TIMING OF HIGH SCHOOLS: ACHIEVEMENT, ATTENDANCE, AND GRADUATION

by

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Dedication

My desire to further my education with a doctoral degree has been instilled within me by watching my mother battle cancer for 19 years. She was determined to live life to the fullest while fighting the disease. My mom was a career driven woman running a thriving business with my father while completing her masters at the University of Houston – Clear Lake. Her desire to succeed along with the physical struggles of cancer will forever inspire me to clear all roadblocks no matter how challenging they may be in life. Even with the day to day struggles my mom remained optimistic and cheerful which has inspired me to dedicate my dissertation to my beloved mother, Clara Haney. As I know she constantly whispered words of wisdom to comfort, redirect, and guide my passionate soul to finish this milestone in my life.

Acknowledgements

My inspiration goes to my prior superintendent who was adorned with a hat to protect her golden locks on a windy high school graduation night. From that point, I desired to wear a velvet hat like her at graduation, too. Little did I know this would lead to the destination dissertation process in a doctoral program at University of Houston-Clear Lake.

As my heart and mind nears the finish line for this major accomplishment, acknowledgements of dear loved ones must be addressed. My husband, Monty Keown, has only known the struggles, frustrations, and roadblocks of a doctoral student. It is with great pleasure that I recognize him for the emotional support and guidance he has provided during this time. And, who could forget the midnight snacks to accompany the deadlines with an occasional glass of the Prisoner, our favorite wine. We were officially intertwined in marriage, in St. Lucia, by the time I defended my dissertation. For without Monty, I could not have crossed the finish line.

My dad and two sons, as well as other family members, were supportive when they were pushed aside for another deadline. I will always be thankful for those who inspired and encouraged me to prosper through this process. Especially, the numerous friends, both old and new, who cheered from the sidelines with every twist and turn of the dissertation deadlines. And, who could forget all the professors' words of wisdom that were like gold medals towards the end of this race. However, if truth be told, I just wanted the velvet hat!

ABSTRACT

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This study was conducted as a sequential mixed method design to determine the relationship of school start times with achievement, attendance, and graduation rates among high schools. The misalignment of the internal clocks in teenagers and high school start times has been evident among high school campuses. Teenagers have required at least 8.5 to 9.5 hours of sleep; however, research has shown that 87% of high school students received less sleep due to the early start times of high schools (Owens, Au, Carskadon, Millman, & Wolfson, 2014a; Wahlstrom, 2002). High schools have not changed their start times in decades; thus, the purpose of this study examined the routines of schools and the collision with the biological needs of adolescents, contributing to sleep deprivation (Owens, Drobnich, Baylor, & Lewin, 2014b; van der Vinne et. al., 2015). The high school start times were acquired from 256 high schools in three region centers

(Region IV, Region V, and Region VI) in southeast Texas for the 2017 – 2018 school year. These 256 high schools were sorted by size (small, medium, and large) based on student enrollment figures from the 2017- 2018 school year. Achievement, attendance, and graduation data was collected from the Texas Student Data System (TSDS). This information was analyzed using Pearson's product moment correlations (*r*) to determine if school start times had an impact on achievement, attendance, and graduation averages. The results of this study found that small sized high schools with an average start time of 7:51 a.m. had a statistically significant relationship with achievement, attendance, and graduation averages which aligned the internal clocks of teenagers with their high schools start times more successfully than medium and large sized high schools. Additionally, interviews from 15 superintendents provided a unique perspective on the process and implementation of altering high school start times. The in-depth responses provided a wealth of information that superintendents encounter when addressing school start times. The results of this study revealed the logistical, practical, and political aspects behind the healthy alignment of school start times and the internal clocks of teenagers.

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CHAPTER I:

INTRODUCTION

Excessive sleep loss among teenagers has prevailed in school settings for years (Jacob & Rockoff, 2011). Adolescents averaged less than eight hours of sleep a night; while, their bodies required nine to 10 hours per night (Martin, Gaudreault, Perron, & Laberge, 2016). Sixty-two percent of high school students do not get adequate sleep per night (National Sleep Foundation, 2006).

In the teenage years, sleep patterns drastically transformed with after school activities, homework, and social media feeds. Teenagers in grades 9 through 12 unwind after eleven o'clock on school nights (National Sleep Foundation, 2006). Adolescents' biological rhythms shift in high school; therefore, high school students do not experience a full sleep cycle until the weekend (Wheaton, Ferro, & Croft, 2015).

Traditionally, high school classes started as early as seven o'clock (Wahlstrom, 2002). High school students wake up even earlier than other students due to bus routes in most districts which leads to sleep deprivation (Boyland, Harvey, Riggs, & Campbell, 2015). Many school districts have not changed their transportation schedules in decades (Owens et al., 2014b). The routines of school systems collided with the biological needs of teenagers, contributing to sleep deprivation in teenagers (van der Vinne et al., 2015). Even the American Academy of Pediatrics requested that secondary schools modify their start times to begin no earlier than 8:30 a.m. in the morning (Wheaton et al., 2015). However, most school districts had traditional transportation tiers, with high schools starting school an hour prior to elementary schools (Wolfson & Carskadon, 2005). With high schools starting earlier, teenagers report missing school or arriving late due to oversleeping at least once a week according to the National Sleep Foundation (2006). Schools with early start times deal with discipline issues related to unexcused tardiness,

limited concentration, moodiness, and difficulty staying awake in class (Barnes & Drake, 2015). It is evident that school systems adhere to traditional schedules; although, researchers suggest aligning high school start times to accommodate the physiological needs of teenagers (American Academy of Pediatrics, 2014a; American Medical Association 2016; National Sleep Foundation, 2006).

With chronic absenteeism on the rise in secondary schools, start times may have the potential to improve attendance rates in secondary schools (Wolfson & Carskadon, 2005). In our nation, sleep deprivation among our teenagers is evident with daytime sleepiness, absenteeism, tardiness, and social jetlag present in the high school classrooms (Wahlstrom, 2002). Social jetlag describes the incongruity between work and free time, connected with their sleep patterns and social time (Wittmann, Dinch, Merrow, & Roenneberg, 2006). This continues to affect teenagers as they balance school schedules and biological sleep patterns.

Teenagers struggling to get the recommended amount of sleep per night, often experience emotional issues such as depression, anxiety, and moodiness (Wahlstrom, 2016); therefore, discipline issues could result in the lack of sleep among teenagers in high school. With the rise in teenage issues, research will need to address altering school start times (Owens et al., 2014b). The procedures in switching time frames could show a cost savings in transportation, depending on size and type of district (Owens et al., 2014a). Along with transportation savings, a decrease in absenteeism could be a financial advantage to districts when considering altering start times (Wheaton et al., 2015). Texas school districts receive funding per student based on their daily attendance throughout the year (Henderson, 2015). It may be necessary for the school systems to address the issue of sleep deprived teenagers, in high schools, based on research suggesting teenagers' sleep wake cycle is disrupted due to early start times, which may lead to attendance

issues among schools. Thus, research should examine the alignment of healthy teenagers and high school start times. The traditional models with early start times must be analyzed to determine if a relationship between start times and sleep deprivation among teenagers has an impact on achievement, attendance, and graduation.

Research Problem

A concern in the secondary field of education exists in adolescents experiencing changes in sleep patterns during puberty. This physiological shift may lead to an unhealthy balance of sleep especially during the school week (Barnes et al., 2016). Sleep deprivation in teenagers leads to behavior and attendance issues in schools (Thatcher & Onyper, 2016). With most of the high schools starting class before 7:45 a.m. in the morning, drowsy adolescents are struggling to survive their high school years (Owens et al., 2014a). The biological changes in adolescents alone, supports the need for a later start time in high schools; however, districts are not seeking change in high school start times (Wahlstrom, 2002). Medical researchers provide educational systems information on the detrimental effects of early start times on teenagers in high school; yet, 60% of 345 school systems studied have not even contemplated changing start times for high schools (Wolfson & Carskadon, 2005).

Historically, high schools open before elementary schools in most districts especially with larger enrollment numbers (Wolfson & Carskadon, 2005). Administrators face several barriers when attempting to alter start times at the high school level. In a survey conducted with secondary school administrators, 55% perceived athletics as the biggest challenge due to later practices and game times (Wolfson & Carskadon, 2005). Along with athletics, any after school program such as band, choir, or cheer could be challenging, with parents opposing a later school start time due to extended practice times on weeknights (Owens et al., 2014a).

