and refine concepts, establishing the bigger picture of the phenomenon. Table 9 shows an example of the data coding method.

Table 9

Example of Coding Procedure for the Theme of Forgotten

Unitized Data	Conceptual Category	Theme
I did have more [walk-throughs] during EOC testing. (Laura, I2: 377)	Hands-off	Forgotten
Erin: And I know that you said the district-based assessment… *Cris: Went out the window. I haven't heard anything this year.* (Cris, I1: 539)	End of Data Collection & Analysis	
Laura: It didn't feel like it [professional development] contributed anything to what we were trying to accomplish. *Erin: Do you feel like it was more geared toward biology and junior high students?* *Laura: Yes, because that's tested. It feels like there's a massive disconnect to what we [physics and chemistry] actually need, and what will be helpful for us…* (Laura, I4: 392)	Professional Development Focused on State tested Subjects	

Trustworthiness

The case study methodology employed pursues meaning and understanding by utilizing an inductive approach with the researcher as the primary instrument of data collection and interpretation (Patton, 2001). The researcher brings life experiences and ultimately, bias into the study. While some bias is inevitable, ideally the researcher should acknowledge predispositions and attempt to minimize the subjective nature of the research. The trustworthiness of the qualitative research is overall dependent on his or her skills, ability, and effort.

Credibility, *transferability*, *dependability*, and *confirmability* (Lincoln & Guba, 1985) are essential components of qualitative research that reflect multiple areas of establishing truth. Credibility refers to the extent to which the findings reflect reality. Since my experience as an educator in the public school system was a potential source of bias, many measures were taken to enhance the study's credibility. Multiple methods including triangulation, prolonged engagement, member-checking, and peer debriefing were employed in this study to improve credibility. Triangulation, defined as a "validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study" (Creswell & Miller, 2000, p. 126), is typically the strategy used for improving credibility; however, triangulation can also enhance dependability and confirmability. Yin (2009) posited that using multiple methods of data collection leads to more valid, reliable, and diverse construction of realities. To adhere to his principles, multiple data sources (interviews, observations, field notes, post-observation conferences, and artifacts) have been used in this research.

Prolonged engagement also improves credibility. In this research, interviews were conducted six times, increasing the likelihood that the teacher's account yielded accurate data.

Prior interview responses were referenced to confirm the acquired data was reliable and the phenomenon was thoroughly understood. Member-checking occurred by allowing each participant to review his or her transcribed interviews. If they noticed an error or if their views had altered, changes were made. In addition to the interviews, classroom observations of each teacher occurred 14 times. This frequency allowed me to blend into the environment and to thoroughly gain a perspective about the classroom dynamic. After every observation, the teachers were questioned about classroom events. This fostered thorough understanding of occurrences, avoiding assumptions about actions of students/teacher or classroom activities. Peer debriefing with a science education colleague at Texas Christian University was also used to minimize bias and acquire suggestions regarding research design, analysis, and conclusion. By having a second set of eyes read through the research, areas of possible bias were highlighted and eliminated.

Transferability represents the degree to which the results of a study can apply or transfer beyond the bounds of the case study. Since the findings of a qualitative study are specific to a small number of individuals in a particular environment, many scholars argue that it's impossible to demonstrate findings that are applicable to other settings and individuals. However, Denscombe (1998) and Stake (2000) deem that although every case is unique, it serves as one example within a larger group, and they contend that the possibility of transferability should not be rejected. To improve the possibility of transferability, thick descriptions were provided of the phenomenon being explored, participants, setting, data collection measures, and data analysis procedures.

Dependability indicates the reliability of the results, questioning if the study were repeated, would it yield the same results? In addition to providing thorough descriptions of study

details that enable another researcher to replicate the study, strengthening dependability can also occur by leaving breadcrumbs. My "breadcrumbs" are in the form of an audit trail, a chronological record of research steps taken from the beginning to the end of the study. By using this approach, others are about to view the process, inner thoughts of the researcher, and ethical decisions made during the research study.

Confirmability refers to the degree to which the results can be verified or corroborated by others. In order to validate the research findings as the result of the experiences and the ideas of the teachers, rather than the bias of the researcher, multiple methods were employed. In addition to expressing my own positionality in the study, a peer researcher consistently checked for bias in the research design, data collection, analysis, and conclusion. Furthermore, researcher notes in the audit trail and field notes often brought awareness to possible self-bias. Confirmability was also greatly enhanced by using multiple approaches of data collection to reduce the effect of researcher bias.

By addressing credibility, transferability, dependability, and confirmability, a qualitative study gains trustworthiness in the research community. Since the researcher is the tool of data collection and analysis, there can be no perfect qualitative study. However, by using multiple sources of data and multiple methods of checks and balances, one can enhance trustworthiness for acceptance and appreciation.

Chapter 4: Results

This chapter presents the research on the changes or lack of changes in a post-standardized tested world. The chapter is divided into four sections, each addressing a specific research question. Coding for themes was individually conducted by research question; therefore, there are two themes each for research questions one, two, and four and three themes for research question two. To accurately portray the phenomenon, the beginning of each section will paint a picture of the life of teachers and students undergoing standardized testing. Once the scene has been created for the high-stakes testing environment, the differences or lack thereof in the post-standardized testing world will be addressed with emerging themes from the data.

Research Question 1: When high-stakes testing ceases in high school science classes, what happens to teacher perceptions of administrative support?

Administration in the school district falls into two categories: central and campus. Central administration, also called district-level administration, oversees every school in the district and includes the superintendent, assistant superintendents, and curriculum coordinators. In the majority of school districts, teachers have the most interaction with their curriculum coordinators when compared to other central administrative personnel. The science coordinator's role is to support classroom instruction by providing exemplary curriculum, quality professional development, and resources for each science subject at every school in the district. In Monroe Independent School District, state non-tested physics and chemistry are taught at the high schools, and state tested biology is taught at the junior high schools.

Campus administrators assist teachers and students in one school and includes principals, associate principals, and assistant principals. The role of the principal, regardless of rank, is to support classroom learning by assisting teachers in the development of skills necessary for

quality instructional practice. To identify areas in need of improvement, the campus administrators must be present in the classroom. In addition to supporting the development of teachers' skills, principals assist teachers with student discipline and classroom management to ensure the classroom is a safe environment for learning. To answer the research question, both groups of administrators were examined, and the emergent themes were *forgotten* and *professionalism*.

Theme 1: Forgotten

As a subject no longer state tested, the physics and chemistry teachers in this study experienced a large shift in focus from administrators. From being in the limelight to barely on the radar, the teachers reported feeling less of a priority to all administrators. The focus shifted to state tested subjects, such as biology and eighth grade science, and the physics and chemistry teachers seemed to be forgotten. This was exhibited through the elimination of data collection and analysis at the district and campus level, the "changing" emphasis of professional development, and the "hands-off" demeanor of district and campus administrators.

District assessment data. Accountability takes many forms in the public school system. School districts and individual school campuses often analyze data to identify areas of student weakness. During TAKS and EOC testing for physics and chemistry, the teachers were held more accountable and used various methods to assess the students' academic standing. These scores were analyzed and reported at the district level, and then schools created plans to address low-performing students. On the school campus, teachers also administered weekly quizzes over TAKS review material. The following excerpts describe the district regulation during state tested years.

> *There were benchmarks. Our scores were looked at by the science coordinator for the district, commented on, and we were observed. And we had more departmental meetings with the department chair. So yes, it was a lot more regulated.* (Laura, I4: 358)

> *We had benchmarks during EOC that were always at the end of the six weeks, and it was a big deal. We had to pull days out to let the kids do them. Sometimes, it was a couple of days to give them enough time.* (Laura, I2: 388)

With the removal of the state test for physics and chemistry, the teachers reported that the district administration eliminated data collection and analysis for the state non-tested courses. While there was discussion about the continuation of data collection and analysis "to make sure we're teaching something" (Cris, I1: 289), the plan never came to fruition. As of the 2012-2013 school year, all forms of data collection, such as benchmarks, released exams, and weekly quizzes, came to a halt for state non-tested subjects.

> *Erin (Researcher): And I know that you said the district-based assessment…*
>
> *Cris: Went out the window. I haven't heard anything this year.* (Cris, I1: 539)

Laura also reported that district assessments ceased for all state non-tested science courses.

> *We don't do benchmarks at all anymore… There was talk of maybe continuing on with them just so the district had data for the student's progress in the subjects, but then we just stopped doing them all together. And there's zero talk about benchmarks anymore.* (Laura, I2: 397)

The removal of district assessment data collection and analysis for state non-tested science subjects was just one of the measures that caused the teachers to feel forgotten.

Changes in accountability. Teachers of state tested subjects were still required to administer benchmarks and released exams for data analysis; however, the time and energy needed to create and analyze benchmark scores was no longer spent towards state non-tested subject areas. This lack of data analysis at the campus and district level bred less accountability. The teachers reported that there was no accountability with campus or district administrators to cover all of the TEKS for their subject area. Although they had every intention to cover the entire curriculum, they often fell short.

> *It's not like we aren't told what to do, but there's absolutely zero accountability for whether we do that or not. Speaking for myself and probably my colleagues, we do the best we can to get through everything. But if they were to come in and audit us and make sure that we covered everything single topic on the TEKS, we don't.* (Laura, I4: 225)

> *If I have to cut something out of the curriculum, they don't really know about it. There's not any way for them to measure that. We don't do benchmarks or anything.* (Laura, I4: 217)

Cris also reported disappearing accountability.

> *Erin: Are there any consequences right now if you don't cover material?*
>
> *Cris: No, because no one really checks. There's that much autonomy… There isn't accountability for that really cause we're not tested.* (Cris, I4: 438)

With less accountability to district and school administrators, the teachers felt they were no longer under a magnifying glass. They could subtract topics from the curriculum without consequence.

Professional development. District professional development continued to be more concentrated on high-stakes tested subject areas (Cizek, 2001); however, for physics and chemistry teachers, the change in roles from being a state tested to a state non-tested subject area caused their perspective about professional development to change considerably. When physics and chemistry were state tested, teachers spent a large amount of the school day dissecting areas of weakness in the curriculum and their own lessons. Professional development was considered relevant to their teaching because it emphasized strategies to increase test scores across the district in the tested subjects.

> *They [central administration] regulated in terms of planning [lessons that incorporated professional development strategies]. It took a lot of our planning time to plan for that test. We would actually get together in the morning before school started to try to plan out.* (Cris, I4: 211)

The district professional development continued to be concentrated on state tested subjects or strategies helping populations that struggled on the STAAR/EOC exams. The topics and strategies did not seem relevant to the participants in this study. No longer learning physics or chemistry instructional strategies, the professional development was viewed as unrelated to their current needs as educators.

> *I haven't really gotten anything out of professional development this year. We had to do this Foldable thing that was awesome for the junior highs… it was not level-appropriate for high school, even for our on-level classes. And this Foldable, it just sucked the life out of me, and my colleagues around me felt the same.* (Laura, I4: 374)

Laura's comment that the professional development was not appropriate for upper level high school students highlights her *forgotten* status. She felt that the professional development

was more focused on reaching students at the junior high, where biology and eighth grade were currently state tested. Below, she continued to discuss the same professional development and lack of support for her subject.

> *Laura: It didn't feel like it [professional development] contributed anything to what we were trying to accomplish.*
>
> *Erin: Do you feel like it was more geared toward biology and junior high students?*
>
> *Laura: Yes, because that's tested. It feels like there's a massive disconnect to what we [physics and chemistry] actually need, and what will be helpful for us… Our science coordinator's doing the best he can. I know that. I just feel like they're [central administrators] unaware. I wouldn't say they don't care… We're not a priority.*
>
> *Erin: We, as in the non-tested subjects?*
>
> *Laura: Yes. Chemistry, physics, we are not a priority.* (Laura, I4: 392)

Cris was also aware that the professional development was more focused on increasing standardized test scores in the ESL population; however, he recognized the value in enhancing student learning for specific populations in his classroom.

> *Cris: The professional development at the beginning of the year was more on focusing on ESL [English as a Second Language] kids, which is great... I think what's holding us back generally in [test] scores are our ESL kids. I think for our district, it's the one area to address. I think as a science as a whole, they're trying to do that.*
>
> *Erin: So the strategies are beneficial for you; however, they're also good for those kids that are going to be tested, that ESL population?*
>
> *Cris: There's really good techniques. Yes, [the kids] that normally don't pass it the first time and hurt our scores. That's what the intent was.* (Cris, I4: 417)

Both teachers realized that the professional development was focused on state tested subjects and improving standardized test scores. However, only one teacher was optimistic about the content.

Hands-off. When discussing administrators in the post-standardized tested world, the most prevalent finding was the declining interaction with teachers. Although both groups of administrators were described as hands-off on numerous occasions, the term had a positive or negative connotation depending on the administrator. This finding reiterates that relationships change perspective.

Central administration. In addition to receiving irrelevant professional development, the teachers also noticed that state tested subjects were receiving more time, energy, and resources from the science coordinator. Since their role and significance to the district had changed, the science coordinator's role in their lives also changed. In this segment, Cris discussed the science coordinator's shifting focus, and Laura described her feelings regarding the district's priorities, elaborating on why she felt some science subjects were more significant to central administration personnel.

> *There's obviously urgency from him [Brent, science coordinator] to work with them [biology teachers] longer or be with them. Which makes sense from his perspective, but hands-off from the district level for physics.* (Cris, I2: 290)

Laura also felt that the central administration was more focused on state tested subjects.

> *Erin: Why do you feel that way [that chemistry is no longer a priority]? Other than the professional development?*
>
> *Laura: Because it is all about biology. You talk to a junior high [biology] teacher, and the district is all about them. And they have all these resources and it just seems like*

there's a lot more resources and time and looking after that's being done at the junior high level than up here [at the high school]. I hardly see admin in here. (Laura, I4: 413)

While the science coordinator exhibited this description through refocusing his time and energy towards state tested subjects, his lack of presence and interactions during professional development and throughout the year solidified these feelings.

They're a little more hands-off. I'm talking about district administration. We just don't hear from them as much. It's the same as with the kids. We're [chemistry and physics] not the priority, or not what makes or breaks the graduation rate. (Laura, I1: 595)

Cris mentioned that he only had contact with the science coordinator at the beginning of the year.

Erin: As far as central admin, what are interactions like with Brent? Do you still hear from Brent a lot or not very much?

Cris: Actually no. We hear a lot from Brent at the beginning of the year and that's pretty much it. I think he's mostly focused on the testing. (Cris, I2: 276)

The lack of communication with the science coordinator throughout the year at the high school validated the teachers' feelings of insignificance.

Campus administration. Teachers indicated that administrators on the school campus also played a more interactive role in the daily classroom when physics and chemistry were state tested. Both teachers reported that the principals were previously in the classroom more often, a process they call a *walk-through*, ensuring that the teachers were aligning their lessons with the state standards. Observation notes support that no district or campus administrator was present in any classes.

I did have more [walk-throughs] during EOC testing. (Laura, I2: 377)

Cris felt that campus administrators were more concerned with teachers that were state tested.

> *They seem like they don't worry about us as much. I've noticed less walk-throughs… They really don't worry about you as much. They're more worried about…. people who have STAAR or end of course.* (Cris, I1: 566)

> *Cris: They're hands off. Yeah, there's definitely a lot more autonomy. Before, during testing, you definitely had a lot more administrators coming in your room to see what you're doing. Now with not testing, I have an administrator maybe once every two months.*
>
> *Erin: Whereas when you were tested, how often do you feel like you had them?*
>
> *Cris: It felt like they came like almost three times a month or sometimes when we got closer [to the state test], it felt like once a week. It was a lot. I mean I get it absolutely.* (Cris, I4: 378)

The final sentence in this exchange shows that Cris understood the purpose of the walk-throughs, to ensure teachers were doing what they needed to for student learning, and ultimately for test performance. The quote also shows a differing view of administrators at the campus level. When questioned about their campus administration versus district administrators, the teachers had a different perspective towards the intentions of each group of administrators. Although the campus administrators were similarly described as hands-off, the lack of interaction from campus administrators was perceived as a sign of professionalism.