Teenagers are often counted on to provide after school care for siblings when they get home from school, which is another barrier for districts to overcome (Owens et al., 2014a). Realigning school start schedules are problematic for transportation departments due to routes, tiers, and traffic flow patterns (Owens et al., 2014b). After all, in most districts these routines have been established for decades without changes (Owens et al., 2014; Pradhan & Sinha, 2016). Therefore, transportation has been a huge barrier to change school start times for teenagers at the high school level. The culture and routines of families, transportation, cities, and districts will require adjustments to adhere to the psychological needs of adolescents in school. Over the years, educational practices do not align with proven medical and psychological research when making healthy decisions for teenagers (Pradhan & Sinha, 2016; Valdez, Ramirez, & Garcia, 2014; Wahlstrom, 2002). Therefore, extensive research will be needed to analyze the high school start times with achievement, attendance, and graduation rates.

With a crisis in school funding in Texas, attendance rates are critical to school districts. Attendance rates provide funds through an Average Daily Attendance (ADA) which is a calculation of the number of students in attendance divided by the number of instructional days attended during the year (Jones, Toma, & Zimmer, 2008). In simple terms, it means the state determines how much it will fund a district based on perfect attendance per student; then, by calculation missing days per student with a formula (TEA, 2019a). The state determines how much money per student each district will get according to tax revenues.

According to Texas Education Agency (TEA), districts could receive ADA funds between $3,500 and up to $6,000 per student with 90% attendance; therefore, in order to receive this additional funding, it is important for students to attend school every day (TEA, 2019a). In each comparison, students gaining 90% attendance or more counts

towards ADA funding which is set by the state (Jones et al., 2008). Attendance rates are a direct source of funding for districts; hence, each district has different funding amounts depending on the ADA rate and type of district (TEA, 2019a). If high school students attended school more frequently, districts would receive more funding for education. Thus, further research must be established to determine if school start times may have an impact on high school attendance rates.

Teenagers face changes in sleep and wake patterns especially in high school which leads to shorter sleep duration at night (Pradhan & Sinha, 2017). The circadian cycle extends approximately two hours in the sleep and wake patterns of teenagers (Dunietz et al., 2017). The shift in biological sleep cycles changes during the teenage years causing later sleep and wake patterns than teenagers experience at younger ages (Barnes et al., 2016). This causes a lack of sleep among teenagers as they stay up late until their biological sleep cycle catches up with them which is often around midnight. Then students rush to wake up early to catch a bus or drive to school before the bell rings for first period (Wheaton et al., 2015). Thus, sleep deprivation becomes apparent in teenagers during high school with daytime sleepiness, absences, and late arrivals (Wahlstrom, 2002). As students fall asleep later, the timing of schools may affect their sleep patterns which leads to sleep deprivation. This leads to a mismatch between the natural circadian cycle to fall asleep and wake up as compared to the school schedules at most high schools (Barnes et al., 2016). Clearly, the synchronization of teenage sleep patterns and school start times cause sleep deprivation over time leading to high attendance issues on high school campuses (Barnes et al., 2016).

In high schools, students suffering from sleep deprivation due to their circadian cycle are referred to as late chronotypes or owls (Zerbini et al., 2017). Sleep deprivation leads to poor academic functioning among late chronotypes which affects high school

students with early start times (Dunietz et al., 2017). During the early morning hours students are not receptive to new knowledge which affects academic performance in early start time schools (Valdez et al., 2014). Students fall asleep, lack comprehension, and struggle with memory recall items in the morning hours. Compensation for these inabilities cause students to stay up later to cram and prepare for early morning tasks leading to further sleep deprivation (Valdez et al., 2014). Late chronotypes are prevalent in the teenage years as their circadian cycle changes; thus, school performance may suffer with sleep deprivation leading to inability to concentrate, perform memory tasks, and receive new knowledge during the early hours of the day (Dunietz et al., 2017; Valdez et al.,2014; Zerbini et al., 2017).

Sleep deprivation is prevalent among teenagers attending high schools. When students repeatedly sleep less than seven hours per night, they struggle to function in school academically and with attendance; thus, students will choose to drop out instead of completing their high school education. When students receive at least eight hours of sleep per night, academic performance increases and lower drop-out rates are prevalent (Boergers, 2014). With 70% of adolescents receiving less than eight hours of sleep, high school students face sleep deprivation leading to poor academic performance and lower graduation rates (Boergers, 2014). Furthermore, teenagers sleeping more than eight hours of sleep per night have more of a chance of graduating with their cohort within four years according to Sabia, Wang, and Cesur (2016). Teenagers may need education on healthy sleep habits to address sleep deprivation.

Significance of the Study

The impact of sleep deprivation among teenagers has been well researched. Teenagers are more likely to struggle with high school start times due to insufficient sleep during the school week according to Lin and Yi (2015). Teenagers suffer from

delayed bedtimes and wake times which affects their circadian cycle during these years (Boergers, 2014; Dunietz et al., 2017). Research suggests that teenagers require 8.5 to 9.5 hours of sleep; however, teenagers are sleeping less than eight hours a night leading to sleep deficits (National Sleep Foundation, 2006). Sleep deprivation is common among adolescents as their sleep wake cycles conflict with early start times of most high schools (Martin et al., 2016). According to the National Sleep Foundation (2006), 62% of high school students get less than eight hours of sleep. Adolescents fall asleep shortly after 11:00 p.m. allocating less than seven hours of sleep during the school week (Wolfson & Carskadon, 2005). In prior research, details regarding school start times and sleep deprivation were based on student self-report measures or specific sample populations. This detrimental impact of sleep deprived teenagers affects high schools.

Primarily, research focuses on the psychological and physiological effect on teenagers in high schools; thus, the generalizability of the research is uncertain when relating to achievement, attendance, and graduation rates. With all the literature on sleep deprivation and school start times, it is imperative to address the unhealthy balance with school start times and sleep deprivation. A practical view analyzing the impact of school start times on achievement, attendance, and graduation rates will examine this relationship. Another component of this study will report high school start times which is not a requirement of the state; thus, the researcher will obtain school start times via phone calls, emails, and websites to portray a clear picture of high school start times across three regions. This study will provide data analysis from multiple high schools empowering superintendents to face school start time challenges with confidence (Wahlstrom, 2002).

Research Purpose and Questions

The purpose of this study will determine if there is a relationship between high school start times with attendance, achievement, and graduation. The following research questions will guide this study:

1. Is there a relationship between start times of high schools and achievement scores on STAAR EOC Exams in English I, English II, Algebra, Biology, and U.S. History?
2. Is there a relationship between the start times of high schools and attendance rates?
3. Is there a relationship between high school start times and graduation rates?
4. What are the perceptions of school superintendents concerning the influence of high school start times on student attendance, achievement, and graduation rates?

Definitions of Key Terms

The terms relevant to this study are listed below:

Achievement Percentages: The average achievement score for English I, English II, Algebra, Biology, and U.S. History for each high school as calculated by the state (TEA, 2017b)

Attendance Averages: The attendance average for a high school campus will be calculated by the state through the Average Daily Attendance (ADA) which calculates the number of students, who are in attendance each day of the school year for the entire school year and then dividing that number by the number of instructional days in the school year, which can be found in ADA computations. This calculation determines how

much money the school system will receive the following year based on Average Daily Attendance. The ADA is calculated based on individual formulas created by the Texas Education Agency to allocate funding to each district (TEA, 2019a)

Graduation Rates: These percentages will show the number of students from a cohort of ninth graders who earned a diploma without alternate means of graduating such as a longitudinal plan or passing high school equivalency exams within four years (TEA, 2019b).

Independent Town: When a district is located in a county with "a population of 25,000 to 99,000 and at least 75% of the largest district enrollment for the county" it will be classified as Independent Town (TEA, 2019c).

Large School Size: The University Interscholastic League conference cut offs for a large high school would be 6A with 2,150 students or higher which designated the large size schools in the research (UIL, 2016).

Major Suburban: A district that doesn't meet the criteria for Major Urban with an enrollment of at least 4,500 students or 15% of the largest major urban district in the county (TEA, 2019c).

Major Urban: When a district is located within a county of at least 950,000 people and at least 35% of enrolled students are economically disadvantaged (TEA, 2019c). The district would need to have an enrollment of at least 70% of the largest district enrollment in county to be classified as Major Urban (TEA, 2019c).

Medium School Size: The University Interscholastic League conference cut offs for a medium high school would be 4A and 5A with 480 -1099 students which designated the medium size schools in the research (UIL, 2016).

Non-Metropolitan Stable: The enrollment is equal to or greater than the average district enrollment for the state (TEA, 2019c).

Other Central City: The district does not border a major urban district but located within a county population of 100,000 and 959,999 (TEA, 2019c). The district could be the largest in the county or at "least 75% of the largest district enrollment in the county" (TEA, 2019c).

Other Central City Suburban: The district would be located in a county with a population of 100,000 to 959,999 and enrollment is "at least 15% of the largest district enrollment in county" or the" enrollment is equal to or greater than the average district enrollment for the state" which would be 880 students (TEA, 2019c).

Region: Region designated the high schools in Region Service Centers IV, V, and VI which were marked by the numbers four, five, and six to represent the appropriate service center in southeast Texas (TEA, 2017a).

Rural: The district will have an enrollment of 300 to 880 students with an "enrollment growth rate over the past five years of less than 20%" (TEA, 2019c). The district could even have less than 300 students to be classified as Rural.

School Size: High schools across Texas are classified based on University Interscholastic League (UIL) conference cutoffs. UIL football conference cutoff numbers based on student enrollment into categories (UIL, 2016). For this study, high schools will be categorized by student enrollment into three categories: (Small) 1A, 2A, and 3A, 18 – 479 students; (Medium) 4A and 5A, 480 – 2,149 students; and (Large) 6A, 2,150 – 4,835 students (UIL, 2016).

School Start Times: Texas Education Agency (TEA) does not require districts or campuses to record school start times with the state; therefore, start times will be acquired via phone calls, emails, and websites.

Small School Size: The University Interscholastic League conference cut offs for a small high school would be 1A, 2A, and 3A based on 18 to 479 students on the campus which designated the small school sizes in the research (UIL, 2016).

Social Jetlag: Social Conflict is a conflict between biological patterns and external time factors (Wittmann et al., 2006).

State of Texas Assessment of Academic Readiness (STAAR) End of Course (EOC)Testing: In the state of Texas, high school campuses are measured based on student achievement on standardized testing. Students are given the STAAR EOC assessments. The STAAR EOC test began the first administration in 2012 which consists of English I, English II, Algebra, Biology, and U.S. History. After test administration, campuses are measured based on average student performance on each test. The purpose of the EOC tests guarantee high school graduates master specific skills; thereby, meeting the state standards for graduation criteria (TEA, 2017b).

Total Sleep Time (TST): Total sleep time measures the time devoted to sleep duration in most of studies on sleep deprivation (Morgenthaler et. al., 2016).

Conclusion

This chapter provided an overview of the need for this study, significance of the problem, research purpose and questions, and key definitions pertaining to the study. This study will analyze prior data to determine the impact of achievement, attendance, and graduation rates on school start times among high schools. The following areas will be researched to determine the benefits to high school start times: achievement, attendance, and graduation rates. As high school students continue to struggle to keep their heads off their desk each morning, school districts must determine if they are providing the optimal educational environment for high school students experiencing biological changes in

adolescence. The next chapter will be a literature review of the major studies that address this topic.

CHAPTER II:

REVIEW OF LITERATURE

Throughout the vast amount of literature and research associated with the role of school start times and sleep habits among high school students, there is a significant lack of empirical research connecting school start times with achievement, attendance, and graduation rates (Taras & Potts-Datema, 2005). The major body of research focused on subjective analysis with self-reported sleep quantity and quality in the form of diaries, student surveys, parent observations, and teacher questionnaires. This prospective could be misleading with numerous medical associations promoting later start times for high schools based on medical or psychological research; whereas, these experimental designs addressed sleep disorders rather than address key educational concerns. Thus, the purpose of this study was to examine the relationship between school start times and achievement, attendance, and graduation rates. To address these areas, this literature review focused on: (a) school start times and attendance, (b) sleep deprivation and attendance, (c) school start times and achievement, and (d) school start times and graduation rates.

School Start Times and Attendance

In a recent study, the role of sleep in relation to attendance was studied in a Dutch High School. Studies often show students with a late chronotype and short sleep patterns performed poorer than early chronotypes (Zerbini et al., 2017). In this study, it was found that academic performance was like attendance with late chronotypes and sleep deprived teenagers. Early or Late Chronotypes among 523 students were determined with a Munich ChronoType Questionnaire (MCTQ) (Zerbini et al., 2017). Sleep deprivation impairs teenagers especially with early school start times; thus, late chronotypes exhibit higher tardiness rates and attendance percentages (Zerbini et al., 2017). A statistical analysis showed that along with academic performance the late chronotype students were

absent more than the early chronotype students (Zerbini et al., 2017). The research showed late chronotypes were significantly more likely to miss school, become ill, arrive tardy, and receive early dismissals than early chronotypes (Zerbini et al., 2017).

In another study, a four-year observation was conducted with a before-after-before design with school start times changing from 8:50 to 10:00 in the morning at an English state-funded high school (Kelley, Lockley, Kelley, & Evans, 2017). This study analyzed student absences as it related to student illness after the school start time change. In the results, it was found that the later start time, 10:00 in the morning, drastically reduced student illness by 50%; while, reverting to the early start time, 8:50 in the morning, showed an increase of 30% in illness (Kelley et al., 2017). This field experiment reflected attendance was directly tied to school start times. The findings concluded later start times will decrease student absences; yet, more research should be conducted due to the small sample size and only addressing student illness in the type of absenteeism.

Few districts have taken steps to alter start times to improve student attendance and tardiness at high school levels. Schools with delayed start times experienced meaningful declines in tardiness rates and absences according to prior research (Thacher & Onyper, 2016). Conversely, in upstate New York, a public high school was analyzed to determine if delayed start time of 45 minutes would benefit attendance. This study used a sleep index measure and self-report survey to collect data (Thatcher & Onyper, 2016). A comparison from pre and post start times indicated the first year showed a 20-minute gain in total sleep time (TST); however, after the second year the TST reverted to the original reported time of under seven hours of sleep (Thatcher & Onyper, 2016). In this study, absences showed an increase after the delayed start time; however, reductions in tardiness and discipline were evident (Thatcher & Onyper, 2016).

Another study examined the relationship between delayed start times and attendance rates by delaying the start time by 30 minutes (Owens, Belon & Moss, 2010). A boarding school in Rhode Island, with 201 high school students, proposed a change in start time which showed an increase in total sleep time (TST) of 45 minutes, the percentage of students getting less than seven hours of sleep decreased by 79.4%, and an increase in attendance was evident (Owens et al., 2010). Students completed a retrospective sleep habits survey to analyze the relationship of school start time as compared to adolescent alertness, mood, and health (Owens et al., 2010). The study showed an increase in attendance after implementing a delayed start time by 30 minutes. Further research would be required for these results to be comparable to public school districts due to sample size and enrollees.

Sleep Deprivation and Achievement

Strong evidence exists regarding the relationship between sleep deprivation and achievement. Dimitriou, Knight, and Milton (2015) conducted a research study with 48 students, aged 16 to 19, who participated in a School Sleep Habits Survey, logging information into a sleep diary, and measuring the mean grade point averages (Dimitriou, et al., 2015). Primarily, the study found the participants recorded a bedtime of 11:30 p.m. with an average of seven hours and eight minutes (Dimitriou et al., 2015). The study utilized Pearson's correlations to explore the relationships between variables; thus, the greater the total sleep time (TST) and earlier bedtimes strongly correlated with higher academic results (Dimitriou et al., 2015). One of the correlations addressed sleep/wake patterns and morning/evening problems which were associated with sleep quality and cognitive processing (Dimitriou et al., 2015). This study recognized the sleep/wake patterns of teenagers when school start times conflicted with the biorhythms of teenagers which led to sleep deprivation. The research study could not directly tie a causation with

sleep and academic performance; yet, reduced quality and quantity of sleep negatively impacted academic performance (Dimitriou et al., 2015). The study did find negative associations with stimulants and media use before bedtime which led to low academic performance (Dimitriou et al., 2015). Thus, further research is needed to examine the relationship between sleep deprivation and academic performance when considering school start times.

In a similar study, the biological clocks of teenagers were studied in relation with sleep deprivation and student achievement (Valdez et al., 2014). This study looked at the circadian rhythms in cognitive processing which showed improvement during the day and decreases in the night and early hours of the morning (Valdez et al., 2014). Furthermore, sleep deprivation was found as an implication in cognitive processing which directly affects school learning (Valdez et al., 2014). Circadian variations in cognitive processing were found in human performance such as attention, working memory, and executive functions (Valdez et al., 2014). This study analyzed circadian variations which found a decline in attention, working memory, and executive functions which was observed between the hours of four and seven in the morning due to sleep deprivation and chronotype (Valdez et al., 2014). Therefore, the sleep-wake cycle and body temperature combined with circadian rhythms showed an effect on academic achievement (Valdez et al., 2014). Teenagers were experiencing a delay in the sleep-wake cycle as they typically go to bed late and wake up late causing sleep deprivation during the school week. These results suggested students experiencing early start times showed a decrease in academic performance due to a conflict with their sleep/wake cycle. Further research is needed to analyze the connection between sleep deprivation and school start times as it relates to academic achievement.