Theme 2: Professionalism

With less accountability from central and campus administration, the teachers were no longer viewed as a means to acquire high test scores. The teachers viewed fewer classroom

interactions with campus administrators as trust bestowed upon them to fulfill their role. The conversation below depicted this phenomenon.

> *The expectations are already given to us at the beginning of the year: to be professional. Which we are.* (Cris, I2: 268)

> *They're [campus administration] leaving the rest, everything else up to you. For me, as a professional, that's great. That's what I want. Let me do what I want because I can do it... I could sit at my desk and not doing anything and I could probably get away with it. You're going to stick out here at Madison. No one does that.* (Cris, I4: 454)

Laura also expressed that the campus administrators allowed her to make decisions regarding her classroom and instruction.

> *I think my administration expects me to do my job, but I think they kind of put it in my hands to figure out what that is.* (Laura, I4: 250)

In this post-standardized world, the teachers felt that their principals viewed them as professionals and classroom authority was given to the teachers.

Freedom. The preceding quotes described a campus administration who abandoned the micromanagement of teachers. The teachers understood the expectation to be professional, and without a state test on the line, the campus administration allowed them to define *professional* and the actions that embodied that title. With less accountability, the teachers had a new sense of freedom.

> *I feel like now- I can teach now! That may sound funny, but I feel more freedom.* (Cris, I1: 242)

Laura felt free to teach in any fashion.

> *I love having the freedom to teach the way that I want to teach.* (Laura, I4: 605)

For the first time in their career, these teachers who entered the profession under state tested conditions, finally felt like they could do their jobs.

Accountability to colleagues. The state was no longer watching. The district was no longer watching. The administrators were no longer watching. The accountability had dramatically decreased and what remained, shifted from the district and state to colleagues and self. The consequence of not covering material in the curriculum created tensions among colleagues and created pressure to stay on track with the curriculum. Cris and Laura both felt responsible to their colleagues, especially since their colleagues may receive their students later in the year or in subsequent years.

> *I'm lucky to work at a school where I work with consummate professionals… There's almost like a social pressure that if you're not doing your job and you're not good for kids, or at least not trying real darn hard to be, people will start looking down on you.* (Laura, I4: 252)

Cris expressed that all of the physics teachers compete with each other professionally.

> *At our school, we're all competing with each other so we can't really slack off and you're always trying to be better, always trying to outdo each other… We're always trying to one-up each other in a professional way.* (Cris, I2: 309)

As shown in the preceding quotes, Cris and Laura emphasized the professionalism of their colleagues multiple times throughout the study and discussed holding each other to high expectations for the betterment of student learning, even without a state exam.

Accountability to self (and students). With the new sense of freedom and shift in accountability, Cris and Laura felt they were being treated as professionals; however, they also felt a consistent pressure to continually improve their own practice as an educator to enhance

student learning. Since physics was no longer state tested, Cris felt that he had more time to research activities and teaching methods to improve his instruction.

> *I'm making more of an effort on my part to research… I'll get on twitter and see what everyone else is doing or recommending… I guess I have my own professional development… I have time to actually professionally read or look at articles.* (Cris, I2: 138)

Regardless of the professional development offered by the district (and being forgotten), Cris and Laura took it upon themselves to improve as professionals. No longer state tested, each teacher had redirected time and energy to set goals for themselves every year, and "professionally developed themselves."

> *I have no excuse for not improving, so I put that pressure on me to improve.* (Cris, I2: 28)

> *[I'm] more reflective, more driven to better myself, continuously improve. It's less hectic [without state testing], so I have more time or it feels like I have more time to focus on lessons, more time to get input, collaborate.* (Cris, I5: 123)

Although Laura reported less pressure from administrators, she put pressure on herself to improve.

> *I don't feel like there's as much pressure on me [now that I'm not tested]. I put the pressure on myself to be a better teacher. I know what the problems are and I try to fix them the best way that I can, but I don't feel like there's that same urgency coming from the admin at the district level, or to some extent, at the school level.* (Laura, I4: 424)

The decline in accountability afforded the teachers more time to improve their instruction. The teachers alluded to feelings of guilty if they did not seek opportunities for growth.

Conclusion

Transitioning from a state tested to a state non-tested subject area, the teachers reported that central administration continued to focus on state tested subjects. This focus and the change in role caused the teachers to feel forgotten. Data collection and analysis were no longer necessary, and professional development and resources were no longer fixated on their needs. Although the central and campus administrators appeared to be more hands-off, the teachers viewed the lack of interaction from campus administrators to be a sign of trust and professionalism.

Once physics and chemistry were no longer under the magnifying glass at the district and campus level, Laura and Cris felt that as professionals, they could "actually teach." The little remaining accountability shifted from the state and administration to their colleagues, who held the teachers to higher expectations. Laura and Cris also had a sense of self-accountability to consistently improve as educators for the benefit of their students.

Research Question 2: When high-stakes testing ceases in high school science classes, what happens to teacher perceptions of student demeanor?

This section addresses the change in student demeanor following the removal of the high-stakes test. For the reader to gain a complete perspective of the difference in student demeanor, discussions of state tested, science students will first be described, followed by a description of students that are not state tested in science. The major themes that emerged were a *shift in the sense of community, apathy in the absences of high-stakes testing,* and *lowered expectations*.

Theme 1: Shift in the Sense of Community

The significance of relationships in the classroom cannot be overemphasized. Whether the relationship is between students or teacher and students, the interactions and community

created in a classroom environment can either magnify or inhibit student learning. For the physics and chemistry teachers in this study, the shift in sense of community resulted in increased stress and exile.

Class versus the state. During high-stakes testing, the teachers expressed that the students and teacher formed a community aimed towards the same goal, for all students to pass the state test (preferably with high scores). The students had little, if any, animosity towards the teacher because they knew he or she was just trying to help the students pass the test for graduation. Students knew that teachers had just as much at stake as they did. In this instance, the old adage "misery loves company" even applied to the classroom.

> *While the kids were terrified of the EOC, they were also really focused. They had all their arrows pointing in the same direction. They had a goal, and they knew we were all in this together.* (Laura, I1: 237)

> *[During EOC] it was all like we're in this together, kind of vibe. And the students knew that I wasn't doing it to them, that I was there to get them through it… and they were working hard because there was a goal there.* (Laura, I2: 26)

Cris also found his students to be more motivated when teaching a course tied to a state exam.

> *I think that [state test] was the big motivator…. That's why they were like, "I don't want to deal with this, let me just pass it, and get my stuff in."* (Cris, I3: 75)

In the high-stakes, pressurized environment, the classroom was a community focused on an attainable goal with a "class versus the state" mentality. The teacher was viewed by the students as the heart and soul of the class, their guide on the journey to success. Students and teacher were "all in this sinking ship together" (Laura, I1: 498).

Student versus teacher. Amid removal of the high-stakes system, students' perspectives were altered and the sense of community transformed. Without the attainable goal of passing the state exam, the students no longer viewed Laura as their guide to success. She was now the "bad guy" responsible for student grades.

> *Now [that they are no longer state tested], it really does feel like it's more me against them, and I don't want that*. (Laura, I1: 501)

> *Laura: All the weight falls on me, on whether or not this kid gets credit to graduate…. There have been a couple times where it's come down to me. And it's the last day of school and I'm sitting with a kid just being like, "Tell me anything you know about chemistry. Just show me anything." Because otherwise, I'm the hard ass that didn't let a kid get a high school diploma. When you have a test, you're in it together. When you don't, it's all on you. You're the bad guy.*
>
> *Erin: And you don't have the backing of a test?*
>
> *Laura: Right. You're the make or break if you don't have that test, and that's a lot pressure.* (Laura, I5: 289)

Cris also found it challenging to motivate students to learn. During observations, students would often appear defiant towards Cris. Observation notes recorded an incident when Cris asked students to get their notes out. One student responded, "You can't make me." During the same observation, Cris constantly had to redirect the students back to the lesson. At the end of the lesson when Cris asked, "So, why do you care about lenses?", numerous students responded in unison with, "We don't." These disrespectful actions demonstrated a "student versus teacher" mentality.

Giving versus earning. Laura also noticed that many students in the post-standardized tested world expected her to "give" them the grade to pass instead of them earning a passing grade. Observation notes document an event in Laura's classroom that depicted this behavior. Towards the end of chemistry class, the students were discussing the following trimester. One student proclaimed to Laura, "I'll only come back to see you if you choose to pass me." These words put all of the responsibility of the student passing the class onto Laura. There was no mention of earning grades or putting in the work necessary to acquire good grades. Furthermore, the following two passages describe this phenomenon in the teacher's own words.

> *There's no test at the end of this. It's strictly, "Are you going to give me the credit for this class or not for graduation?"* (Laura, I1: 468)

> *Because I am one of the people that is a judge-jury-executioner… Rather than the state saying, "You didn't get this credit. You don't get to graduate."* (Laura, I1: 505)

This sense of entitlement increased tremendously with the removal of the state exam. Without the state dictating graduation status, many students expected the teacher to adjust grades because the teacher held the authority.

Theme 2: Apathy in the Absence of High-Stakes Testing

In an ever-changing society with less value placed on education, motivation to learn and student apathy are major areas of concern. When Cris and Laura entered the teaching profession during high-stakes testing, apathy was a small issue to address with a handful of students. However, following the removal of the standardized exam, the teachers saw major changes in student motivation and apathy.

High-stakes motivation. State tested chemistry and physics students were much more motivated to learn content because there was a goal at the end of the year. The goal of passing the state test was a short-term, attainable goal that affected their graduation status. Cris felt that state tested students cared more about the course because there were consequences for those students that did not pass the state exam.

> *Erin: Do you feel students cared more during TAKS?*
>
> *Cris: That's what it seems. Yes, and the reason is because there was an incentive and there was a consequence because if they didn't pass those [district-based assessments], then they would have to come after school for TAKS review sessions.* (Cris, I1: 293)

The following excerpts describe TAKS or EOC tested students in Laura's class.

> *They [EOC tested students] were probably my most motivated regular [on-level] students. I don't know if they would have been that way if there hadn't been a big test looming over their head. And I can certainly see the difference [in the students now].* (Laura, I2: 17)

> *My students, when they were tested, they had a point, they had a goal…. Man, you better believe there weren't very many zeros in my grade book.* (Laura, I5: 118)

Laura made a point to discuss the few zeros in her grade book during state tested years. This suggests that students who were EOC or TAKS tested were turning in their classwork and homework. They saw value in doing activities that would help them learn the material necessary to pass the state exam.

No-stakes apathy. Drastic changes in student motivation occurred with the removal of the physics and chemistry state tests. Without a goal of passing the high-stakes test, teachers

relied on the student's intrinsic motivation for submitting assignments and student learning. Unfortunately, students raised in a high-pressure, high-stakes system are typically conditioned to think that standardized testing is the most significant event in their education.

> *I think they're still used to being terrified of the high-stakes testing, and when they don't have it, they feel like they can kind of just slack off.* (Cris, I2: 338)

Laura also noticed a large increase in apathy.

> *Laura: [During testing], there were certainly kids that were apathetic, but they were few and far between.*
>
> *Erin: What percentage of kids, when you were tested, would you say were apathetic?*
>
> *Laura: Out of 100 kids, maybe two or three.*
>
> *Erin: What about now?*
>
> *Laura: Out of 100 kids, 20%.* (Laura, I4: 538)

To the chagrin of their physics and chemistry teacher, many state non-tested students exhibited apathetic behavior daily. Apathy for physics or chemistry was displayed in the following ways: the need for justification to learn, not turning in work, and showing precedence for state tested subjects.

Why learn? During state tested years, students would occasionally ask "'Why are we learning this?', but it was easily shut down" (Laura, I5: 123). This type of behavior was quickly dissolved because they were reminded of the end goal. In the post-standardized tested world, the teachers reported that this question was asked constantly. Observer notes provided evidence that this question was asked during almost every observation. During observation six, a student asked, "Why do we need to learn about light? Why can't we learn about waffles?" In the subsequent observation (seven), a student questioned, "It's Monday. Why do we have to learn on

Monday?" The following is the post-observation conference regarding the student who wanted to learn about waffles.

> *Erin: I hear him ask, "Why do I need to know about light?" Can you tell me a little bit about that interaction?*
>
> *Laura: Yea. I give him my rote response, which is that the kids may not use a lot of the stuff that we learn in chemistry directly, but it is full of abstract concepts that do stretch their brains a little and teaches them how to think. I also tell them that if that's not enough, that chemistry is a required course for them to get their high school diploma from the state of Texas. And so, they will use that high school diploma bare minimum.*
>
> *Erin: And how often do you feel like you give that speech?*
>
> *Laura: It's definitely a few times a week.*
>
> *Erin: Was it about the same when you were [state]testing?*
>
> *Laura: I did, but not as much… The immediate goal [state test] was closer to them than graduating high school when they are sophomores.* (Laura, POC6: 3)

As demonstrated above, goals were significant to students, and the closer the goal, the greater the motivation. Proximate goals of passing a state exam to a sophomore were more imminent than the overall goal of graduating high school.

Missing work. Without motivation to learn for an end goal (standardized exam), apathy swiftly set into many students. Between the 2012-2013 and 2015-2016 school years, both teachers saw a heavy decline in the amount of student work turned in. This resulted in zeros in the grade book, and ultimately, higher failure rates.

> *We've all got issues with zeros in our on-level classes. Just turning work in in general.* (Laura, POC7: 68)

Cris felt like he needed to constantly "hound" students to turn in work.

> *Cris: With general physics classes, it's putting that carrot at the end of the stick and trying to get them motivated and it's constantly being on them is what I've realized.*
>
> *Erin: You constantly have to be on them for?*
>
> *Cris: Getting work in.* (Cris, I3: 49)

Observation notes documented each teacher addressing missing work on numerous occasions. Teachers would often highlight zeros [missing work] on the posted grade sheet every week. The grade sheets often appeared yellow or pink due to the overwhelming amount of missing work.

State tested subject precedence. The efforts to pass the mathematics standardized exam spilled over into chemistry and physics. Both teachers reported an increase in the amount of homework being done in their classes for state tested subjects, such as mathematics. This redirected focus was apparent during observations in both classrooms. Students were often seen working on math homework during science class. The following is a researcher note made during an observation in Laura's classroom:

> *'As I walk around, some students are working on math homework instead.'* (Laura, OBS7)

The succeeding excerpt describes how Cris was feeling at the end of the trimester.

> *I'm anxious because there are kids that haven't turned in work… There's not really that stress. There's no test, so they aren't really motivated to get stuff done… Since it's not tested, they'll focus on other classes that are.* (Cris, I3: 3)

Students choosing to work on homework for state tested courses instead of completing their science assignments reiterated that their focus was on courses tied to state exams. Most students found state tested courses more significant to their academic success.

Four-letter word. Teachers also noticed changes in how they approached apathy and the subject of testing. When teaching state tested subjects, Cris would purposely not use the word *test* in the classroom for fear that it would stress the students out. After the state test was removed, he purposely used the word *test* to create a sense of urgency and motivation in the students.

> *Cris: To motivate them, I'm saying more often that, "This is going to be on a test," because they think they can zone out… And I never liked to say that before because I didn't want to stress them out. But now, I have to say that to motivate them. Like, "Hey, this is important!"*
>
> *Erin: So you're saying back in TAKS days, you didn't mention testing too much because…*
>
> *Cris: They knew it was there, and they knew it was coming… I didn't want to stress them out. Now, I need to stress them out, or I need to motivate them. We say "test."*
>
> (Cris, I2: 358)

Cris's change in behavior demonstrates the degree of apathy in his classroom. He had resorted to measures he used to avoid in an attempt to get his students to perform.

Theme 3: Lowered Expectations

Lower expectations often translate to higher grades for students (Jackson, 1985). In an attempt to decrease their failure rates, the teachers admittedly afforded students easier exams, time to do "homework" in class, ever-changing deadlines, and multiple grade-increasing opportunities that they would not have allowed if they were still teaching a state tested subject. In the following passage, Laura discusses the science department "lowering the bar" to address apathy and failure rates.

> *Because there isn't any accountability for us or for the kids, we have lowered the standards pretty significantly. I don't particularly like it, but it's been decided on as a department that that's what we need to do to make sure that we don't have super high failure rates.* (Laura, I4: 458)

Although Laura felt lowering the bar was not the right thing to do for student success, she complied since it was a departmental decision. By lowering the expectations, more students would pass and failure rates would remain acceptable to the campus administration. This act showed the desperation of the chemistry teachers in addressing student apathy.

Questioning. One way the chemistry teachers lowered their expectations was through their level of questioning. During a post-observation conference, Laura was questioned about the test she was administering. The test was different than the one given to students during EOC tested years in the areas of difficulty and additional help. In an attempt to increase test scores during TAKS and EOC, upper level science teachers were given a professional development over levels of test questioning. Test questions were assigned a level 1, 2, 3, or 4. A level 1 question was considerably easy and a level 4 was extremely difficult. To prepare students for the state exam, teachers were to proportion the level of questions on their own exams to mirror those on the state exam. The following is the transcript from the post-observation conference regarding the "new" test.

> *Erin: Are you using the same test that you were using [when state tested]?*
>
> *Laura: No…We adjust them to fit how that class is doing that year. I would say that we used to make sure that we had a certain percentage of level 1, level 2, level 3, level 4 questions to get them better prepped for the EOC… Well, I should say we do fewer of those level 4 questions, at least in on- level.* (Laura, POC4: 1)

In addition to creating easier tests, the chemistry teachers also decided to allow students to look at their periodic table notes towards the end of the test. Like Laura, Cris also adjusted tests to make them easier for students.

> *Erin: And I noticed that you mentioned that you were going to give them the variables on the board [for the test]?*
>
> *Cris: Yes, I did.*
>
> *Erin: Did you do that when you were tested?*
>
> *Cris: No! I didn't. I wanted to be more authentic to the test.* (Cris, POC1: 46)

The purpose of adjusting the exams was to increase the test average and ultimately, decrease the failure rates. Although the accountability that accompanied standardized test scores had diminished, the teachers still felt responsible for producing high student passing rates for their courses.

The end of homework. The teachers indicated they lowered their expectations on class work, allowing students to complete it during class, since they assumed most students would not return it. Although Laura ended up getting grades for many assignments this way, it slowed down the pacing of the curriculum to the extent that she did not cover all of the topics and did not get to engage the students in exploratory activities.

> *I have to trade one for the other… If I assign them homework outside of class, it will not get done. I'll have a bunch of zeros in the grade book and a bunch of people will be failing. If I let them do it in class, and I tell them you have to turn this in and check it with me… I've found a lot of success with that, but it takes a long time.* (Laura, I5: 102)

Cris also allowed students to do homework during instructional class time.

> *They have time to do homework in class so I can help them out with that.* (Cris, I2: 172)

Student apathy was so rampant that the teachers felt the only way to receive assignments was to have students work on them during instructional time. While this did slow down curricular pacing, it also allowed the teachers to address misconceptions to the entire class as necessary.

Ever-changing deadlines. Although the physics teachers, as a team, did not seem to consciously lower the bar, Cris lowered his standards in other areas. In an attempt to raise student averages, he abandoned his own late work policy, allowing students to turn it in until the last day of the trimester. Observation notes documented several extending deadlines.

> *At the very end, I gave up and told them you have until the last day of school to get your stuff in. So I was taking all this late work. And that actually helped a lot of people pass.* (Cris, I6: 112)

> *We had two assignments this past week that I am letting them turn in. Today is the last day. They were due last week*. (Cris, I5: 117)

Out of desperation for lower failure rates, Cris consistently extended deadlines for students to turn in classwork. Consequently, students began to expect extensions for every assignment in Cris's class.

Opportunities. To offset the apathy and maintain failure rates at a percentage acceptable to the campus administration, the teachers offered more opportunities than ever before for students to raise their grades. These opportunities included notebook grades (also called a "fluff grade" by Laura), extra credit, retesting, submitting late work, and redoing assignments. Observation notes showed that Laura and Cris discussed opportunities for grade improvement with their students on numerous occasions. As mentioned previously, teachers often highlighted the zeros on their posted grade sheets and included information about opportunities for grade

enhancement. The following is a quote from Laura during an observation as she points to the grade sheet.

> *"There is a lot of pink [highlighted zeros]. You do not want to repeat Chem A for the second or third time. If you attend a 30-minute tutorial, I will give you half credit back. There's a direct correlation between missing daily work and not passing the class. Doing daily work helps you prepare for the test."* (Laura, OBS7)

Following this observation, Laura was asked about this incident.

> *I write that up there as much as for documentation as anything [points to grades and remarks about tutorials]. And then, every week that it's an option. It's something I can tell parents, "Look, they've got these zeros. It's not because I'm not making the time or effort. They're just being a bum not doing their work."* (Laura, POC7: 70)

The many opportunities afforded to students, yet not taken, demonstrated the level of student apathy present in a post-standardized tested world. The teachers desperately wanted students to succeed, but as Laura put so eloquently, "I can lead a horse to water, but I cannot make them drink. I can't make it learn chemistry" (Laura I3: 26).

Conclusion

This evidence suggests that the student population followed suit with the state, and shifted focus to state tested subjects. Once the state test was removed, the motivation to learn and turn in work in chemistry and physics dwindled. Students found significance in state tested subjects because passing the standardized exam was needed for graduation. To address the overwhelming apathy and in an attempt to decrease the failure rate, the teachers lowered their standards and started offering numerous opportunities for students to increase their grades.

Research Question 3: When high-stakes testing ceases in high school science classes, what happens to teacher perceptions of the curriculum?

This section will address the changes teachers made to the curriculum, including curricular pace and coverage, following the removal of the state test for physics and chemistry. Teacher descriptions will be used to thoroughly paint a picture of the curriculum pace and coverage when physics and chemistry were state tested followed by descriptions of curriculum in a post-standardized tested world. The emergent themes for this research question are *time* and *curiosity*.

Theme 1: Time

When exploring the changes in curriculum from a standardized to a post-standardized tested world, the word continually verbalized was *time*. The teachers explained the need to rush through the curriculum with no time to slow down for student understanding when state tested and then described no longer having time to cover all of the curriculum when not state tested. In either circumstance, time and the management of time played a large role in the selection and depth of content the students were taught.

Rushed curriculum (standardized testing). To ensure students had exposure to every TEKS in their subject area prior to the administration of the state test, teachers kept a rigid classroom schedule to adhere to the district's scope and sequence. Set by the curriculum coordinator, the scope and sequence listed the amount of days allotted to teach a particular topic in a subject area. It was structured to ensure every TEKS was covered prior to the state exam. Following the district's strict schedule meant planned lessons were rarely adjusted. Students were expected to attend tutorials if they didn't understand content fully, regardless the number of students in the class who were confused about a particular topic. There was no time to slow

down and no time for repetition. Teachers had a goal to cover the entire curriculum, and students were responsible for their own learning. Laura and Chris describe curriculum pacing during high-stakes testing in the following excerpts.

> *[It was] way too fast for chemistry! I'd say since I started teaching, the pacing has been, for your regular, standard kid, way too fast for where their abilities are. Because for chemistry right now all the way to my first year teaching with TAKS, it is one topic a day… There aren't a whole lot of TEKS that you get more than a day to cover because there is so much. And even then, you don't get to do that repetition.* (Laura, I1: 86)

Cris felt that the rushed curriculum didn't allow for in-depth instruction.

> *It was very rushed to cover the TEKS for the actual course itself. I had to cut back and I couldn't go more in depth with rich material because I was doing the [TAKS] quick reviews. Super fast paced. It definitely took away from it [physics].* (Cris, I1: 95)

> *Cris: When we did testing, I did cover quantum, but it was very compressed. Like, here you go. Here's three days to cover it. Alright, let's take the test.*
>
> *Erin: Check in the box.* (Cris, I2: 202)

By the time the state tests were administered, students had exposure to every TEKS. They may not understand every topic, but the teachers had put a "check in the box." The teachers often felt conflicted about how to handle the pace of the curriculum. If they slowed down, students who were excelling at the fast pace would not see all of the content and ultimately, select incorrect answers on the test because they had not been taught all of the TEKS. If they continued at the fast pace needed to complete the curriculum prior to the test, then students who learned at a slower pace would also be left behind. It was a no-win situation for all parties. The

following excerpts describe the teachers' frustrations of trying to do what is right for every child, yet not doing right by any.

> *They [instructors in preparatory programs] always teach you that you teach the kids, do some kind of formative assessment, what they don't understand, you go back and reteach it. Well, what if there is no time to reteach it? Do you reteach that topic and then end up not even touching the other one? That's where some of the frustration came from too. You either have to drop one [topic] all together or leave behind another topic. Well you know, "I covered it," but you know there are kids that fell off the bus along the way. And you don't know what to do about it.* (Laura, I1: 92)

> *I know that's terrible [choosing to move to the next topic when knowing students do not understand the current topic], but it's either... I figured I did teach it, I know I taught it. I hit that as hard as I possibly could versus just straight up not mentioning something altogether.* (Laura, I1: 109)

Cris felt he "touched" on the TEKS, rather than covering them.

> *[During state testing], in physics, we covered all the TEKS, but to define "covering" would be very limiting… during TAKS, it felt like I touched on it more than I covered it. Does that make sense? Because I felt like I didn't spend enough time as I should have, but I still covered it.* (Cris, I1: 344)

Both teachers felt they were not adhering to measures that advocated effective student learning; however, they had no choice. Their task was to cover the entire curriculum prior to the administration of the standardized exam.

Cutting curriculum (post-standardized testing). No longer being state tested had its perks! Without the pressure of the state test, the teachers felt they could gauge student learning and adjust lessons to student needs. Lessons that used to take one day during state testing were taking two to three days, allowing students more time to process and understand information. Laura and Cris both reported slowing down to address topics that the students did not understand.

> *I notice it when the kids don't get it. I notice it when they're nodding their head and saying, "Yes, I get it." "Do you really? No, you don't. Ask me questions." I notice it and with EOC I couldn't slow down because I would cheat kids that needed to see all the material because they would do something with it. I guess now I feel a lot… I feel like I'm doing closer to my heart's work with the kids when there's not a test. When I know it's right.* (Laura, I3: 163)

Cris also reported having more time to cover topics.

> *It depends on the relationship with the class and what's the content and how they feel. Like, do I need to go back and [re]teach it? Or are they taking too long on a subject? What I've noticed so far, on an average is, I have more time to spend longer on the content.* (Cris, I2: 156)

Although each teacher strived to complete the curriculum by the end of the year, they often ended up cutting it short. Spending more time focusing on student understanding and allowing time for homework in class to offset apathy became the priority**.** In the passage below, Laura admitted that although she and her colleagues strived to cover the entire curriculum, it rarely happened.

> *We have to cut some of those things. For me, I prioritize it with… Is this going to hit them later on? Like, can they afford to not know this when they go into physics, or whatever their senior year science is? And I will cut those things.* (Laura, I4: 228)

Cris realized it was difficult balancing the extra time afforded after state testing was removed and covering the entire curriculum. With the removal of the test preparation activities (which consumed 75 minutes of instructional time per week), Cris had more class time to address physics content. He took longer on particular units for student understanding or reteaching; however, he still felt rushed to cover the curriculum set by the district, even though there was no state exam.

> *What I realized about this trimester for me was I was spending too much time on a topic than I normally should. For example, electricity… I'd stretch it out like an extra week. I'd stretch topics out more than I usually do. Which is not a bad thing, but any time you stretch something, it takes away from something else*. (Cris, I3: 26)

> *Cris: I want to try putting in a unit project again. I didn't get to do it for this last six weeks, but I want to do it for the next six weeks.*
>
> *Erin: Why were you unable to do it this past [winter] trimester?*
>
> *Cris: Because I expanded the waves too long.* (Cris, I3: 221)

The same thing happened to Cris in the spring trimester. Similarly, Laura also expressed difficulty in time management and covering the curriculum.

> *I'm kind of hard-pressed [for time] as it is. But then again, I'm also spending time trying to reiterate or having to reexplain concepts. So, I'm trying to figure out what would be the best approach, the most efficient approach.* (Laura, I6: 63)

Without the accountability to the district, the teachers were no longer following the scope and sequence. In the passage below, Laura mentions that all of the chemistry teachers cut thermodynamics from the curriculum. She also admits that if it had been a state tested year, she would have found a way to cover the information.

> *This year, across the board, all the chemistry teachers cut thermo. We can't teach thermo chemistry. There's absolutely zero time for it. But if I had to do that during the testing year, I would've been a mess. I would've found a way to get it in. I'm not as stressed about cutting that right now.* (Laura, I4: 288)

Ironically, the physics teachers also cut thermodynamics the same year.

> *Cris: We covered everything except the thermodynamics… We spent most of the tri[mester] focusing on electricity more, expanding time on that, and light and optics.*
>
> *Erin: When you were a tested subject, did you get through the thermodynamics?*
>
> *Cris: From what I remember, yes. And that's because we cut back on other parts, though.*
>
> (Cris, I5: 3)

The faster pace set to complete the curriculum for state testing made students more responsible for their own learning. Without urgency to learn outside of the classroom, students took advantage of class time, knowing that Laura and Chris would give them more time to complete assignments than necessarily needed. In fact, both teachers reported fewer students in tutorials compared to state tested years since there was additional time in class to address misconceptions and confusion.

Theme 2: Curiosity

From infancy, humans have a natural tendency to be curious about the world around them. Although curiosity is a significant component of scientific learning, it is not always valued

in the learning process. The pressure associated with high-stakes testing often caused teachers to only focus on topics necessary for high test scores; however, the removal of the exam changed the way the teachers approached student interests.

Curiosity killed the cat (standardized testing). During state tested years, every second of class time was devoted to covering the TEKS needed to pass the TAKS or EOC. Laura and Cris realized the importance of "feeding student curiosity"; however the pressure of the state exam often caused them to avoid students' interests in exchange for predicted test topics. The following excerpts described the teachers' frustrations and internal struggles about doing what was best for their students.

> *With TAKS, it was very, "Here is my lesson plan, and I have to stick with this." I can't get off task.* (Cris, I3: 165)

Although Laura wanted to discuss non-tested topics students found interesting, she felt it was in the best interest of the students to focus solely on tested topics.

> *I can't talk about cold fusion and nuclear chemistry, those interesting questions they ask, because at the end of the day, that's not what they were being tested on.* (Laura, I1: 80)

> *They were legitimately leaning forward, asking questions, thinking about it, interested. And the sad thing about the EOC, I could not do that. Nuclear chemistry was on that test, but a lot of those questions they want to know weren't.* (Laura, I1: 412)

Instead of denouncing the students' questions, Laura and Cris would ask the students to come after school to discuss interesting science topics not covered in the curriculum. Of course, very few students actually came by to discuss science after school. Laura even mentioned that she noticed a decline in student questions overtime.