A study conducted near schools in Paris, France, 177 adolescents in the 9th and 10th grades were recruited to examine the relationship between sleep habits, grade averages, and grey matter volumes (GMV) (Urrila et al., 2017). The method of research analyzed sleep habits of teenagers tied with regional grey matter volumes and grade averages in adolescence through magnetic resonance imaging (MRI) and voxel-based morphometry (VBM) (Urrila et al., 2017). In the results, the study found that later bedtimes on weekends correlated with poor grade point averages and smaller brain GMV's. However, the study found medial prefrontal-anterior cingulate cortex relates to the adolescents' variations in sleep habits from weekday to weekend timing (Urrila et al., 2017). These results suggest sleep habits including weekday and weekend recovery affect achievement scores. It is clear more research is needed to examine sleep habits, school start times, and academic performance among adolescents.

In Switzerland, a study conducted with 2,716 adolescents assessed sleep patterns and daytime sleepiness through on-line surveys which were linked with math and German grades (Perkinson-Gloor, Lemola, & Grob, 2013). The average total sleep time for students was eight hours and thirty-six minutes with an average bedtime of 10:29 p.m. (Perkinson-Gloor et al., 2013). The results showed males and females, with less than eight hours of sleep, had lower school grades as compared to those with eight to nine hours of total sleep time (Perkinson-Gloor et al., 2013). Sleep deprivation correlated with lower school grades; however, more than nine hours of sleep had no significant advantage with academic grades (Perkinson-Gloor et al., 2013). The results support healthy sleep practices to avoid sleep deprivation in teenagers. Further research would be needed to isolate the difference in recorded bedtime verses actual sleep time due to the nature of self-reported surveys.

Another study addressed the impact of school schedules on adolescent sleep patterns with teenagers through sleep diaries. The method of collection relied on 60 high school seniors who logged their activities during a period of three months to record sleep habits (Hansen, Janssen, Zee, & Dubocovich, 2005). Two types of test were administered with the following time frames: (a) 6:30 – 800 a.m., (b) 11:30 – 1:00 p.m., (c) 3:00 – 4:30 p.m. (Hansen et al., 2005). Then test scores were correlated with total sleep time as recorded by the students (Hansen et al., 2005). Artificial light treatments were administered to one group while the other group was issued a placebo treatment (Hansen et al, 2005). This was utilized to determine if early morning light treatments improved performance; however, all students performed better in the afternoon even with morning light treatments (Hansen et al., 2005) The findings of the sleep diaries, light treatments, and performance test exhibited adolescents lost 120 minutes of sleep during the school week with lower performance in the morning as compared to the afternoon (Hansen et al., 2005). Limitations in the study included the homogeneity of the 60 students, who were advanced biology students, which may not transfer to the general population. More research should be conducted to correlate sleep deprivation and academic performance.

The examination of sleep quality, duration, and sleepiness in relation to academic performance was conducted with a meta-analysis approach through researchers at the University of Amsterdam (Dewald, Meijer, Oort, Kerkhof & Bögels, 2010). The various studies ranged from behavioral ratings, self-reported diaries, and surveys to comparisons with grade point averages and assessment measures; however, significant differences in gender results were evident (Dewald et al., 2010). In multiple studies, females consistently suffered from sleep deprivation as compared to males (Dewald et al., 2010). Although these results would prompt further research, the differences in females and males could be explained by the age range of the sample. The meta-analysis showed a

small effect on school performance in relation to sleep duration, quality, and sleepiness in school (Dewald et al., 2010). Future experimental studies should be conducted to address the timing of puberty among males and females in relation to sleep quality, sleep duration, and sleepiness in schools (Dewald et al., 2010).

School Start Times and Achievement

In a consolidated attempt to analyze sleep deprivation with school start times, a study conducted by Lin and Yi in 2015 examined the unhealthy sleep practices of students during the school week due to school start times. This study utilized an eight-year longitudinal data set, along with surveys of 2,472 students, to determine if sleep deprivation occurred during the school week. The study looked at school start times to determine the impact on achievement based on weekly sleep habits. The findings of the study demonstrated sleep deprivation, defined as sleeping six hours or less, among teenagers were most likely to face poor academic performance (Lin & Yi, 2015). These results found lack of sleep during the school week led to negative factors on cognitive functions which directly correlated with academic performance in this study (Lin & Yi, 2015). This study also found that short sleep during weekend periods had a negative impact on academic performance (Lin & Yi, 2015). Overall, the findings concluded that teenagers sleeping six hours or less are more likely to struggle in academics especially with memory and problem-solving skills (Lin & Yi, 2015). The findings alluded to the difference in biorhythms in this age group which contrasted with the school start times; however, more research is greatly needed to examine the direct relationship of school start times on achievement rather than just hours of sleep per night.

In a compelling study, a fire burned down a high school which led to the development of morning and afternoon schedules in a nearby high school to accommodate the additional students (Martin et al., 2016). This created an environment

to analyze school start times among 57 students. A dual schedule was developed with an early start time of 7:40 a.m. and late start time of 1:25 p.m. to merge two high schools. The researchers used an wrist actigraphy study; whereas, students wore bracelets to register ambulatory activity for seven days and nights (Martin et al., 2016). The study also included diary entries and surveys. The study showed students with the late start schedules slept longer, on both weekdays and weekends, compared to students with early start schedules (Martin et al., 2016). The findings did not find a difference in academic performance between the two groups wearing the actigraphy wrist bands in the study; however, early start times were associated with sleep deprivation and daytime sleepiness than the later start times (Martin et al., 2016). Limitations in this study suggest seven days is not adequate to measure academic achievement between early and late start times; thus, more research is needed to clarify whether school start times affects achievement.

In a longitudinal study, the relationship between school start times, sleep duration, and academic performance was measured by Sabia, Wang, and Cesur to address policymakers regarding school start times (2016). The study found that increased quantity of sleep related to classroom concentration and homework completion unless the amount of sleep exceeded 8.5 hours per night; whereas, longer sleep duration showed diminished academic abilities (Sabia et al., 2016). Overall, the study found that increased sleep improved academic performance with quality and quantity of sleep measured; yet, civilian school start times were not utilized (Sabia et al., 2016). The information gained on school start times were generated by student surveys which were not one of the indicators used in the data analysis process. The findings were clear that excessive sleep over eight and half hours could lead to declining academic achievement (Sabia et al., 2016). Therefore, a more extensive study on academic achievement and school start times

verses sleep quality is greatly needed to determine the relationship of school start times with achievement.

In a study conducted at the United States Air Force Academy, the daily schedules of 6,165 teenagers were separated into three start times over a period of three years (Carrell, Maghakian, & West, 2011). The academy linked start times with achievement scores on norm reference testing, class ranks, and Grade Point Averages (GPA) (Carrell et al., 2011). Within three school years, the academy started at three different times with the earliest being 7:00 in the morning to the latest at 7:50 in the morning. The findings addressed a causal effect with later start times and academic achievement (Carrell et al., 2011). These results showed a positive correlation with academic achievement and the later start time; whereas, the earlier start time had a negative effect on student achievement (Carrell et al., 2011). The study lacked information on total sleep time among the military academy students; hence, sleep deprivation was difficult to measure among the teenagers. The academy randomized the class schedules of students with a requirement to wake up 25 minutes before the first class for breakfast whether start time was at 7:00, 7:30 or 7:50 in the morning (Carrell et al., 2011). Thus, the total sleep time should be calculated to further the implications of this study on start times.

In a subjective study, researched by Eliasson, Eliasson, King, Gould, and Eliasson (2002), 1,000 high school students and 200 middle school students completed a one-page questionnaire designed to formulate information on school start times and academic performance. The results from the self-reported surveys showed an average sleep time of 6.7 hours during the school week with 90% reported sleepiness during school by the participants (Eliasson et al., 2002). The study showed a common belief that 8.43 hours was the recommended rate of sleep by doctors; although, 80% of the participants recognized their inadequacy in sleep acquisition (Eliasson et al, 2002). The findings of

this study indicated no link between sleep time on school days and grade point averages as reported by the participants. In the results of the survey, the highest correlation with grade point averages was the time spent on homework according to the participants in the study (Eliasson et al., 2002). Further research would be needed to determine if students perceive school start times as a factor in their academic performance.

Edwards (2012) studied middle school students in Wake County, North Carolina to determine the causal effect of start times and achievement. Wake County was a large school district with multiple start times among various schools. The researcher compared standardized test scores instead of grade point averages among students in twenty-two middle school campuses over seven years (Edwards, 2012). The results were powerful with positive relationships between reading and math test scores with a one-hour delay in start times; however, the data portrayed demographics of students that attended early start time schools drastically different than the late start time schools (Edwards, 2012). In a comparison between early and late start time schools, the researcher found more minorities, economically disadvantaged, less educated parents, and female students present in the early start time schools (Edwards, 2012). The highest number of middle schools, which included magnet schools, started school at 7:30 a.m. with less than ten percent of the schools starting at 8:20 a.m. or later (Edwards, 2011). This research supported a relationship between achievement and start times.