Laura: I would explicitly say, "Write that question down and you can ask me before or after class."

Erin: But throughout the tri[mester], you ended up saying that less and less.

Laura: Yea! Because of course they- I would have been happy to address it, but, "Hey, stay after class and we'll talk about that chemistry question," and they just go, "Oh, I'm just not going to get it answered." (Laura, POC3: 42)

Cris also asked students to come after school to discuss non-tested science topics.

Erin: So, you would typically cut them off and say. What would you say then?

Cris: I would say, "Talk to me afterschool. Can we talk about this later on?" (Cris, POC3: 7)

Curricular decisions to only concentrate on predicted test topics and the avoidance of subjects not in the curriculum were not good for student learning; however, covering all the TEKS at high capacity was nonnegotiable. Continuing to plow through curriculum although the majority of the class did not understand concepts and dodging student's curiosity questions often negated Laura's ethics and teaching philosophy. The following excerpts describe her internal struggle.

I want to feed that curiosity. They do ask questions and I don't feel like I'm doing what I'm supposed to do as an educator… To me it's not ethical to say, I can't answer that because that's not one of the TEKS. (Laura, I2: 71)

I want to sit there and reinforce, but I can't. I have to move on to another calculation, and they've got to know how to do it at level one million on the EOC test. And for the

> *regular, average, run-of-the-mill kid, it's hard for them to maintain from one day to another, let alone to May.* (Laura, I1: 263)

> *If I had gotten hammered again, the third year, with that [state testing]. That would have discouraged me from continuing in the career.* (Laura, I2: 97)

As demonstrated by the previous excerpt, the frustration that Laura experienced due to conflicting ethics and the pressure for high test scores often caused her to question her future in education.

Curiosity instilled the cat (post-standardized testing). Although neither teacher completed the entire curriculum once they were no longer state tested, Laura and Cris did report that they were able to go beyond what the curriculum required to address topics that interested their students. By engaging these topics and having time to answer the students' curiosity questions, the teachers felt that they contributed more to the education of their students and the field of science. Laura and Chris felt that they could pique students' interests in science.

> *I'm able to implement newer things that come out [since I'm not state tested]. I can talk about things that come out.* (Cris, I3: 163)

> *Basically, it is the same content, except expanded more. So, I can dive in deeper. In thermodynamics, I could actually spend more than three days on it, and we could spend two weeks on it if we wanted to.* (Cris, I1: 315)

Laura felt she had time to answer students' curiosity questions.

> *If someone asks a question and there's buy-in from the class, I can kind of sell science a little bit to them and get them into a topic whenever I have that opportunity. Even if that*

means I have to slow down for ten minutes to get their buy-in, I can take time for that. (Laura, I2: 66)

With these kids, I've got time to sell them on science in the classroom, and I can get them invested more easily. I can answer those curiosity questions. (Laura, I3: 198)

In the post-standardized tested world, the students had their curiosity questions answered; thus, the class tended to ask more thought-provoking questions, leading to increased student interest. Researcher notes taken during observation three in Laura's classroom cited students asking questions about the possibility of non-carbon organisms. Observation notes also documented physics students asking numerous questions about electricity in Cris's classroom.

'Students seem more interested in electricity than any other topic. They are asking lots of questions.' (Cris, OBS 14)

Following the lesson, Cris was asked to comment about student interest.

Erin: I noticed the kids had lots of questions during this lecture about TV. Have kids always asked this many questions? In this unit?

Cris: Well, now we have more time. I know I'm tying into the testing, but now I can allow those questions to draw out. Kinda pull, pull, pull. Whereas before, I would limit it and be more controlled with the questions. (Cris, POC14: 7)

In addition to answering students' curiosity questions, Cris knew the importance of making content relevant to students. No longer constricted by the standardized test, he made more of an effort to make physics more relatable to the students' lives. The follow excerpt describes how Cris made his classroom more student-friendly.

> *What I've noticed now is that I'm trying to make more real world connections than before where I just gave them the lesson, lab, move on… next one. So, I try to incorporate more real stuff like NASA.* (Cris, POC12: 29)

> *How's it relative? And that depends on the kids. I'll scare them with something like a solar flare knocks out their cell phones, and they freak out… And because of that, I can bring an article or show a video… a longer video that's more related to them and ties into the lesson.* (Cris, I1: 496)

Observation notes documented that Cris consistently tied the curriculum to real-world experiences. By incorporating "the familiar," the students appeared more engaged and considered the topic more significant to their lives.

Conclusion

Curriculum pacing and the amount of curriculum covered have definitely changed since the removal of high-stakes testing. During high-stakes testing, teachers rushed to cover the entire curriculum to increase the odds of student success on the test, although they were aware these actions were not good for student learning. With the removal of the state test, teachers felt they were doing what was best for their students, which was slowing down the pace of the course to address student needs and interests. Curiosity became a valuable component of learning in their classrooms, and although the teachers did not cover as much curriculum as they did when they were state tested, they felt better knowing students gained knowledge and possibly a love of science.

Research Question 4: When high-stakes testing ceases in high school science classes, what happens to teacher perceptions of their instructional practices?

Teaching subjects no longer state tested, the teachers had less accountability and the option to alter their instructional practices. Entering their educational careers during high-stakes testing, both teachers admitted that their instructional practices were greatly altered by the pressure of state testing and the influence of their colleagues. The emerging themes for this section are *mentor influence* and *the continuation of teacher-centered instruction.*

Theme 1: Mentor Influence

In this high-stakes environment where uniformity was encouraged, teachers communicated and collaborated daily. As new teachers teaching a state tested subject, Laura and Cris reported that they looked to mentors and colleagues for test preparation and guidance on how to teach their subject. The significance of what their mentors taught them cannot be overlooked. Teachers learn through experience, often modeling the methods of their mentors. The following excerpts describe the teachers' experiences at Madison High with test preparation and the search for guidance from mentors regarding teaching methods.

> *I was still trying to learn the expectations because they [the State Board of Education] give you the standards, but you never know how they're going to ask it. There were some veterans that knew exactly what they were going to do, and I was still learning*. (Laura, I1: 41)

> *Mary [my former teacher and mentor] made a huge impact on me, so I need to be like her.* (Laura, I2: 498)

Like Laura, Cris also followed veteran teachers and looked to a mentor for guidance.

> *Cris: I went with what other teachers were using, so I can do what they were doing… it was a tried and true method that they had used, and I just adopted it as my own.*
>
> *Erin: Would you say that your teaching methods were actually modeled by whoever was helping you out?*
>
> *Cris: Most definitely. When I came in, the test scores were great compared to the rest of the state. I was like, " I'm not going to mess with that. I'm going to do whatever they're doing."* (Cris, I4: 253)

> *The other physics teacher would tell me certain things to cut out because she had a pacing system already that worked.* (Cris, I1: 104)

The preceding quotes show that as teachers new to the profession, Cris and Laura often looked for guidance and help when they entered the school system. While they came with ideas of what education should look like, those ideas crumbled the second the pressure of the state test became a reality. In fact, in many instances, teachers will follow exactly what their mentors do in class. When Cris transitioned into teaching physics, he used a mentor to provide guidance and resources, and he mirrored her activities, lessons, and pacing in his own classes.

> *I did adopt Ms. Harrison's calendar… and followed it to the tee. I didn't mess with it or add anything because I didn't know what I was doing.* (Cris, I4: 357)

Because Cris had never taught physics, he implemented his mentor's instructional practices and pacing. Ms. Harrison had taught physics for many years; therefore, Cris assumed that she was using best practices for teaching that subject.

Theme 2: Continuation of Teacher-Centered Instruction

During interviews, the teachers were asked to use five words that described themselves while teaching a state tested subject and five words to describe themselves once they were no longer state tested. Teaching a state tested course, Laura described herself as "structured, focused, rigid, demanding, and impersonal." With the removal of the state test, she described herself as "fun, understanding, flexible, compassionate, and engaging." Being a state tested teacher, Cris described himself as "stressed, anxious, and short-tempered." As a state non-tested teacher, he described himself as "reflective, carefree, collaborative, and creative." The 180-degree turn around in the teachers' descriptions of themselves is due to a newfound freedom and subsequently, the ability to teach however they'd like. To understand how the teachers had altered their instruction, it is imperative to first understand their restricted teaching practices.

Restricted teaching (standardized testing). The TAKS for tenth and eleventh graders was an accumulation of biology, chemistry, and physics concepts. To ensure students were prepared for the test, the school had a system for test preparation for science, and all teachers were expected to follow it. Every science teacher would spend approximately 15 minutes on topics that did not specifically pertain to his/her course. For instance, physics courses would review biology and chemistry, while chemistry courses would review biology and physics. These mini-lessons occurred four days a week, and students would have a quiz on Friday. The scores of the quizzes would then be reported to the science department head. In the following passage, Laura describes the beginning of a typical day when teaching a state tested subject.

> *On a typical day, we would start with a 10- or 15-minute warm-up activity where the kids would go over some topic that would be tested on TAKS… It was always a little bit weird because the TAKS review would not usually have anything at all to do with what we were*

> *teaching that day [in chemistry]. We would go over phylums and kingdoms and then, "Okay kids, now let's balance this chemical reaction." It was hard for me to switch my brain over, so I'm sure it was hard for the kids too.* (Laura, I1: 7)

After test preparation, Laura would then begin the chemistry lesson.

> *Laura: Typically, I would teach them some kind of conceptual thing. We might do like a short activity, like table talk or a lab… Some days, I would teach them an equation and that would take all class. That would be me showing them how to do it, and them doing some of the practice problems… Then, there would probably be some kind of worksheet where they would practice the problems and we would go over it the next day.*
>
> *Erin: So, as far as labs go, what percentage do you think you did during those days [during state testing]?*
>
> *Laura: Definitely not as much as I should have…Probably like 20 or 25%. It was at least one a week, but I was lucky if I got two in.* (Laura, I1: 51)

Cris also adhered to the mandatory TAKS reviews every day during state tested years. The following exchange describes Cris's day when he was state tested. Like Laura, he also expressed a lack of exploration in his lessons.

> *Erin: After the TAKS quick reviews, what kind of activities did you do in your lesson?*
>
> *Cris: There were demos arranged, Foldables…. different strategies, kind of tying in those TEKS. That first year, I really didn't have a science classroom, so I didn't really [do any labs]. It was hard for me to do labs in general, but it was almost prepping for two lessons within the same class period. So I felt pressured to pay more attention to TAKS instead of the actual lesson itself.* (Cris, I1: 44)

To adequately prepare their students to achieve passing (and preferably high) scores on the state exam, Cris and Laura focused an enormous amount of instructional time towards test preparation. The amount of time test preparation consumed during a class period significantly decreased the amount of instructional time actually spent on their specific subject.

Set free (post-standardized testing). No longer state tested or accountable to the district, both teachers felt the freedom to teach in any fashion they desired; however, only one proclaimed major changes in instructional practice. Laura hadn't changed her instructional practice and when asked the differences in lessons between state tested years and state non-tested years, she admitted that the only change to her lesson was an increase in the amount of time to cover the topic. The lessons were the same.

> *They [the state] took away the EOC, but the TEKS didn't change, so… how I ran my class didn't change a whole ton.* (Laura, I1: 331)

After an observation, when asked to describe a typical day teaching a state non-tested subject, Laura responded with the following.

> *Typically, I actually do a lot more direct teach than this. They hate direct teach, but it works for most of them because they're used to it… They prefer to watch me just fill them in [fill-in-the-blank notes] and work problems. So, that's how I probably teach 80% of the time.* (Laura, I2: 122)

In fact, this description mirrors researcher notes from several observations. Laura would fill in notes on the document camera, and then the students would work problems on a worksheet. Other than occasional banter, the information was transmitted directly from teacher to student.

On a positive note, although Laura had not altered her lessons or methods, she did report that she was more concerned with students gaining and retaining conceptual knowledge at the completion of her chemistry course. Hence, she started focusing on the big picture and omitted detailed information the average chemistry student may no longer need to know. This caused her to feel better about the job she was doing as an educator.

Erin: So you feel better as a whole? Ethically?

Laura: Yes. Which may not necessarily be reflected in black and white test scores because sometimes that means that I cut out TEKS. Because I know that it's more important that they have a solid foundation. (Laura, I3: 169)

I can do my job more, honestly. I have less pressure rather than just keeping the bus trucking, while kids fall off left and right. (Laura, I2: 52)

The additional time in class given for gaining conceptual knowledge and doing homework often meant that students did not get the opportunity to engage in activities, labs, and projects. Laura felt it more significant to transmit facts to students in the notes and worksheets, rather than engage in activities that allowed student exploration. The following passage describes Laura's irritation with crafting creative activities and labs that went unused.

I have labs planned and set up in the back… There have been things that I've set up, that I've come up with, that I've got the materials to do and set up in the back lab, and we can't do it because it's taking the kids a little bit longer to understand the concept. Yea, I'm wanting to do more labs, but can't necessarily get back there. (Laura, I1: 575)

Cris used his "newfound freedom" to alter his classroom significantly. By having an additional 75 minutes per week that was previously used for test preparation, Cris was able to go

more in-depth with the material and incorporate more labs, games, discussions, and research projects. Observation notes often documented labs and games in his classes. The following excerpts describe how Cris changed his instructional practices after the removal of the state test.

> *The [TAKS] quick reviews went away. So, you have more labs, more time for labs and… a little bit more technology, so we can do more virtual labs. I can actually do a research project now.* (Cris, I1: 316)

> *Because of that flexibility of not having that standardized test, you feel like you could do a lot more things. You can do more games. I feel like we do more discussions now than I did during TAKS because I feel like that without the pressure, I have more time, and I can manipulate the curriculum a little bit more.* (Cris, I1: 487)

> *They [students] probably feel like they're more part of the lesson now than before, where I was very dogmatic and in your face [during state testing] and now it's kind of the holistic thing.* (Cris, I3: 159)

In addition to allowing more time for labs, games, and projects, Cris also highlighted that the flexibility allowed for more notes. He seemed very proud that the physics teachers now had longer notes. To Cris, this translated into more depth of the content.

> *We're doing more notes… like they're writing it down. We go overall more in depth. Yes, the notes are longer, but the labs tie into the notes. A lab that we don't normally do.* (Cris, I4: 619)

Observation notes documented that note-taking comprised a large portion of instructional time in Cris's classroom. The PowerPoint notes were teacher-centered and rarely allowed for

interactions among students. During observation two, Cris stated, “We’ll stop notes here because I’m losing you guys. Falling asleep.” That moment, researcher notes documented that 27 out of 29 students had their heads down on their desks. In fact, subsequent researcher notes cited that Cris would constantly ask students to keep their heads and eyes forward on the PowerPoint during notes on numerous occasions. The lack of engagement during notes was so apparent that Cris sarcastically stated how exciting the notes were and that they were having “just too much fun for one day” (Cris, OBS10).

Conclusion

Although the teachers reported they had the freedom to instruct their courses however they deemed fit, the evidence suggests that many instructional strategies they used when teaching a state tested subject were still present in the classroom. *Teacher-centered* describes the majority of the observations; however, both teachers desired to make their classes more hands-on in the future. With little accountability, the teachers took it upon themselves to improve as educators.

Chapter 5: Discussion

With the enactment of No Child Left Behind, the country changed. Students became test scores, and test scores became more important than education. The purpose of this study was to examine the teacher perceptions of the changes in an educational environment following the removal of the state test in chemistry and physics and the associated pressure. In answering the four research questions, one cannot deny that the elimination of the state exams generated a completely new environment for all involved.

Changes in Administrative Support

Physics and chemistry courses no longer affected the school district's state rating; thus, the chemistry and physics teachers felt that the central administrators seemed to forget them with the discontinuation of data collection and the preparation for professional development. For state tested subjects, professional development was still highly focused and results-oriented (Cizek, 2001; McMillan, 2005; Stecher, 2002); however, since Laura and Cris were no longer state tested, the professional development did not address their needs. From the teachers' perspectives, it seemed that the central administration's focus had changed to state tested biology and eighth grade science. However, the central administrators, specifically the curriculum coordinator, had always been focused on state tested subjects. They were still doing the job they were hired to do and had done in previous years. The teachers' roles had merely changed. The teachers were no longer a means to high test scores, and now feeling forgotten like those educators before them in subjects never standardized tested. The overwhelming emphasis on state tested teachers, those that ultimately affected district state ratings, suggests that the test scores were the most important factor in education and that the school system was more concerned with public opinion than their own students.

For the physics and chemistry teachers, the term *hands-off* had both a positive and negative connotation. While central AND campus administration exhibited hands-off behavior, the teachers viewed the central administrations' actions more offensively. The junior high state tested subjects had "more resources and time and looking after" (Laura, I4: 417) from the science coordinator. Furthermore, he was no longer present throughout the year to help physics and chemistry teachers improve instruction. The campus administrators had fewer walk-throughs and less interactions overall with the teachers, no longer finding it necessary to observe classrooms on a weekly basis as they did during state tested years. However, the hands-off behavior of the campus administrators was viewed as trust. Not being as present in their classrooms meant the principals of the school trusted the teachers to do their jobs as professionals. This difference in the views teachers had towards the central and campus administration demonstrated that relationships can alter teachers' perspectives. In fact, Fisher, Sperling, and Carr (1990) found that relatedness can affect how people view their interpersonal relationships. In this study, the consistent interactions with campus administrators resulted in stronger, empathetic relationships; therefore, the teachers were more likely to view the campus administrative actions positively than those actions of the central administration. Although each group of administrators had, in essence, forgotten the teachers, the closer relationships with campus administration caused this hands-off behavior to be viewed as a sign of professionalism.

As the accountability shifted from the district and state to colleagues and self, their forgotten status offered the teachers a new level of autonomy. The teachers could finally teach! No longer under a microscope and with no one monitoring their scores or classrooms, both teachers reported they could "slack off" if they so desired. However, the professionalism expected from their colleagues and the internal motivation to improve overcame each teacher

once the intensity of the test was removed from their daily lives. Instead of their time and energy being directed to drill-and-kill practices and constant test review, the teachers now had time to professionally develop themselves and set goals.

Changes in Student Demeanor

People bond and form relationships quickly during times of duress (Hogan, Jones, & Cheek, 1985). The pressure associated with high-stakes testing resulted in swift, strong bonds formed between the teacher and students. With graduation and possibly a teaching career on the line, the students and teacher could easily relate to each other in this high-pressure environment, which thrived on a sense of belonging. All parties viewed the state of Texas as the bad guy that could affect student graduation status, and the teacher was regarded as the key to success. Although there was pressure, the classroom vibe was one of unity and focus during state testing, and the students' sense of relatedness to their teacher and fellow peers contributed to their motivation (Furrer & Skinner, 2003) to achieve the goal of passing the standardized test.

Upon removal of the state exam, the storyline altered. The same objective applied for students (graduation); however, there was little to no interference from the state. Without a taxing unifier, Laura reported that the students viewed her as they used to view the state, as the "bad guy" (Laura, I5: 305). The teacher was the only thing standing between students and a high school diploma. The mentality of the teacher being the "judge-jury-executioner" (Laura, I1: 505) caused the atmosphere of the class to change dramatically and the sense of community dissolved. The new sense of authority the teacher held correlated with less academic ownership. Since the grade the teacher entered was the deciding factor for student achievement, many students placed their fate and the responsibility on the teacher to give them grades. It was no longer the state assigning a score; score decisions belonged to the teacher.

Ames (1992) concluded that students are motivated to achieve a goal when it is considered valuable and attainable. Since the implementation of NCLB, goals have been consistently set for students since third grade. The goal of passing the standardized exam caused increased student effort, especially when failure of the exam resulted in consequences (Barnes, 2005; Roderick & Engel, 2001; Stecher, 2002; Walker, 2000), such as afterschool tutorials, replacing elective courses for remedial courses, retaking the exam, or not graduating from high school. Similar to the findings of Roderick and Engel (2001), the teachers in this study reported that high-stakes testing caused students to "have all their arrows pointing in the same direction" (Laura, I1: 238).

Growing up in a NCLB environment, the students in this study associated learning with standardized exam success. Teachers indicated that student motivation stemmed from the exam (Roderick & Engel, 2001) and without an exam, the motivation to learn ceased. The evidence in this study suggests that students lose their motivation in the absence of standardized testing. Cris and Laura reported that from 2013 to 2016, students increasingly needed more justification to learn, turned in less work, and were more likely to focus on state tested subjects in their classes. The majority of Laura and Cris' students arrived to their classes having already obtained their science goal by passing the biology state exam. With no other standardized science goal in sight, the students lacked the ability to properly respond to personal goal setting unrelated to a test result. They may have never learned [science] just for the sake of learning. Learning had centered on passing the standardized test that year or preparing to pass a test in the following year(s). Thus, should it be a surprise that these students no longer believed that state non-tested subjects were significant?

Unfortunately, this student response is a result of our "testing culture." From the day the students set foot in school, the significance of the test has been engrained in each of them indirectly by behavior and directly through practice and words. The name of the exam is plastered on school walls. YouTube songs are created that revolve around high scores. School wide t-shirts are made with logos such as "STAAR Wars: May the Scores be with You." Every meeting and professional development is centered on "increasing the scores" and data is analyzed to identify students in need of drill-and-kill tutoring. This overwhelming emphasis causes student anxiety (Casbarro, 2005; McDonald, 2001; Putwain, 2008), teacher anxiety (Barksdale-Ladd & Thomas, 2000; Barnes, 2005; Walker, 2000), and often leads to exemplary teachers leaving the field of education (Hoffman et al., 2001; Tye & O'Brien, 2002). Laura often contemplated this option when the instructional changes deemed necessary for good scores (Avdeniz & Southerland, 2012; Deci et al., 1982; Flink et al., 1990; Kauffman et al., 2002) negated her teaching philosophy.

The new post-standardized tested environment in chemistry and physics lacked any goals set by the authorities, and without the class versus the state mentality, the sense of community ceased and apathy transpired. For over a decade, the students were caged birds, acting accordingly to avoid any consequences linked to test failure (Barnes, 2005; Roderick & Engel, 2001; Stecher, 2002; Walker, 2000). They were finally set free. Like the teachers, no one was watching them any longer, and like the teachers, they thought they could do what they wanted… And many of them wanted to do nothing. The large influx of apathy was a constant battle among teachers and students. Although the high-stakes test had been removed, the evidence suggests that the testing mentality was still prevalent in state non-tested classrooms. The standardized testing stress for teachers had not disappeared; it has simply shifted to student apathy.

The teachers addressed the apathy in various ways. During high-stakes testing, Cris avoided using the word *test* in an attempt to alleviate stress on his students. Now that his course was no longer state tested, Cris found that using the word *test* was one of the only measures that slightly motivated his students. In addition, both Laura and Cris had significantly lowered their standards to decrease student failure rates. Tests were less difficult because students would not study. Homework was rarely assigned because chances were slim that it will be returned. Deadlines were constantly being extended in the hopes that more student work would be turned in, and the opportunities afforded to students for grade improvement were numerous.

Changes in Curriculum

The significance of state testing in this study cannot be overstated. Rushing through curriculum to ensure every TEKS was covered and avoiding student interests was routine during state tested years. Teachers adhered to the district's scope and sequence, the roadmap for the year's instruction (Buck, Ritter, Jensen, & Rose, 2010), and lessons were not adjusted, regardless of student needs or understanding. Similar to the results revealed by Smith (1991), the teachers only taught topics they considered relevant to the test, and discarded non-tested topics the students may have found interesting. Ironically, once the teachers lived in a post-standardized tested world, their students continued to only focus on topics that were state tested… for other classes.

During standardized testing, the teachers struggled with what they knew was best for students and what the state and district demanded of them. This situation, one which came up several times during this study, showed the frustration teachers had with the fast pacing required when teaching the TEKS. Ultimately, they had to cut activities, to the detriment of their students, for the sake of covering all of the material that could feasibly be tested.

The absence of "big brother" and the state exam bred less accountability. The teachers could ignore the district's scope and sequence and base their pacing on student needs and understanding. This often translated to a much slower pace and an unfulfilled curriculum. However, the redistribution of instructional time created a more relaxed classroom that allowed for student comprehension and interests, which was "closer to my heart's work" (Laura, I3: 167). Teachers were able to address student curiosities that extended beyond the curriculum, and mirroring the findings of Gerde, Schachter, and Wasik (2013) and Loewenstein (1994), this ultimately led to students asking more questions. This desire to understand the unfamiliar made the classroom more engaging and possibly sparked a love of science in students.

Whether this slower paced curriculum that fostered student scientific interest, yet did not cover all of the standards, was in the best interest of the students is up for debate. Many critics will argue that if the TEKS are not covered to entirety, students will be ill prepared in the area of physics or chemistry in higher education. Instead of the mile-wide and inch-deep approach, proponents would argue a deeper knowledge of foundational concepts is more important in the educational preparation of our children. Only time will tell.

Lack of Change in Instructional Practice

Teacher instructional practice is the dominant factor in student learning and retention (Wright, Horn, & Sanders, 1997), and mentors have tremendous influence on the instructional practices of novice teachers (Smylie, 1989). As an alternatively certified teacher, I can attest that my education about education was bare and impractical. Since I did not know how to teach, my first year teaching resembled my high school experience: lecture-based and teacher-centered. The transition into a larger school district resulted in the assignment of a well-seasoned mentor, who ensured that I taught "the right way," just like she did. In this school, her strict classroom

management was perceived as best instructional practices. Entering a high-stakes testing environment and still unsure of my teaching identity, I followed her methods and instructional practices for teaching science. Unfortunately, this narrative is the reality for many new secondary, alternatively certified science teachers entering the public school system.

Out of the 10,644 people entering the teaching career in Texas in 2012, 44.9% were alternatively certified (Institute for Educational Policy Research and Evaluation, 2016). Since alternative certification educational training typically just scratches the surface of the expectations for the teaching profession, novice teachers are inclined to use veteran teachers as a resource to understand their role as a teacher in the public school system. Laura believed that she needed to be like Mary, since she was her former teacher and mentor. Cris looked to Ms. Harrison because he "didn't know what he was doing" (Cris, I4: 358). Unfortunately, many veteran teachers that mentor new teachers utilize traditional teaching methods and are often unaware of best teaching practices for the average science student.

Contrary to research on best instructional practices for effective learning, many teachers abandon their beliefs about what constitutes an effective science classroom the second they begin teaching a course attached to a standardized exam. Being a high-stakes testing novice, Cris and Laura learned to "play the game" from their colleagues and mentors in order to maximize student test results. Unfortunately, playing the game often meant changing teaching methods and behavior (Avdeniz & Southerland, 2012; Kauffman et al., 2002). Mirroring the findings of Jones et al. (2003), the teachers in this study engaged in 75 minutes per week of test preparation, which decreased the amount of available time for actual chemistry or physics instruction. Consequently, frustrations surfaced as Cris and Laura spent the majority of their time coaching students on test-taking skills and teaching a curriculum based on an assessment (Johnson et al., 2004; Kauffman

et al., 2002; Tye & O'Brien, 2002). Laura exhibited this frustration as she struggled with her own teaching philosophy and covering all the tested material. Similar to the studies by Jones et al. (1999) and Taylor et al. (2002), the stress and focus placed on the test, rather than on educating youth, lowered her morale and caused her to question her own future in education. This should not be surprising since extreme changes in teaching methods due to high-stakes testing were found to be the primary reason for teacher attrition (Hoffman et al., 2001; Tye & O'Brien, 2002).

In the post-standardized tested world with little accountability, freedom from the pressure and stress of state testing could equate an effective science classroom based on best teaching practices. Although both teachers reported that with less accountability, they were free to teach in any fashion, the evidence suggests that the teachers continued to basically teach the way they did when state tested. The new sense of freedom that each teacher experienced had merely translated to a slower pace for lessons that largely mirrored those implemented during state tested years.

Shulman (1986) stated that content knowledge is crucial to effective teaching, but it is not sufficient for excellent teaching. He suggests that pedagogical content knowledge is also needed. Laura and Cris had the content knowledge; however, they lacked the pedagogical content knowledge necessary to engage students in exploratory learning. There was never mention or evidence of the 5E model (Bybee et al., 2006) being used in either classroom. The internal struggle of doing what was best for the students and what was required, suggests that these teachers were ethical and would go to measures far beyond standard practice for their students' best interests. Both teachers consistently mentioned goals and adjustments they wanted to make to their instruction. Therefore, the lack of transformation in instructional practice for these

teachers was not due to a lack of desire for improvement. And yet, the question remains of why these teachers were not delivering instruction to their students using best practices.

Initially, rushed alternative certification programs, mentors demonstrating traditional teaching methods, and testing pressure that ultimately changed instruction could be to blame for the lack of pedagogical content knowledge. Once chemistry became a state non-tested course, however, Laura continued to do the exact lessons and activities she did when she was state tested. The only difference mentioned by Laura and seen in observations was a prolonged period to cover each chemistry topic. Cris added more technology and labs into his lessons; nevertheless, he adhered to the teacher-directed PowerPoint notes that typically took the majority of the class period to complete. Therefore, the evidence in this study suggests that these teachers were unaware of best instructional practices for teaching science, and without quality professional development advocating these methods, Cris and Laura lacked the knowledge of what constituted an innovative, inquiry-based science classroom.

Implications and Recommendations

The implications of this research involve changing roles of many in the public school system. With the removal of the state test for chemistry and physics, classrooms transformed. As with any large renovation in life, plans must be implemented to properly prepare for what is to follow.

Central administration should exhibit sensitivity and take precautionary measures to ensure all teacher needs are being met. Although chemistry and physics are no longer responsible for the district's state rating, their roles are still significant for the education of our youth. As educators, teachers deserve quality professional development that can improve their instruction, thus reaching and possibly instilling a love of science in their students.

Since many secondary science teachers entered the profession during high-stakes testing and merely modeled "best practices for high test scores," they are in need of training on Bybee's 5E model. In addition to implementing this inquiry-based approach, it is important that the science coordinator communicate with ALL science teachers to understand their professional needs and interests when developing professional development. Differentiated instruction is encouraged in the classroom. Why could this not be a reality when instructing teachers?

The large influx of apathy in the post-standardized tested classroom can be attributed to our testing culture. Enough is enough. As educators, hatred for the testing mentality runs deep, yet we perpetuate the cycle every day. Educators, administrators, and state officials must stop placing an overwhelming emphasis on the state exam, and they must recognize that state test scores are only one measure of academic achievement. In a standardized tested world, students need goals to perform. Thus, until the emphasis on standardized testing is completely diminished, teachers that teach state non-tested subjects must have training in goal and reward systems for students.

Regardless of standardized testing status, administrators and educators must realize the importance of maintaining high expectations in all classes. Realizing there will be student pushback and high failure rates at first, administrators must collaborate with the teachers to implement a plan to combat student apathy.