School Start Times and Graduation

In a study conducted through Central Connecticut State University, 30,000 high school students enrolled in 18 high schools across seven states were analyzed through data analysis to determine the relationship between school start times and graduation rates (McKeever & Clark, 2017). In the analysis, a pre-post design using a repeated measures analysis of variance was utilized two years after the late start and one year prior

to the change in school start time (McKeever & Clark, 2017). The information yielded graduation rates rose from 79% to 88% after the high school start time changed (McKeever & Clark, 2017). These findings are significant to highlight the importance of healthy sleep habits, daytime functioning, and alignment with biorhythms which correlates with later school start times. This study could be replicated with a broader base of high schools in more than seven states; however, the convenience sample was predetermined by contracting with the Children's National Medical Center's Division of Sleep Medicine. Therefore, an increase in sampling size would be desired to replicate the study.

In a longitudinal study, eight high schools in five districts among three states participated in a study from 2010 to 2013. These high schools had start times that ranged from 8:00 until 8:55 in the morning with 9,000 students total (Walhstrom,2016). Among these high schools, a range of demographic characteristics were evident. A data analysis was conducted to study academic variables such as grade point averages, attendance, standardized test results, and graduation rates. The findings concluded the graduation rates among late start times rose from 81% to 97% (Walhstrom,2016). Thus, the results show a benefit for late start times in high schools with at least eight hours of sleep among teenagers.

In a recent experiment in Glen Falls High School, in New York, the school district moved school start times from 7:30 to 8:30 in the morning (Wechsler, 2018). With a thirty percent rise in attendance after the school start time was altered, the increase in graduation rates jumped from the low 70's to 89 percent; thus, Glen Falls High School experienced a growth in graduation rates (Wechsler, 2018). The district incorporated healthy sleep concepts in newsletters and parent workshops to encourage the importance of sleep in the teenage years (Wechsler, 2018). The results of the growth in graduation

rates for Glen Falls showed drastic improvement for this district. Although, these rates were impressive further research is needed to isolate the correlation between school start times and graduation rates with data analysis.

A new perspective of school start times and graduation rates was conducted through a brief literature review conducted by Hale and Troxel (2018). In this approach, the researchers covered a major concern for sleep deprivation among teenagers (Hale & Troxel, 2018). A brief history was examined with a strong contention that current school start times unfairly caused disparity among economically disadvantaged youths (Hale & Troxel, 2018). Thus, the study found a social justice issue prevailed in early start time schools that led to negative consequences such as increased drop outs, high attendance, and poor academic achievement (Hale & Troxel, 2018). Further research would be needed to examine sleep deprivation as a public health and social justice issue; however, increased graduation rates were cited among healthy school start times according to Hale and Troxel (2018).

Summary of Findings

In the review of literature, researchers have found evidence that teenagers experienced physical and psychological changes with the onset of puberty during their high school years which led to altered sleep patterns (Diaz-Morales, Prieto, Barreno, Mateo, & Randler, 2012; Martin et al., 2016; Zerbini et al., 2017). Thus, sleep deprivation permeated high school attendance rates with several variables such as technology, after school activities, homework, sleep-wake cycle, transportation, and school start times (Owens, 2014; Wahlstrom, 2002; Wolfson & Carskadon, 2005). In multiple studies, school start times factored into the equation of sleep deprivation and attendance in teenagers. Several bodies of research were based on longitudinal studies

with multiple subjects (Borlase, Gander & Gibson, 2012; Kelley et al., 2017; Owens et al., 2014b; Thacher & Onyper, 2016; Wahlstrom, 2002).

Wrist actigraphy, diaries, or surveys determined early and late chronotypes to measure the disconnect between school start times and attendance (Boyland et al., 2015; Diaz-Morales et al., 2012; Martin et al, 2016). This mismatch between school start times and chronotypes correlated with reports from associations, foundations, and agencies which proclaimed school start times are detrimental to the sleep patterns of teenagers (American Academy of Pediatrics, 2014a; American Medical Association, 2016, National Sleep Foundation, 2006). In the findings, the mismatch between sleep deprivation and school start times remained a controversial issue when dealing with attendance; hence, educational practices were not unified in addressing attendance and school start times.

In several studies, the quality and quantity of sleep shifted during the onset of puberty which caused a delay in the circadian rhythms (Carrell et al., 2011; Sabia et al., 2016; Wahlstrom, 2016). Basically, the sleep and wake patterns changed for teenagers especially with early start times in high school schedules (Valdez et al., 2014). The combination of metabolic changes and loss of sleep triggered several studies on school start times as it relates to achievement. Academic performance declined with six hours or less sleep per night (Lin & Yi, 2015; Urrila et al., 2017). Then a study found eight and half hours of sleep per night showed a decrease in academic performance due to daytime sleepiness (Sabia et al., 2016). Another study based on student surveys, found students with less than eight hours of sleep experienced lower grades than those with eight to nine hours of sleep (Perkinson-Gloor et al., 2013). Studies used grade point averages (GPA), and surveys to account for academic performance which leads to lack of generalizability to other areas due to the subjective nature of surveys and varying degrees of grade point averages (Wheaton, Olsen, Miller & Croft, 2016b). In this area of research, academic

performance has been controversial due to discrepancies in various forms of measurement. More research will be needed to determine the relationship between school start times and achievement. Based on the studies mentioned adolescents needed healthy sleep habits to perform academically in school regardless of the start times of the schools.

The research conducted with school start times and graduation was difficult to find. This correlation needed more archival data studies to address the changes in early or late start times in high schools. In one of the studies, the convenience sample of high schools were already part of the Children's National Medical Center's Division of Sleep Medicine Committee which eliminated generalizability (McKeever & Clark, 2017). However, the data showed a significant increase in graduation rates with a delayed start time. A larger study with eight high schools altered start times by 55 minutes which led to an increase in graduation rates from 81% to 97% (Walhstrom, 2016), while a school in New York shifted start times by an hour which increased graduation rates (Wechsler, 2018). The correlation between start times and graduation rates was limited due to the vast differences in graduation requirements from state to state. More research is greatly needed to examine the benefits of school start time as it relates to graduation rates.

Theoretical Framework

The theoretical framework utilized in this study will be the work of Michael Fullan's Change Theory (Fullan, 2006; Johnson, 2012). In the past 35 years, school districts have not contemplated changing high school schedules to an earlier time even though research suggested changes (Wolfson & Carskadon, 2005). In Fullan's Change Theory, seven components are examined to propose educational reform (Johnson, 2012). The seven premises are the following: (a) a focus on motivation, (b) capacity building, (c) learning in context, (d) changing context, (e) a bias for reflective action, (f) tri-level engagement, and (g) persistent flexibility in staying the course (Fullan, 2006). These

seven components will be advantageous to districts embarking change. School systems have routinely kept secondary schools at an earlier time which is a direct conflict with the biological rhythms of adolescents.

The politics surrounding late start times is often more than superintendents want to endure from a community (Wahlstrom, 2016). According to Allison and Schumacher, "leading change is a draining and potentially perilous activity" for district administrators (2011). Districts will need a cultural shift to alter school start times which will require motivation and capacity building among the stakeholders (Johnson, 2012). Chronic sleepiness among teenagers affected health and mental issues which led to an academic threat on education in high schools (Owens, 2014). According to Owens, the benefits to delayed start times have been irrefutable; however, districts routinely scheduled high school students earlier than other students (Owens et al., 2014b). Districts have not been convinced to alter schedules of high school students due to concerns from parents, community, and transportation issues. Thus, the premises of Michael Fullan's Change Theory would be beneficial to the development of change in educational systems (Johnson, 2012). Without developing a strategic planning process with the stakeholders, to evoke the seven components of change theory within a district; alas, it could be detrimental to the leadership of the district embarking on the challenge of changing school start times (Allison & Schumacher, 2011).

Conclusion

Invariably, teenagers experienced a change in their sleep-wake cycles during puberty due to hormonal changes; thus, ultimately these changes affected the quality and quantity of sleep (Dimitriou et al., 2015; Taras & Potts-Datema, 2005; Wahlstrom, 2016). Medical and mental health professionals issued recommendations to delay start times on secondary campuses to decrease sleep deprivation among teens (Paksarian, Rudolph, He,

& Merikangas, 2015). In reviewing literature, there was a clear mismatch between the psychological recommendations and educational practices regarding sleep deprivation among teenagers. The complex issue has been handled on a local basis rather than nationwide due to the politics involved in changing antiquated school systems (Hamiduzzaman & Phillips, 2014). Evidence on both sides whether proponents of early or late start times, addressed sleep deprivation among teenagers as a rising concern. However, more research will be needed to determine if school start times impacted attendance, achievement, and graduation rates in high schools. Relevant and logistical data will empower education administrators to align procedures with healthy decisions regarding sleep deprivation (Taras & Potts-Datema, 2005; Wahlstrom, 2010; Wechsler, 2018). In Chapter III, methodological aspects of this dissertation were detailed which included the operationalization of theoretical constructs, research purpose and questions, research design, population and sampling selection, data collection procedures, data analysis techniques, privacy and ethical considerations, and the research design limitations for this study.