Although state law mandates that Texas teachers cover all of the TEKS in their subject area, the standards are vague and broad enough for curricular adjustment. During state testing, teachers found it necessary to approach the TEKS from multiple angles in anticipation of plausible test questions; however, the lack of accountability currently experienced by subjects no longer state tested allows for more teacher interpretation. By asking students about their interests

and then collaborating with their colleagues, chemistry and physics teachers can decide what curriculum and topics are most relevant to their students, while still covering all of the TEKS. Decisions to eliminate or add topics allow teachers to focus more on student conceptual knowledge instead of detailed, factual knowledge. In addition, a slower pace coupled with less factual information to address enhances the probability that teachers can address students' curiosities and possibly spark a love of science.

In the new post-standardized tested classroom, careful selection of mentors is imperative. Realizing that the best classroom management does not necessarily equate to best teaching practices, administrators should look to assign novice teachers to mentors with knowledge and practice of inquiry-based instruction. New teachers should be allotted time to view master teachers perform.

To enhance science teaching on the entire campus, veteran and new teachers should be well versed in inquiry and the Bybee's 5E model. As mentioned previously, professional development would be an ideal time to ensure all teachers are cognizant of best practices in the science classroom. Teachers must realize that implementing these methods are not easy. It takes practice and devotion to transform their classroom. If financially feasible, instructional coaching can help with the implementation and consistent focus of inquiry-based learning, resulting in much greater utilization than just training alone (Poglinco & Bach, 2004; Showers, 1984).

Limitations

The researcher, first and foremost, limited this research. As a former educator who taught state tested subjects, I bring my own bias to the study. However, employing multiple data sources, an audit trail, peer debriefing, and member-checking alleviated as much subjectivity as possible.

The participants may have been influenced by my past association with the school district. During interviews and post-observation conferences, I attempted to ask questions as if I had no knowledge of the school or district processes. I was vigilant to remain true to the teachers' experiences and not my own teaching experiences in state tested and state non-tested subject areas. Although the established trust allowed for authentic data, the participants could have possibly been hesitant to comment on experiences or express thoughts that could negatively affect them in the future.

Another limitation of this study was the uniformity of the participants and setting. In addition to working in the same school, Laura and Cris were both alternatively certified and entered their careers as teachers in state tested subjects. Although the setting allowed for consistency in the study, teacher perspectives may differ depending on their educational training, school rating, district teaching requirements, campus teaching expectations, school district location, local stress, demographics, and class scheduling system.

A larger population of teachers to examine would also have been more ideal for this research. However, with changing teaching schedules, it was only possible to follow two teachers in this school. Incorporating a larger sample of teachers would make the results more generalizable for educators and researchers throughout the country.

Recommendations for Future Research

Recommendations for future research include expanding this research to include more participants and more school districts. As mentioned in the limitations, teacher perspectives may differ depending on many school factors, such as scheduling system, local stress, and district teaching requirements. A larger scale study of many physics and chemistry teachers would make the results more generalizable.

This study only examined science teachers' perspectives. House Bill 5 also removed state tests from other content areas, such as social studies, mathematics, and English. Investigating teacher perspectives from different subject areas where high-stakes testing has been removed to understand their experiences would also enhance the study. In addition, viewing areas that have never been state tested, such as the arts, would also lend findings important to the topic.

A further study examining the voices of biology teachers, the other side of the transition, is also necessary. Although many of these educators were teaching tenth grade students during TAKS testing, several school districts moved biology from tenth to ninth grade to allow students more opportunities to pass the EOC exam. When this occurred, a large population of teachers had to learn a new subject area or apply to work at a different school. Researching teachers who had to transition from teaching state non-tested, ninth grade integrated physics and chemistry to state tested, ninth grade biology would show an alternative side of the state testing transition.

In addition, examining alternative perspectives based on role in the school system is also significant. Principals, curriculum coordinators, students, etc., may have differing views of the school environment in a post-standardized tested world. Their views are equally important in understanding this phenomenon.

References

Abell, S. K., Bryan, L. A., & Anderson, M. A. (1998). Investigating preservice elementary science teacher reflective thinking using integrated media cased-based instruction in elementary science teacher preparation. *Science Education, 82*(4), 491-509.

Abdi, A. (2014). The effect of inquiry-based learning method on student academic achievement in science. *Journal of Education Research, 2*(1), 37-41.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. New York, NY: Oxford Press.

American Association for the Advancement of Science. (2001). *Atlas of science literacy: Project 2016*. Washington, DC: AAAS.

Ames, C. (1992). Classrooms: Goals, structures and student motivation. *Journal of Educational Psychology, 84*(3), 261-271.

Amrein, A. L., & Berliner, D. C. (2003). The effects of high-stakes testing on student motivation and learning. *Educational Leadership, 60*(5), 32-38.

Anderson, R. D. (2002). Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education, 13*(1), 1-12.

Atkins, J.M., & Karplus, R. (1962). Discovery or invention? *The Science Teacher, 29*(5), 45-51.

Atkinson, R. (2007). The life story interview as a bridge in narrative inquiry. In D. J. Clandinin (Ed.), *Handbook of narrative inquiry: Mapping a methodology* (pp. 224- 246). Thousand Oaks, CA: Sage Publications.

Au, W. (2007). High-stakes testing and curricular control: A qualitative metasynthesis. *Education Researcher, 36*(5), 258-267.

Avdeniz, M., & Southerland, S. A. (2012). A national survey of middle and high school science teachers' responses to standardized testing: Is science being devalued in schools? *Journal of Science Teacher Education, 23*(3), 233-257.

Aydin, S., Demirdogen, B., Tarkin, A., Kutucu, S., Ekiz, B., Akin, F. N., Tuysuz, M., & Uzuntiryaki, E. (2013). Providing a set of research-based practices to support preservice teachers' long-term professional development as learners of science teaching. *Science Education, 97*(6), 903–935.

Barkley, E. F., Cross, K. P., & Majro, C. H. (2005). *Collaborative learning techniques: A handbook for college faculty*. San Francisco, CA: Jossey-Bass.

Barksdale-Ladd, M. A., & Thomas, K. F. (2000). What's at stake in high-stakes testing: Teachers and parents speak out. *Journal of Teacher Education, 51*(5), 384-397.

Barnes, M. (2005). The discriminatory effects of high-stakes testing in Georgia: Exploring causes and solutions. *Education Law and Policy Forum*. Retrieved November 3, 2016 from http://www.educationlawconsortium.org/forum/2005/papers/barnes.pdf

Bateman, W. L. (1990). *Open to question: The art of teaching and learning by inquiry.* San Francisco, CA: Jossey-Bass.

Berg, B. L. (2007). *Qualitative research methods for the social sciences* (2nd ed.). Boston, MA: Pearson Education, Inc.

Bevevino, M., Dengel, J., & Adams, K. (1999). Constructivist theory in the classroom: Internalizing concepts through inquiry learning. *The Clearing House, 72*(5), 275-278.

Beyer, C. J., & Davis, E. A. (2012). Learning to critique and adapt science curriculum materials: Examining the development of preservice elementary teachers' pedagogical content knowledge. *Science Education, 96*(1), 130–157.

Bogdan, R., & Biklen, S. (1998). *Qualitative research for education* (3rd ed.). Boston, MA: Allyn and Bacon.

Booher-Jennings, J. (2005). Below the bubble: "Educational triage" and the Texas accountability system. *American Educational Research Journal, 43*(2), 231-268.

Bradley, R. T., McCraty, R., Atkinson, M., Arguelles, L., Rees, R. A., & Tomasino, D. (2007). *Reducing test anxiety and improving test performance in America's schools: Summary of results from the TestEdge national demonstration study.* Retrieved from Institute of HeartMath website: http://www.heartmathbenelux.com/doc/Tends_Summary_Results%202007.pdf

Bransford, J., Derry, S., Berliner, D., Hammerness, K., & Beckett, K. L. (2005). Theories of learning and their roles in teaching. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 40–87). San Francisco, CA: John Wiley & Sons, Inc.

Bruffee, K. A. (1995). Sharing our toys: Cooperative learning versus collaborative learning. *Change, 27*(1), 12-18.

Buck, S., Ritter, G. W., Jensen, N. C., & Rose, C. P. (2010). Teachers say the most interesting things: An alternative view of testing. *The Phi Delta Kappan, 91*(6), 50-54.

Bybee, R., Taylor J., Gardner A., Scotter, P., Powell, J., Westbrook, A., & Landes, N. (2006). *BSCS 5E instructional model: Origins and effectiveness.* Colorado Springs, CO: BSCS.

Cardak, O., Dikmenli. M., & Saritas, O. (2008). Effect of 5E instructional model in student success in primary school 6th year circulatory system topic. *Asia-Pacific Forum on Science Learning and Teaching, 9*(2), 2-9.

Casbarro, H. (2005). *Test anxiety and what you can do about it: A practical guide for teachers, parents, and kids.* Port Chester, NY: Dude Publishing.

Charlesworth, R., Fleege, P. O., & Weitman, C. J. (1994). Research on the effects of group standardized testing on instruction, pupils, and teachers: New directions for policy. *Early Education and Development, 5*(3), 195–211.

Cizek, G. J. (2001). More unintended consequences of high-stakes testing. *Educational Measurement: Issues and Practice. 20*(4), 19-27.

Cochran, K.F., DeRuiter, J.A., & King, R.A. (1993). Pedagogical content knowledge: An integrative model for teacher preparation. *Journal of Teacher Education, 44*(4), 263–272.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfield, F. D., & York, R. L. (1966). *Equality of educational opportunity.* Washington, D.C.: U.S. Government.

Common Core State Standards Initiative. (n.d.). Preparing America's students for college and career. Retrieved March 24, 2016 from http://www.corestandards.org

Connor, M. (2003). Pupil stress and Standard Assessment Tasks (SATs). *Emotional and Behavioral Difficulties, 8*(2), 101-107.

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (4th ed.). Thousand Oaks, CA: Sage.

Cracolice, M. S., & Trautmann, J. A. (2001). Vygotsky's theories of education: Theory bases for peer-led team learning. In D. K. Gosser, M. S. Cracolice, J. A. Kampmeier, V. Roth, V. S. Strozak, & P. Varma-Nelson (Eds.), *Peer-led team learning: A guidebook* (pp. 94-102). Lower Saddle River, NJ: Prentice Hall.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-131

Cruse, K., & Twing, J. (2000). The history of statewide achievement testing in Texas. *Applied Measurement in Education,13*(4), 327-331.

Curran, E., Carlson, K., & Celotta, D. T. (2013). Changing attitudes and facilitating understanding in the undergraduate statistics classroom: A collaborative learning approach. *Journal of the Scholarship of Teaching and Learning, 13*(2), 49-71.

Davis, E. A., Petish, D., & Smithey, J. (2006). Challenges new science teachers face. *Review of Educational Research*, *76*(4), 607–651.

De Bard, R., & Kubow, P. K. (2002). From compliance to commitment: The need for constituent discourse in implementing testing policy. *Educational Policy, 16*(3), 387- 405.

De Jong, O., Van Driel, J. H., & Verloop, N. (2005). Preservice teachers' pedagogical content knowledge of using particle models in teaching chemistry. *Journal of Research in Science Teaching, 42*(8), 947–964.

Deci, E. L., Spiegel, N. H., Ryan, R. M., Koestner, R., & Kauffman, M. (1982). The effects of performance standards on teaching styles: The behavior of controlling teachers, *Journal of Educational Psychology, 74*(6), 852-859.

Denmark, F. L. (1970). Effects of integration on academic achievement and self-concept. *Integrated Education, 5*(3), 34-42.

Denscombe, M. (1998). *The good research guide for small-scale social research projects.* Buckingham, England: Open University Press.

Denzin, N. K., & Lincoln, Y. S. (2005). *The sage handbook of qualitative research* (3rd ed.). Thousand Oaks, CA: Sage Publication.

Dewey, J. (1997). *Experience And Education* (Reprint.). New York, NY: Touchstone. (Original work published in 1938).

Dietz, C. M., & Davis, E. A. (2009). Preservice elementary teachers' reflection on narrative images of inquiry. *Journal of Science Teacher Education, 20*(3), 219–243.

Diamond, J., & Spillane, J. (2004). High-stakes accountability in urban elementary schools: Challenging or reproducing inequality. *Teachers College Record, 106*(6), 1145-1176.

Dillon, E., & Rotherham, A. (2007, December 20). States' evidence: What it means to make Adequate Yearly Progress under NCLB. *4LAKIDS.* Retrieved from http://4lakidsnews.blogspot.com/2007/12/states-evidence-what-it-means-to-make.html

Dillon, J. T., & Dillon, J. T. (1988). Questioning and teaching: A manual of practice. London, England: Croom Helm.

Fisher, P. H., Sperling, M. B., & Carr, A. C. (1990). Assessment of adult relatedness: A review of empirical findings from object relations and attachment theories. *Journal of Personality Assessmen*t, 55(3), 499-520.

Flink, C., Boggiano, A. K., & Barrett, M. (1990). Controlling teaching strategies: Undermining children's self-determination and performance. *Journal of Personality and Social Psychology, 59*(6), 916–924.

Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology, 95*(1), 148-162.

Gallagher, C. J. (2003). Reconciling a tradition of testing with a new learning paradigm. *Educational Psychology Review, 15*(1), 83- 99.

Geddis, A. N., Onslow, B., Beynon, C., & Oesch, J. (1993). Transforming content knowledge: Learning to teach about isotopes. *Science Education, 77*(6), 575-591.

Gee, J. P. (2001). Literacy, discourse, and linguistics: Introduction and what is literacy? In E. Cushman, E. R. Kintgen, B. M. Kroll, & M. Rose (Eds.), *Literacy: A critical sourcebook* (pp. 525-544). Boston, MA: Bedford/St. Martins.

Gerde, H. K., Schachter, R., E., & Wasik, B. A. (2013). Using the scientific method to guide learning: An integrated approach to early childhood curriculum. *Early Childhood Education Journal, 41*(5), 315-323. doi: 10.1007/s10643-013-0579-4.

Gess-Newsome, J., & Lederman, N. G. (1993). Preservice biology teachers' knowledge structures as a function of professional teacher education: A year- long assessment. *Science Education, 77*(1), 25-45.

Ginns, I. S., & Watters, J. J. (1995). An analysis of scientific understandings of preservice elementary teacher education students. *Journal of Research in Science Teaching, 32*(2), 205-222.

Ginns, I. S., & Watters, J. J. (1999). Beginning elementary school teachers and the effective teaching of science. *Journal of Science Teacher Education, 10*(4), 287–313.

Glesne, C. (2006). *Becoming qualitative researchers: An introduction* (3rd ed.). Boston, MA: Pearson.

Grossman, P., Schoenfeld, A., & Lee, C. (2005). Teaching subject matter. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 201–231). San Francisco, CA: John Wiley & Sons, Inc.

Groves, P. (2002). Doesn't it feel morbid here? High-stakes testing and the widening of the equality gap. *Educational Foundations, 16*(2), 15-31.

Hackling, M., Peers, S., & Prain, V. (2007). Primary connections: Reforming science teaching in Australian primary schools. *Teaching Science: The Journal of the Australian Science Teachers Association, 53*(3), 12-16.

Haidar, A. H. (2010). Prospective chemistry teachers' conceptions of the chemical thermodynamics and kinetics. *Eurasia Journal of Mathematics, Science, and Technology Education, 6*(2), 111-121.

Haladyna, T., Nolen, S., & Haas, N. (1991). Raising standardized achievement test scores and the origins of test score pollution. *Educational Researcher, 20*(5), 2-7.

Haney, W. (2000). The myth of the Texas miracle in education. *Educational Policy Analysis Archives, 8*(14). Retrieved from http://epaa.asu.edu/epaa/v8n41.html

Hanson, F. A. (1993). *Testing, testing: Social consequences of the examined life*. Berkeley, CA: University of California Press.

Harlen, W. (1999*). Effective teaching of science: A review of research*. Edinburgh, Scotland: Scottish Council for Research in Education.

Hassard, J. (2012, August 1). In math and science, have American students fallen behind? *National Education Policy Center*. Retrieved from http://nepc.colorado.edu/blog/math-and-science-have-american-students-fallen-behind

Hatch, A. (2006). *Early childhood qualitative research.* New York, NY: Routledge.

Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research, 58*(1), 47–77.

Heubert, P., & Hauser, R. M. (1999). *High stakes: Testing for tracking, promotion and graduation*. Washington, DC: National Academy of Sciences.

Hill, K. T., & Wigfield, A. (1984). Test anxiety: A major educational problem and what can be done about it. *The Elementary School Journal, 85*(1), 105 – 126.

Hoffman, J. V., Assaf, L. C., & Paris, S. G. (2001). High-stakes testing in reading: Today in Texas, tomorrow? *The Reading Teacher, 54*(5), 482-492.

Hogan, R., Jones, W. H., & Cheek, J. M. (1985). Socioanalytic theory: An alternative to armadillo psychology. In B. R. Schlenker (Ed.), *The self and social life* (pp. 175-198) New York, NY: McGraw-Hill.

Hope, J. (1975). *Twenty years after Brown: Equality of educational opportunity*. Washington, D.C.: Commission on Civil Rights.

Howes, E. (2002). Learning to teach science for all in the elementary grades: What do preservice teachers bring? *Journal of Science Teacher Education, 13*(2), 147-165.

Hurd, P. D. (1958). Science literacy: Its meaning for American schools. *Educational Leadership, 16*(1), 13-16.

Hurd, P. D. (1970). Scientific enlightenment for an age of science. *The Science Teacher, 37*(1), 13-15.

Illich, I. (1970). *Deschooling society*. London, UK: Marion Boyars Publishers LTD.

Impara, J., & Plake, B. (1996). Professional development in student assessment for educational administrators. *Educational Measurement: Issues and Practice, 15*(2), 14-20.

Institute for Educational Policy Research and Evaluation. (2016). *Performance analysis for colleges of education 2016* (Report No. 10). Houston, TX: Center for Research, Evaluation, & Advancement of Teacher Education.

Jackson, B. (1985). Lowered expectations: How schools reward incompetence. *The Phi Delta Kappan, 67*(4), 304-305.

Jacob, B. A. (2005). Accountability, incentives, and behavior: The impact of high-stakes testing in the Chicago Public Schools. *Journal of Public Economics*, *89*(5-6), 761-796.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, *38*(5), 365-379.

Johnson, D. W., Johnson, R. T., Ortiz, A. E., & Stanne, M. (1991). The impact of positive goal and resource interdependence on achievement, interaction and attitudes. *Journal of General Psychology*, *118*(4), 341-347.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). *Active learning: Cooperation in the college classroom*. Edina, MN: Interaction.

Johnson, D. W., Maruyama, G., Johnson, R. T., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin*, *89*(1), 47-62.

Johnson, R. T., & Johnson, D. W. (1994). An overview of cooperative learning. In J. Thousand, A. Villa, & A. Nevin (Eds.), *Creativity and collaborative learning: A practical guide to empowering students and teachers*. Baltimore, MD: Brooks Press.

Johnson, S., Kardos, S., Kauffman, D., Liu, E., & Donaldson, M. (2004). The support gap: New teachers' early experiences in high-income and low-income schools. *Education Policy Analysis Archives*, *12*(61), 1-25.

Jones, B. D., & Egley, R. J. (2004). Voices from the frontlines: Teachers' perceptions of high-stakes testing. *Education Policy Analysis Archives*, *12*(39). Retrieved November 1, 2016 from http://epaa.asu.edu/epaa/v12n39/

Jones, M., Jones, B., Hardin, B., Chapman, L., Yarbrough, T., & Davis, M. (1999). The impact of high-stakes testing on teachers and students in North Carolina. *The Phi Delta Kappan, 81*(3), 199-203.

Jones, G. M., Jones, B. D., & Hargrove, T. (2003). *The unintended consequences of high- stakes testing*. Lanham, MD: Rowman and Littlefield.

Jorgensen, M., & Hoffmann, J. (2003). *History of No Child Left Behind Act of 2001*. San Antonio, TX: Pearson.

Justi, R., & Van Driel, J. H. (2005). A case study of the development of a beginning chemistry teacher's knowledge about models and modeling. *Research in Science Education, 35*(2), 197-219.

Kagan, S. (1992). *Cooperative learning*. San Juan Capistrano, CA: Resources for teachers.

Kauffman, D., Johnson, S. M., Kardos, S. M., Liu, E., & Peske, H. G. (2002). Lost at sea: New teachers' experiences with curriculum and assessment. *Teachers College Record, 104*(2), 273-300.

Kearns, L. L. (2011). High-stakes standardized testing and marginalized youth: An examination of the impact on those who fail. *Canadian Journal of Education, 34*(2), 112-130.

Keys, C. W., & Bryan, L. A. (2000). Co-constructing inquiry-based science with teachers: Essential research for lasting reform. *Journal of Research in Science Teaching, 38*(6), 631–645.

Klopfer, L. E. (1971). Evaluation of learnings in science. In B. S. Bloom, J. T. Hastings, & G. F. Madaus. (Eds.), *Handbook on formative summative evaluation of student learning* (pp. 559-642). New York, NY: McGraw-Hill.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Lesko, N. (2001). *Act your age: A cultural construction of adolescence.* New York, NY: Routledge Falmer.

Lincoln, Y., & Guba, G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage

Linn, R. L., Baker, E. L., & Betebenner, D. W. (2002). Accountability systems: Implications of requirements of the No Child Left behind Act of 2001. *Educational Researcher, 31*(6), 3-16.

Lipman, P. (2004). *High-stakes education: Inequality, globalization, and urban school reform.* New York, NY: Routledge Falmer.

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin, 116*(1), 75-98.

Lord, T. R. (1999). A comparison between traditional and constructivist teaching in environmental science. *Journal of Environmental Education, 30*(2), 22-28.

Loughran, J.J., Milroy, P., Berry, A., Gunstone, R., & Mulhall, P. (2001). Documenting science teachers' pedagogical content knowledge through PaP-eRs. *Research in Science Education, 31*(2), 289–307.

Lufi, D., Okahsa, S., & Cohen, A. (2004). Test anxiety and its effect on the personality of students with learning disabilities. *Learning Disability Quarterly*, *27*(3), 176-184.

Lunemann, A. (1973). Desegregation and achievement: A cross-sectional and semi-longitudinal look at Berkeley, California. *Journal of Negro Education, 42*(4), 439-446.

Madaus, G., & Clarke, M. (2001). The adverse impact of high stakes testing on minority students: Evidence from 100 years of test data. In G. Orfield & M. Kornhaber (Eds.), *Raising standards or raising barriers? Inequality and high states testing in public education* (pp. 85-106). New York, NY: The Century Foundation.

Marchant, G. J., & Paulson, S. E. (2005). The relationship of high school graduation exams to graduation rates and SAT scores. *Education Policy Analysis Archives, 13*(6). Retrieved from http://epaa.asu.edu/ojs/

Marlowe, B. A., & Page, M. L. (2005). *Creating and sustaining the constructivist classroom*. Thousand Oaks, CA: Corwin.

McCaleb-Kahan, P., & Wenner, R. (2009, October). *The relationship of student demographics to 10th grade MCAS test anxiety.* Paper presented at the 40th Annual Meeting of the Northeastern Educational Research Association, Rocky Hill, CT. Retrieved from http://digitalcommons.uconn.edu/cgi/viewcontent.cgi?article=1002&context=nera_2009

McDonald, A. (2001). The prevalence and effects of test anxiety in school children. *Educational Psychology*, *21*(1), 89-94.

McMillan, J. H. (2005). *The impact of high-stakes test results on teachers' instructional and classroom assessment practices.* Retrieved from ERIC database. (ED490648)

McNeil, L. M. (2000). *Contradictions of school reform: Educational cost of standardized testing*. New York, NY: Routledge.

Merriam, S. B. (1988). *Case study research in education: A qualitative approach.* San Francisco, CA: Jossey-Bass.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation.* San Francisco, CA: Jossey-Bass.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

National Assessment of Educational Progress. (n.d.). NAEP History and Background. Retrieved March 26, 2016 from http://nces.ed.gov/nationsreportcard/about/naephistory.aspx

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative of educational reform.* Washington, D.C.: U.S. Department of Education.

National Research Council. (1996). *National Science Education Standards*. Washington, DC: National Academic Press.

National Research Council (2012). *A framework for K-12 science education: Practices, cross-cutting concepts, and core ideas*. Washington D.C.: National Academies Press.

Nichols, S. L., & Berliner, D. C. (2008). Testing the joy out of learning. *Educational Leadership, 65*(6), 14-18.

Nye, B., Konstantopoulos, S., & Hedges, L. V. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis, 26*(3), 237–257.

O'Sullivan, R., & Chalnick, M. (1991). Measurement-related course requirements for teacher certification and recertification. *Educational Measurement: Issues and Practice, 10*(1), 17-19, 23.

Office of Elementary and Secondary Education. (1998). *Goals 2000: Reforming education to improve student achievement.* Washington, D.C.: U.S. Department of Education.

Orel, S. (2003). Left behind in Birmingham: 522 pushed-out students. In R. Cossett Lent & G. Pipkin (Eds.), *Silent no more: Voices of courage in American schools* (pp. 1-14). Portsmouth, NJ: Heinemann.

Orfield, G., Losen, D., Wald, J., & Swanson, C. (2004). *Losing our future. How minority youth are being left behind by the graduation rate crisis.* Cambridge, MA: The Civil Rights Project at Harvard University.

Orfield, G., Monfort, F., & Aaron, M. (1989). *Status of school desegregation 1968-1986: A report of the council of urban boards of education and the national school desegregation research project*. Washington, D.C.: National School Board Association.

Patton, M. Q. (1990). *Qualitative evaluation and research methods.* Newbury Park, CA: Sage.

Patton, M. Q. (2001). *Qualitative research and evaluation methods* (2nd ed.). Thousand Oaks, CA: Sage

Plank, S. B., & Condliffe, B. F. (2013). Pressures of the season: An examination of classroom quality and high-stakes accountability. *American Educational Research Journal, 50*(5), 1152-1182.

Poglinco, S. M., & Bach, A. J. (2004). The heart of the matter: Coaching as a vehicle for professional development. *The Phi Delta Kappan, 85*(5), 398-400.

Putwain, D. W. (2008). Do examinations stakes moderate the test anxiety-examination performance relationship? *Educational Psychology, 28*(2), 109–118.

Redfield, D., & Sheinker, J. (2004). *Framework for transitioning from IASA to NCLB.* Washington, D.C.: Council of Chief State School Officers.

Renter, D. S., Scott, C., Kober, N., Chudowsky, N., Joftus, S., & Zabala, D. (2006, March 28). *From the capital to the classroom*. Washington, DC: Center on Education Policy. Retrieved August 28, 2016 from http://www.cep-dc.org

Rivet, A. E., & Krajcik, J. S. (2008). Contextualizing instruction: Leveraging students' prior knowledge and experiences to foster understanding of middle school science. *Journal of Research in Science Teaching, 45*(1), 79–100.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417–458.

Roderick, M., & Engel, M. (2001). The grasshopper and the ant: Motivational responses to low achieving students to high-stakes testing. *Educational Evaluation and Policy Analysis, 23*(3), 197-227.

Rose, D., & Myers, J. (2004). *Pay now or pay later: The hidden costs of high school exit exams.* Retrieved from the Center on Education Policy website: www.cep-dc.org/cfcontent_file.cfm?Attachment=CEP_Report_HiddenCost...pdf

Roth, W. (1996). Teacher questioning in an open-inquiry learning environment: Interactions of context, content, and student responses. *Journal of Research in Science Teaching*, *33*(7), 709-736.

Rubba, P. A., & Andersen, H. O. (1978). Development of an instrument to assess secondary school students' understanding of the nature of scientific knowledge. *Science Education, 62*(4), 449-458.

Rutherford, F., & Ahlgren, A. (1990). *Science for all Americans*. New York, NY: Oxford Press.

Scott, P. (1998). Teacher talk and meaning making in science classrooms: A Vygotskian analysis and review. *Studies in Science Education, 32*(1), 45-80.

Segool, N. K., Carlson, J. S., Goforth, A. N., Von der Embse, N., & Barterian, J. A. (2013). Heightened test anxiety among young children: Elementary school students' anxious responses to high-stakes testing. *Psychology in Schools, 50*(5), 489-499.

Seipp, B., & Schwarzer, C. (1996). Cross-cultural anxiety research: A review. In C. Schwarzer & M. Zeidner (Eds.), *Stress, anxiety, and coping in academic settings* (pp. 13–68). Tubingen, Germany: Francke-Verlag.

Seyhan, H., & Morgil, I. (2007). The effect of 5E learning model on teaching of acid- base topic in chemistry education. *Journal of Science Education, 8*(2), 120-123.

Showers, B. (1984). *Peer coaching: A strategy for facilitating transfer of training.* Eugene, OR: Center for Educational Policy and Management.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Slavin, R. (1990). *Cooperative learning: Theory research and practice*. Englewood Cliffs, NJ: Prentice Hall.

Smart, J. B. & Marshall, J. C. (2013). Interactions between classroom discourse, teacher questioning, and student cognitive engagement in middle school science. *Journal of Science Teacher Education, 24*(2) 249-267.

Smith, K. A. (2010). Social basis of learning: From small-group learning to learning communities. *New Directions for Teaching & Learning, 2010*(123), 11-22.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of engagement: Classroom-based practices. *Journal of Engineering Education, 94*(1), 87-101.

Smith, M. L. (1991). Put to the test: The effects of external testing on teachers. *Educational Researcher, 20*(5), 8-11.

Smylie, M. (1989). Teachers' views of the effectiveness of sources of learning to teach. *Elementary School Journal, 89*(5), 543-558.

Stake, R. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp.435-453). Thousand Oaks, CA: Sage.

Stallings, F. H. (1959). A study of the immediate effects of integration on scholastic achievement in the Louisville public schools. *Journal of Negro Education, 28*(4), 439-444.

Stecher, B. M. (2002). Consequences of large-scale, high-stakes testing on school and classroom practice. In L. S. Hamilton, B.M. Stecher, & S.P. Klein (Eds.), *Making sense of test-based accountability in education* (pp.79-100). Santa Monica, CA: RAND.

Stedman, J. (1994). *Goals 2000: Overview and analysis.* Washington, D.C.: Library of Congress.

Stiggins, R. (1999). Evaluating classroom assessment training in teacher education programs. *Educational Measurement: Issues and Practice, 18*(1), 23-27.

Sullivan, N. V. (1968). Discussion: Implementing equal educational opportunity. *Harvard Educational Review, 38*(1), 138-175.

Sungur, S., Tekkaya, C., & Geban, Ö. (2001). The contribution of conceptual change texts accompanied by concept mapping to students' understanding of human circulatory system. *School Science and Mathematics, 101*(2), 91-101.

Svinicki, M. D. (2004). *Learning and motivation in the postsecondary classroom*. San Francisco, CA: Anker.