CHAPTER III:

METHODOLOGY

The purpose of this mixed methods study was to examine the relationship between high school start times and student attendance, achievement, and graduation rates. Data were collected from a purposeful sample of high schools in three region centers (Region IV, Region V, and Region VI) in southeast Texas for the 2017-2018 academic year. The quantitative component, collected from Texas Student Data System (TSDS), were analyzed using Pearson's product moment correlations (*r)*, while an inductive coding process was used to analyze the qualitative data collected from superintendents' interviews. These interviews were conducted to obtain superintendent perceptions of the school start times in high schools. This chapter presents an overview of the research problem, operationalization of theoretical constructs, research purpose and questions, research design, population, and sampling selection, instrumentation, data collection procedures, data analysis, privacy and ethical considerations, and the limitations of this study.

Overview of Research Problem

Sleep patterns significantly change during the adolescent years. Teenagers experience physical and psychological changes with the onset of puberty (Diaz-Morales et al., 2012). On high school campuses, starting at 7:30 a.m. in the morning, teenagers often sleep through first period or arrive late to school (Barnes et al., 2016). Although high schools experience poor attendance rates, it is unknown whether school start times would impact the attendance rates. When analyzing school start times in research, the question remains unanswered, if the timing of school whether early or late had a relationship with student attendance, achievement, and graduation rates. Few studies

provide an in-depth resource for superintendents, when making research-based decisions, on high school start times in their districts.

Operationalization of Theoretical Constructs

This study consisted of four constructs: (a) start times and (b) attendance, (c) achievement, (d) graduation rates. In Texas, local school boards designate times to start schools within their districts. Due to the variety of start times across districts start times were acquired via phone calls, emails, and websites since the Texas Education Agency (TEA) does not mandate recorded school start times with the state. Student attendance was defined by the high school attendance percentage calculated by an average of attendance for the campus (TEA, 2019a). Student achievement was defined by how well campuses perform on the *State of Texas Assessment of Readiness* (STAAR) *End of Course Exam* (EOC) (TEA, 2017b). Student achievement was measured using each high school campus score on English I, English II, Algebra, Biology, and U.S. History. Graduation rates were defined as the average graduation rate for four-year graduates per high school excluding five and six-year graduates (TEA, 2019b).

Research Purpose and Questions

The purpose of this mixed methods study was to examine the relationship between high school start times and student attendance, achievement, and graduation rates. The following research questions guided this study:

1. Is there a relationship between start times of high schools and achievement scores on STAAR EOC Exams in English I, English II, Algebra, Biology, and U.S. History?

   Ha: There is a relationship between high school start times and achievement.

2. Is there a relationship between the start times of high schools and attendance rates?

Ha: There is a relationship between high school start times and attendance.

3. Is there a relationship between high school start times and graduation rates?

   Ha: There is a relationship between high school start times and graduation.

4. What are the perceptions of school superintendents concerning the influence of high school start times on student attendance, achievement, and graduation rates?

Research Design

For this study, a sequential mixed-methods design (QUAN → qual) was utilized. This design consists of two phases: first, a quantitative phase and second, a qualitative phase. The advantage of implementing this design is it allows for a more thorough and in-depth exploration of the quantitative results by following up with a qualitative phase. Archived data from high schools in Regions IV, V, and VI were collected based on attendance, achievement, and graduation rates. Then school start times were acquired from high school campuses within Regions IV, V, and VI due to the lack of archival data on start time information. The combination of archival data from the state and acquired school start time information led to the purposeful sample of high schools. In addition, a purposeful sample of superintendents were interviewed to provide a more in-depth analysis of their perceptions of the influence of student achievement, attendance, and graduation rates. Quantitative data were analyzed using Pearson's *r*, while qualitative data were analyzed through an inductive coding process.

Population and Sample

The population of the study consists of Texas high schools including public, charter, private, academies, and technical schools. The total number of high schools in Texas is 3,709 consisting of 3,263 public schools and 446 private schools (Texas High

Schools, 2018). Texas high schools educate 5,343,834 students on average each year with Hispanic students accounting for 52.4%, followed by White (28.1%), African American (12.5%), Asian (4.2%), and multiracial (2.2%) students (TEA, 2018). The percentage of economically disadvantaged high school students in Texas is 59.0 % with 75.3% eligible for various forms of free or reduced meals on high school campuses (TEA, 2018). The state of Texas has 8.9% of students requiring Special Education Services with 18.9% students having a Limited English Proficiency (LEP) (TEA, 2018).

Table 3.1

Texas High School Demographics: 2017-2018

Students	%	(n)
Total Students	100.0	5,343,834
African American	12.5	673,291
Hispanic	52.4	2,802,180
White	28.0	1,499,559
American Indian	0.3	20,701
Asian	4.2	224,834
Pacific Islander	0.1	7,687
Two or More	2.1	115,582
Females	48.7	2,610,537
Males	51.2	2,748,596

High schools from Region IV, V, and VI with ranges of student enrollment ranges from 182 to 4,688 responded with start time information. The average demographics in Region IV are as follows: African American (18.6%), Asian (6.9%), Hispanic (50.6%), White (21.5%), and Multiracial (1.9%) (TEA, 2018). The average demographics in Region V are as follows: African American (26.2%), Asian (2.3%), Hispanic (20.4%), White (48.1%), and Multiracial (2.3%) (TEA, 2018). Lastly, the average demographics in Region VI are as follows: African American (10.5%), Asian (2.3%), Hispanic (35.9%), White (48.2%) and Multiracial (2.5%) (TEA, 2018). Furthermore, the average number of economically disadvantaged students per region are as follows: Region IV (58.6%),

Region V (59.3%), and Region VI (50.1%) (TEA, 2018). A purposeful sample of high schools was solicited to obtain school start time information for this study.

Table 3.2

Region IV Demographics: 2017-2018

Students	%	(n)
Total Students	100.0	1,204,323
African American	18.5	223,735
Hispanic	50.6	609,620
White	21.4	258,241
American Indian	0.4	5,531
Asian	6.9	83,341
Pacific Islander	0.1	1,413
Two or More	1.8	22,442

Table 3.3

Region V Demographics: 2017-2018

Students	%	(n)
Total	100.0	82,152
African American	26.1	21,508
Hispanic	20.3	16,723
White	96.3	39,575
American Indian	0.6	506
Asian	2.3	1,891
Two or More	2.2	1,888

Table 3.4

Region VI Demographics: 2017-2018

Students	%	(n)
Total	100.0	192,982
African American	10.5	20,355
Hispanic	35.8	69,273
White	48.1	92,956
American Indian	0.4	836
Asian	2.3	4,510
Two or More	2.5	4,862

Participant Selection

A purposeful sample of 15 superintendents were solicited from a framework of participating school districts. The superintendents were selected based on experience in small, medium, and large districts. The participants referred other superintendents during their interviews. The snowball sampling method led to 15 superintendents interviewed for this study. Of the 15 superintendents seven were female with eight being male. The male superintendents ranged in age from 45 to 65. The female superintendents were between 45 to 55 in age with two thirds white and one third being Hispanic. The experience of the 15 superintendents ranged from one year to twelve years in the role of a superintendent. The expertise of superintendents varied from small, medium, and large sized districts with many superintendents serving multiple sizes of districts over the years.

Instrumentation

In the state of Texas, high school campuses are measured based on student achievement on standardized testing. Students are given the STAAR (State of Texas Assessment of Academic Readiness) End of Course (EOC) assessments. The STAAR EOC test began the first administration in 2012 which consists of English I, English II, Algebra, Biology, and U.S. History. After test administration, campuses are measured based on average student performance on each test. The purpose of the EOC tests guarantee high school graduates master specific skills; thereby, meeting the state standards for graduation criteria (TEA, 2017b).

The EOC assessments are formulated on the Texas Essential Knowledge and Skills (TEKS) which is the state mandated curriculum in Texas (TEA, 2017b). Students in high school must pass the EOC tests to be eligible for graduation. If students pass one of these courses but do not pass the EOC test, the students must retake the test until they pass the required assessment for graduation (TEA, 2019b). Due to the low EOC passing

rates, seniors have been able to produce alternative projects or assignments by adhering to the requirements approved by districts and the Individual Graduation Committee to graduate (TEA, 2019b). As a campus, the accountability measures are dependent on the success rates of student EOC scores. There are not provisions to alternatively assess campus scores to improve campus accountability measures. Therefore, campuses are measured by the student success rate on all EOC tests.

English I

The English Language Arts and Reading Texas Essential Knowledge and Skills (TEKS) EOC test was given to students in the freshmen year of high school. There were five reporting categories: (a) Understanding and Analysis Across Genres, (b) Understanding and Analysis of Literary Texts, (c) Understanding and Analysis of Informational Texts, (d) Composition and, (e) Revision. The test was composed of 50 questions, two short answer questions, and one expository essay (TEA, 2017b). During the 2015- 2016 school year, reliability for the English I EOC test was estimated using the statistical measures in the following areas: internal consistency, classical standard error or measurement, conditional error of measurement, and classification accuracy (TEA, 2017b).

English II

The English Language Arts and Reading Texas Essential Knowledge and Skills (TEKS) II EOC test was given to students in the sophomore year of high school. There were six reporting categories: (a) Understanding and Analysis Across Genres, (b) Understanding and Analysis of Literary Texts, (c) Understanding and Analysis of Informational Texts, (d) Composition, and (e) Revision and Editing. The test is composed of 50 questions, two short answer questions, and one persuasive essay (TEA, 2017b). During the 2015 - 2016 school year, reliability for the English II EOC test was estimated

using the statistical measures in the following areas: internal consistency, classical standard error or measurement, conditional error of measurement, and classification accuracy (TEA, 2017b).

Algebra

The Algebra EOC test was given to students in 8th grade or the freshmen year of high school. Students taking the Algebra EOC test in the 8th grade year do not go towards accountability standards for the high school. Students taking the Algebra EOC test in the freshmen year were calculated into the campus accountability. There were five reporting categories tested with 54 multiple choice questions that measure the following: (a) Number and Algebraic Methods, (b) Describing and Graphing Linear Functions, Equations, and Inequalities, (c) Writing and Solving Linear Functions, Equations, and Inequalities, (d) Quadratic Functions and Equations, and (e) Exponential Functions and Equations (TEA, 2017b). During the 2015 - 2016 school year, reliability for the Algebra EOC test was estimated using the statistical measures in the following areas: internal consistency, classical standard error or measurement, conditional error of measurement, and classification accuracy (TEA, 2017b).

Biology

The Biology EOC test was administered to freshmen in high school to show mastery of Biology concepts. There were five reporting categories among 50 questions in the Biology EOC: (a) Cell Structure and Function, (b) Mechanisms of Genetics, (c) Biological Evolution and Classification, (d) Biological Processes and Systems, and (e) Interdependence within Environmental Systems (TEA, 2017b). During the 2015 - 2016 school year, reliability for the Biology EOC test was estimated using the statistical measures in the following areas: internal consistency, classical standard error or

measurement, conditional error of measurement, and classification accuracy (TEA, 2017b).

U.S. History

The U.S. History EOC test was administered during the high school years. There were 68 multiple choice questions among four reporting categories listed as the following: (a) History, (b) Geography and Culture, (c) Government and Citizenship, and (d) Economics, Science, Technology, and Society (TEA, 2017b). During the 2015 - 2016 school year, reliability for the U.S. History EOC test was estimated using the statistical measures in the following areas: internal consistency, classical standard error or measurement, conditional error of measurement, and classification accuracy (TEA, 2017b).

Data Collection Procedures

The researcher acquired approval from the University of Houston-Clear Lake's (UHCL) Committee for the Protection of Human Subjects (CPHS) before any data were collected for this project. Once approval was granted, data were collected from the Texas Student Data Systems (TSDS). This data included enrollment and demographic data as well as campus achievement scores from the 2017-2018 school year for multiple high schools. TSDS also provides names of principals, high schools, and email addresses to collect start time information. This quantitative data were collected, sorted, and uploaded into an SPSS database for subsequent analysis.

A purposeful sample of superintendents were solicited from a framework of participating school districts to participate in the qualitative portion of this study. Seven of the 15 participants were female with one third Hispanic and two thirds Caucasian. While the eight males that participated consisted of 50% Caucasian, 12% Hispanic, and 37.5% African American. The participants were asked to engage in a face to face semi-

structured or guided interviews. The superintendents were orginally contacted via email with a formal request to participate in the interview. Once consent was given, the interviews were scheduled, and the particpants were formally apprised of the study details through a consent form. The form also included assurance that participation in the study was voluntary, that their identities would remain confidential, and that the participants would experience no undue harm while participating in the interview. Participants were also provided with the consent forms which included information on the interview process. The semi-structured interviews lasted on average between twenty to fourty-five minutes.

In the interviews, participants were asked to consider how high school start times affect student acheivement. Specifically, superintendents were asked how the barriers of activities, transportation, parents, and community opinions impact high school start times. Interview questions are listed in the Interview Guide included in Appendix C. After each interview, the interviews were transcribed. The data collected including field notes, audio-tapes, and transcription were stored in three locations: on the researcher's external drive, a cloud server, and on a memory drive. These were all password-protected for security purposes.This confidential data set was stored for five years and then destroyed at the conclusion of the study.

Data Analysis

Quantitative

The quantitative research software, IBM Statistical Package for the Social Sciences (SPSS), was utilized to analyze data from the Texas Student Data System (TSDS) based on 2017-2018 high school data from Region IV, V, and VI for further analysis. Attendance, achievement, and graduation rates were gathered from a purposeful sample of high schools in Region IV, V, and VI in southeast Texas. The data was based

on Public Education Information Management System (PEIMS) reporting measures requested and received by TEA (TEA, 2017a). Next, the start times of each high school were acquired via emails, phone calls, and website queries to ascertain the school start time of each campus.

To answer research question one, Pearson's product moment correlations (*r*) was conducted to determine if there was a relationship between high school start times and student achievement in English I, English II, Algebra, Biology, and U.S. History. To answer research question two, Pearson's product moment correlations (*r*) were conducted to determine if there was a relationship between high school start times and attendance. On research question three, Pearson's product moment correlations (*r*) were conducted to determine if there was a relationship between high school start times and graduation rates. Effect size was measured using the coefficient of determination (r^2) and a significance value of .05 for this study. The significant value of .05 was utilized to distinguish the most unlikely 5% of the sample means from the most likely 95% of the sample means (Gravetter & Wallnau, 2009).

Qualitative

Following the quantitative data analysis, a systematic approach to the data analysis to find order and a general understanding of the superintendents' perspectives of school start times were utilized to develop interview questions to provide a more in-depth picture of their view. An inductive coding process was used to create a resourceful perspective from all the superintendents regarding school start times in high schools. To answer question four, qualitative data gathered from the superintendents were examined, analyzed, and coded for themes. The data analysis process developed as each interview transpires with additional personalities bringing new thoughts and feelings to the research question. After each interview, the transcription process begins which requires total

silence, no interruptions, and multiple hours per interview. Once the audiotapes from the superintendent interviews were transcribed by the researcher, the transcripts were entered into a software system entitled NVivo 12 to assist with the quantity of information from the interviews. It was evident constant-comparative method was internalized within the researcher, with constant thoughts of each superintendent's words resonating before, during, and after each interview. Thus, the codes and themes emerged from the transcripts to answer question four for the purposes of this research. During the interview process, the opening questions were followed by unscripted questions to get a narrower approach which provided a funnel structure to the process. The unscripted questions gave the researcher an indication of the superintendents' thinking process regarding school start times before cueing them into the focused questions. The funnel structure provided the themes which emerged from the superintendents' experience and expertise. Thus, the codes were a combination of priori coding and emergent based on the participants responses from the reoccurring themes that surfaced in the process of coding.

Qualitative Validity

The qualitative analysis process entailed validation by using triangulation across superintendents' responses. The data collected from superintendent interviews were member-checked by having participants review the preliminary results and transcripts to enhance the accuracy of the responses provided. The questions and responses were peer reviewed to ensure perceptions of transcripts are reasonable between peer reviewers from the College of Education at UHCL to enhance validity. The peer reviews served the purpose of obtaining feedback related to the perceptions of the responses from the superintendents which added credibility to the transcription process. Member checking ensured the voices of the superintendents were not misinterpreted and captured a valid record of their responses.

Privacy and Ethical Considerations

The researcher gained approval from the UHCL's CPHS before collecting any data. The data collected were locked in the researcher's office on an external hard drive, in a cabinet, and on a flash drive for five years. With the quantitative data being public records, the identity of specific high schools was never an issue in this research. After five years, the researcher will destroy all data files. Prior to conducting superintendent interviews, all participants were given a consent form and letter describing the purpose of the study (see Appendix A). In these letters, it explains the confidentiality and volunteer participation for the participants. To keep superintendents' names and comments confidential, an alternate name was selected to prevent any connection to the interviewee. During the interview process, the scripted notes and recorded interviews should provide an ethical presentation of the interviewee in the research. The audio recordings were accurately transcribed in order to protect the validity of the data.