Taylor, G., Shepard, L., Kinner, F., & Rosenthal, J. (2002). *A survey of teachers' perspectives on high- stakes testing in Colorado: What gets taught, what gets lost.* Retrieved from University of California- Los Angeles, Center for the Study of Evaluation, Standards, and Student Testing. ERIC database (ED475139)

Taylor, P. C. S., Fraser, B. J., & White, L. R. (1994, April). *CLES: An instrument for monitoring the development of constructivist learning environments*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Te Riele, K. (2006). Youth 'at risk': Further marginalizing the marginalized? *Journal of Education Policy, 21*(2), 129–146.

Texas Education Agency. (n.d.a). No Child Left Behind and Elementary and http://tea.texas.gov/About_TEA/Laws_and_Rules/NCLB_and_ESEA/No_Child_Left_Behind_and_Elementary_and_Secondary_Education_Act/

Texas Education Agency. (n.d.b). New Statutory Requirements Prohibiting the Adoption or Use of Common Core. Retrieved November 28, 2016 from http://tea.texas.gov/About_TEA/News_and_Multimedia/Correspondence/TAA_Letters/New_Statutory_Requirements_Prohibiting_the_Adoption_or_Use_of_Common_Core/

Texas Education Agency. (n.d.c). House Bill 5. Retrieved March 25, 2016 from http://tea.texas.gov/Curriculum_and_Instructional_Programs/Graduation_Information/House_Bill_5__Foundation_High_School_Program

The White House. (n.d.). Race to the Top. Retrieved March 29, 2016 from https://www.whitehouse.gov/issues/education/k-12/race-to-the-top

Thomson, P. (2002). *Schooling the rustbelt kids: Making the difference in changing times.* Crows' Nest, AU: Allen & Unwin.

Totten, S., Sills, T., Digby, A., & Russ, P. (1991). *Cooperative learning: A guide to research*. New York, NY: Garland.

Tye, B. B., & O'Brien, L. (2002). Why are experienced teachers leaving the profession? *The Phi Delta Kappan, 84*(1), 24-3.

United States Department of Education. (2003). *No child left behind: A parent's guide*. Washington, D.C.: Author

Van den Akker, J. (1998). The science curriculum: Between ideals and outcomes. *International handbook of science education, 1*(1), 421-447.

Vogler, K. E. (2002). The impact of high-stakes, state-mandated student performance assessment on teachers' instructional practices. *Education, 123*(1), 39-55.

Vu, P. (2008). Do state tests make the grade? *Pew Research Center Publications*. Retrieved from http://pewresearch.org/pubs/696/do-state tests-make-the-grade.

Vygotsky, L. S. (1987). The genesis of higher mental functions. In R. Reiber (Ed.), *The history of the development of higher mental functions* (Vol. 4, pp. 97-120). New York: Plennum.

Walker, S. F. (2000). High-stakes testing: Too much? Too soon? *State Education Leader, 18*(1), 1-3.

Walsh, W. B., & Betz, N. (1995). *Tests and assessment.* Englewood Cliff, NJ: Prentice-Hall.

Weiss, I. R. (1994). *A profile of science and mathematics education in the United States: 1993.* [A report for the National Science Foundation], Chapel Hill, NC: Horizon Research Inc.

Wright, S. P., Horn, S. P., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education, 11*(1), 57–67.

Yeh, S. S. (2005). Limiting the unintended consequences of high-stakes testing. *Education Policy Analysis Archives, 13*(43). Retrieved from http://epaa.asu.edu/epaa/v13n43.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA:Sage.

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA:Sage.

Zastrow, C., & Janc, H. (2006). The condition of the liberal arts in America's public schools: A report to the Carnegie Corporation of New York. Washington, DC: Council for Basic Education.

Zeidner, M. (1998). Test anxiety, the state of the art. New York, NY: Plenum Press.

Zellmer, M. B., Frontier, A., & Pheifer, D. (2006). What are NCLB's instructional costs? *Educational Leadership, 64*(3), 43-46.

Appendix A
Standardized Testing in State of Texas

Grades	1	2	3	4	5	6	7	8	9	10	11	12
Texas Assessment of Basic Skills (TABS) 1980-1985			M R W		M R W				M R W			
Texas Educational Assessment of Minimum Skills (TEAMS) 1986-1989	M R W		M R W		M R W		M R W		M R W		M R W	
Texas Assessment of Academic Skills (TAAS) 1990-1993			M R W		M R W		M R W		M R W		M R W	
Texas Assessment of Academic Skills (TAAS) Adjusted 1994- 2002			M R	M R W	M R	M R	M R	M R W Sci SS		M R W		
Texas Assessment of Knowledge and Skills (TAKS) 2003-2011			M R	M R W	M R Sci	M R	M R W	M R Sci SS		ELA M Sci SS	ELA M Sci SS	
State of Texas Assessment of Academic Readiness (STAAR) 2012- current			M R	M R W	M R Sci	M R	M R W	M R Sci SS	EOC: Algebra I English I English II		U.S. History biology	

M= Mathematics Sci= Science W= Writing
R= Reading SS= Social Studies

Appendix B

Principal Permission Form

To the TCU Institutional Review Board:

Erin Pearce, Ph.D. candidate at Texas Christian University, has our permission to conduct the study "Life After Testing: Chemistry and Physics Teachers' Perspectives of Teaching State tested and State Non-tested Subject Areas " at Madison High School in Monroe I.S.D. We understand that this study will be conducted during school hours. We are aware that the researcher will be doing classroom observations and interviews may occur during the teacher's conference period. All researchers who visit the school must have criminal background checks.

This permission is contingent on continued approval of the study by the TCU Institutional Review Board. In addition, we may withdraw this permission at any time.

_____

Printed name of school administrator

_____ _____

Signature of school administrator Date

Appendix C

Interview #1 Questions

Welcome. I'll be taking notes. I may ask you to expand on certain questions to make sure I understand. If a question makes you uncomfortable, let me know and we can skip it. Can I record?

PAST

1. Let's go back 2 or 3 years, back to the days of TAKS/ End of Course testing…. Please describe a typical day for you. How did you feel getting up to go to work and throughout the day?..... Why?

2. Still back in the TAKS days….Please take me through one of your lessons…. What kind of activities did you do?

3. Where you able to go in depth with the subject matter or topics student found especially interesting?

4. What was your curriculum like? How was the pacing of the topics? How much of the TEKS did you cover?

5. Please describe the demeanor of your students back then. How did they appear to feel about coming to class? How about their parents?

6. How did administrators act towards you then? What role did they play in your day? What interactions did you have with them?

7. Please describe professional development for me in those days.

TRANSITION YEAR- I know transition years can be crazy! Let's go back to the 2013-14 school year/ last year…..

8. When you received the news that there was no longer testing (end of course) for Chemistry of Physics, how did you feel? Why?

9. In that year of change, how did you feel going to work and throughout the day? Why?

10. What did you lessons look like? What kind of activities did you do?

11. Were you able to go in depth with the subject matter more?

12. What was your curriculum like? How was the pacing of the topics? How much of the TEKS did you cover?

13. Please tell me about how your students felt once the test was removed from your subject area. Did their behavior change? In what way? Less likely to turn in work? How about parents?

14. Since you were no longer teaching a state exam, how did the administrators act towards you? What role did they play in the transition year?

15. Did you receive professional development to help with the transition? Please describe for me the professional development you received.

PRESENT

Okay, let's talk about the present.

16. How do you feel going to work and throughout the day?

17. What do your lessons look like now? What kind of activities did you do?

18. Are you able to go into more depth on topics?

19. How about the curriculum? How is your pacing now? How much of the TEKS do you cover?

20. How are your students now? How do they appear to feel about your class since there is no test? How about their parents? More or less communication?

21. Administrators? What is their role to you now? How do you feel as though they view you since you are no longer tested?

22. What has professional development looks like this year?

For our last thing, please tell me about your teaching experience (years of experience, subjects/degree area, degrees held, type of certification, grade level and number of years at each, public/private)

Appendix D

Interview #2 Questions

1. So for the past three years, your students are no longer taking the state exam. How does that make you feel?
2. How do you feel going to work and throughout the day?
3. What do your lessons look like now? What kind of activities did you do?
4. Are you able to go into more depth on topics?
5. How about the curriculum? How is your pacing now? How much of the TEKS do you cover?
6. How are your students now? How do they appear to feel about your class since there is no test? How about their parents? More or less communication?
7. Administrators? What is their role to you now? How do you feel as though they view you since you are no longer tested?
8. What has professional development looks like this year?

Appendix E

Interview #3 Questions

Interview Questions for the End of the Second Trimester

1. Two-thirds of the school year is almost finished. How does that make you feel? [why or can you explain your answer]

2. What would you say your biggest challenge has been this past trimester? This year? As you go into the final trimester, do you anticipate any challenges?

3. What was your biggest challenge during EOC/TAKS years?

4. Throughout this trimester, as I've talked to you after each lesson, you've identified changes to lessons and overall curriculum. What changes do you notice most in your lessons now that you are no longer tested? [Tell me more about your reason for making the changes.]

5. Do you feel a difference in yourself as an educator? What is the biggest change in your practice today as compared to EOC or TAKS years?

6. We've also discussed students. Positive or negative, what changes do you notice the most in your students? [is this overall or within a sub-group of students]

[If not addressed in above question]

7. Please compare student demeanor.

8. Please compare student buy-in.

9. Do you feel that students have an overall better experience now or during EOC/TAKS?

Teacher A only: Finishing up with Chemistry A, do you feel that these students are as prepared for Chemistry B as those during EOC years?

Teacher B only: Finishing up with Physics B, do you feel that these students are as prepared for physics at the college level or for any physics situations post –high school as those students you had during TAKS testing?

Teacher A only: Since you will no longer have on-level Chemistry the rest of this school year… How does that make you feel?

10. What are you looking forward to most next trimester? What are you not looking forward to?

11. Does the school environment tend to change in the third trimester? In what ways?

12. Do teacher attitudes overall tend to change in the third trimester? In what ways?

13. Do student attitudes overall tend to change in the third trimester? In what ways?

Appendix F

Interview #4

Given Prior to Interview

1. What is your favorite topic to teach?

2. Describe your favorite lesson you have done this year.

3. If there were no constraints on you as an educator – describe your perfect topic and lesson.

Interview

1. EOC is this week. Thinking back to your experiences with TAKS and EOC testing, how were you feeling this time of year when you taught a tested subject?

2. How are you feeling now?

3. There used to be an entire week of testing during TAKS and the first year of EOC. Please describe the atmosphere- what was that week like for you and your students.

4. What has the atmosphere been like this week?

5. When Chemistry/Physics was tested, did you feel regulated by the school, curriculum, or the district administration on your teaching methods or the material you taught? Please explain.

6. Do you feel regulated now? Who checks up on you now?

7. [if not mentioned] What is the district administration's role now that you are not tested?

8. Are there any measures in place to ensure you cover the TEKS?

9. Any consequences for not covering material?

10. Any expectations on teaching methods or how to teach?

Appendix G

Interview #5

End of School Year Interview

Curriculum Covered

1. How far are you in the curriculum?

2. What topics did you not cover?

3. Are there any consequences for not covering those topics? If so, what are they?

4. Do you feel students are more or less prepared in Chemistry/Physics to achieve their goals now compared to when they were tested (whether they go into college, trade school, or begin a career)?

Student Demeanor

5. Describe the students this year.

6. How do they differ from the students a few years ago when you were tested?

7. Going into this week- finals week- predict your failure rate.

8. What is the reasoning behind most of these failures?

Instructional Practices

9. Describe yourself as an educator this year.

10. As an educator, did you set any goals for yourself at the beginning of the year?

11. Did you make those goals? Why or why not?

12. Reflecting on this past year, what major challenges or obstacles did you encounter?

13. Which of these did you overcome and how?

14. How were you feeling at the beginning of the year?

15. How did you feel at the beginning of the year when you were tested?

16. How do you feel right now?

17. How did you feel at the end of the year when you were tested?

18. What does next year look like for you? What are your plans for next year?

19. Do you plan to set any goals for yourself next year? Is there anything you would like to change about yourself or teaching practices? If so, what are they?

Appendix H

Interview #6 Questions

1. What is the school focus for the year?

2. Please describe the professional development you had this week.

3. Was anything you learned beneficial to your teaching practices? Please explain. How will you use that new information?

4. Do you have any new goals for yourself this year? Please explain

5. Did you decide to change any of your goals based on the professional development you had this week?

6. Are there any obstacles you may have to overcome to attain these new goals?

7. In May, you predicted that you would have a failure rate of _____. What was your ending failure rate? Why did most of these students fail?

8. Student apathy was a major problem last year. How will you address that this year?

9. Are there any changes to the chemistry/physics curriculum this year? What will be added or subtracted?

10. Did you have any science department meetings this week? Please describe the meeting.

11. What is your class schedule for the fall? Any added responsibilities? Fewer responsibilities?

12. Compared to this time last year, how do you feel right now going into this school year? Please explain.

13. Compared to last year, what is the biggest change you want to see? How will you do that?

Appendix I

Observation Schedule

Week	M	TU	W	TH	F
1				L1, C1	R2
2		L3, C2		L4	
3	L5			L6, C3	
4	L7	L8, C4			
5	L9			L10, C5	
6	L11	L12, C6			
7	L13	L14, C7			
8	C8				
9		C9			
10	C10				
11				C11	
12		C12			
13			C13		
14		C14			

For example:

C2= Cris Observation 2

L9= Laura Observation 9

Appendix J

Post-Observation Conference Sample After Observation #1

Erin: So, what would this lesson have looked like if you were [state] tested?

Laura: Actually, probably pretty similar because I actually made this activity based on all of the TEKS. Although, I probably would have had a more focused warm-up, like maybe old test questions or whatever test questions that had given us from the state for the EOC test. Yes, so versus me just kind of making up general questions to achieve whatever task I need them to know… And the warm-up too, probably would have been more review. I would have been- they're still kind of sort of on atoms and periodic table and all of that so I made the warm-ups when I was teaching EOC courses, I made those a lot …. I would have one over the content we were learning and then one over the old, like old, old, old material.

Erin: Oh, okay.. the released?

Laura: um hum.. yea

[Tape turns off & then back on once teacher starts talking again]

Laura: I am much more willing to say, " Okay, I'm going to drop teaching this content so I can focus more on this… because this class needs a little bit more time on… versus if I was still teaching the EOC stuff. Then, I would, I would kind of just plow through it because we had to make sure they've at least seen everything.

Erin: Uh huh. So, are you about where you would be in your curriculum?

Laura: No. If I was doing EOC, I would be much, much further ahead. Since this is winter trimester, the A part, I have a lot of kids that have failed chemistry previously. So again, I am much more willing, just based on the speed of the class to say, "Okay, I'm

either going to cut content here or I'm going to make this unit a little bit longer." Like, I'm more willing to personalize it for those individual classes versus… So I would be much further ahead if I was doing EOC cause you know, we didn't have a choice. We wanted them to see all of the content so we would just plow through it.

Erin: So, how much further would you say?

Laura: Ummm, probably about a unit.

Erin: A Unit.

Laura: Yea, so… I'm probably a week, week and half behind where I would be… where I would like to be. And I always, do my schedules to teach with the intention of teaching all of the readiness standards. But if I can't get to all of them, then I'm going to focus on something that's going to get them set up for physics, or like that's going to be a huge player in another unit, then that's what I'm going to focus on versus. Even though, I'm not necessarily always teaching all the readiness standards, but I'd rather do that than have the kids' heads spinning because they don't get anything.

Erin: I understand.

Laura: Yea.