Next, the researcher utilized color coding to find similar themes among the responses. Further, during the coding process, the researcher used the automatic coding capabilities of the NVivo software in order to move to the analysis stage which confirmed the priori and emergent themes from the superintendents' responses. During the coding process, the researcher made every attempt to remain unbiased while themes and supporting data emerged to justify and support the findings. These attempts were to warrant internal and external validity throughout this study.

Research Design Limitations

The research design consisted of several limitations. First, the state does not require school districts to report school start times which may have led to human entry or reporting errors. This was controlled by validated start times through emails, phone calls, and websites in Region IV, V, and VI high schools. Many of the high schools were

removed from the data set if school start times were not determined. This potentially impacted the generalizability due to the sample size. Second, the research was limited by the removal of charter, private, technical, and academies from the database. The differences between required standards for public verses charter, private, technical, and academies would impact the reliability of the research. Third, given all the high schools in Region IV, V, and VI are located within the state of Texas, generalizability of the findings to other states would be limited. The fourth limitation found in the qualitative section of research dealt with interviews of sitting superintendents which limited the findings due to possible political correctness in their communication during the interviews. This was seemingly evident in cues, pauses, and inflections during the interviews. Finally, given the small sample of superintendents interviewed among various school districts, across-the-board generalizations should be interpreted with caution.

Conclusion

The purpose of this study was to examine the relationship between school start times and attendance, achievement, and graduation rates in high schools. This chapter identified the need to further examine the relationships among the constructs. At this time, accountability is critical to school districts; therefore, any way to increase their standards were greatly considered by superintendents across the state. The superintendent interviews shared perspectives on school start times. Ultimately, this body of research provided resources for district administrators to consider alignment of high schools with medical and psychological research; thereby providing a healthy start time for adolescents. In Chapter IV, the findings were analyzed to and discussed in further detail to determine if school start times impact attendance, achievement, and graduation rates.

CHAPTER IV:

RESULTS

This study examined the relationship between high school start times and achievement, attendance, and graduation rates. Utilizing the Texas Student Data System (TSDS) based on archived data (i.e. enrollment size, attendance, achievement, and graduation rates) from high schools during the 2017-2018 school year in Region IV, V, and VI (TSDS, 2017). The quantitative data were analyzed using Pearson's product moment correlations (*r*), while the qualitative data obtained from superintendent interviews were analyzed using an inductive coding process. This chapter presents a detailed description of the participating school districts and the findings of each of the four research questions. The chapter closed with a summary of the findings

Participant Demographics

Overall High Schools

Utilizing the TSDS 2017-2018 database, a purposeful sample of 256 high schools with school start times from Region IV, V, and VI were selected for participation in this study. Table 4.1 provides the descriptive demographics of participating high schools separated by district type, size, and enrollment. The sample consisted of 256 high schools with seven classifications that denoted their type of community and location. High Schools from Major Suburban areas represented the biggest community type with 104 schools, while, the Independent Town areas were the lowest with 13 high schools.

Table 4.1

District Type, Size, and Enrollment of High Schools: 2017-2018

Location	School Size			Enrollment
	Small	Medium	Large	
1. Rural	36	1	*	26 – 1,965
2. Non-Metropolitan Stable	16	8	*	18 – 2,124
3. Independent Town	4	9	*	45 – 1,524
4. Other Central City Suburban	9	24	1	55 – 2,653
5. Other Central City	3	9	10	65 – 4,415
6. Major Suburban	7	32	65	134 – 4,835
7. Major Urban	4	13	5	353 – 3,499

Note. The classification of Non-Metropolitan: Fast Growing was not evident. *High Schools of this size were not present in the district type.

Among the participating high schools in Region IV, V, and VI, the average number of students enrolled in high schools was 1,490 with the smallest enrollment of 18 and highest of 4,835 students. Table 4.2 described high school start times by region, size, and mean averages. The State of Texas does not require high schools to submit start times in any form of recordkeeping; thus, the participating sample was determined by the acquisition of high school start times for the 2017 – 2018 school year. The earliest start time was determined as 6:30 a.m. with 8:30 a.m. being the latest start time within the high schools in Region IV, V, and VI. The latest start time average was evident in Rural districts with an average of 7:53 a.m., while, the earliest start time average of 7:15 a.m. occurred in medium and large sized Major Suburban High Schools.

Table 4.2

District Type and High School Start Times: 2017-2018

Location	School Start Times			Mean Start Time
	Small	Medium	Large	
1. Rural	7:50 – 8:15	8:00	*	7:53:32
2. Non-Metropolitan Stable	7:20 – 8:00	7:05 – 8:15	*	7:43:23
3. Independent Town	7:15 – 8:00	6:55 – 7:55	*	7:36:14
4. Other Central City Suburban	7:20 – 8:15	7:15 – 8:30	7:20	7:48:32
5. Other Central City	7:05 – 8:20	7:10 – 8:25	7:05 – 8:12	7:31:14
6. Major Suburban	6:50 – 8:00	6:30 – 8:00	6:30 – 7:59	7:15:23
7. Major Urban	7:20 – 7:55	7:05 – 8:00	7:15 – 8:00	7:26:35

Note. All times refer to Central Standard A.M. *High Schools of this size were not present in the district type.

Region IV High Schools

In this study, 151 high schools participated from Region IV with an average enrollment of 2,000 students. Table 4.3 depicted the demographics of Region IV. The minimum enrollment was 26 students with the maximum at 4,835. The frequency of small, medium, and large sized high schools were described as follows: small (11.9%), medium (39.1%), and large (49.0%). The majority of high schools were classified as Major Suburban at 66.9% with 101 schools; however, the disparity between types of community districts was evident with Independent Town (1.3%), Major Urban (14.6%), Non-Metropolitan stable (3.3), Other Central City (6.0%), Other Central City Suburban (6.0%), and Rural (2.0%).

Table 4.3

Region IV: Location, Size, and Enrollment of High Schools 2017-2018

Location	School Size			Enrollment
	Small	Medium	Large	
1. Rural	2	1	*	26 – 1,965
2. Non-Metropolitan Stable	2	3	*	380 – 2,124
3. Independent Town	*	2	*	1515 – 1,524
4. Other Central City Suburban	2	7	*	373 – 1,144
5. Other Central City	1	4	4	385 – 2,907
6. Major Suburban	7	29	65	134 – 4,835
7. Major Urban	4	13	5	353 – 3,499

Note. The classification of Non-Metropolitan: Fast Growing was not evident. *High Schools of this size were not present in the district type.

In Region IV, 151 high schools start times were analyzed to find 7:18 a.m. as the mean start time for this area. Table 4.4 showed the district type, size, and start times of 151 high schools. In the Major Suburban type, the start times were on average earlier with a mean of 7:14 in the morning; however, the earliest start time of 6:30 among this

classification was also the earliest for the region. The latest start time average of 7:54 a.m. was found in the Rural classification. In the Other Central City Suburban 7:39 a.m. was the second latest mean for Region IV. The median start time for Region IV was 7:20 a.m. with a standard deviation of 19 minutes between schools.

Table 4.4

Region IV District Type and High School Start Times: 2017-2018

Location	School Start Times			Mean Start Time
	Small	Medium	Large	
1. Rural	7:45 – 7:59	8:00	*	7:54:40
2. Non-Metropolitan Stable	7:20	7:05 – 7:20	*	7:17:00
3. Independent Town	*	7:10 – 7:20	*	7:15:00
4. Other Central City Suburban	7:20 – 7:50	7:15 – 8:30	*	7:39:27
5. Other Central City	7:05	7:10 – 7:20	7:05 – 7:30	7:36:00
6. Major Suburban	6:50 – 8:00	6:30 – 8:00	6:30 – 7:59	7:14:45
7. Major Urban	7:20 – 7:55	7:20 – 8:00	7:15 – 8:00	7:26:35

Note. All times refer to Central Standard A.M. *High Schools of this size were not present in the district type.

Region V High Schools

In Region V, 36 high schools participated in this study with an average enrollment of 643 students. Table 4.5 depicted the demographics of Region IV. The minimum enrollment was 55 students with the maximum at 2,435. The frequency of small, medium, and large sized high schools were described as follows: small (52.8%), medium (44.4%), and large (2.8%). The majority of high schools were classified as Rural at 27.8% with 10 schools; while, Non-Metropolitan and Other Central City were 25.0%. In this region, high schools that participated were not classified as Major Urban with the medium enrollment of 445 students.

Table 4.5

Region V: Location, Size, and Enrollment of High Schools 2017-2018

Location	School Size			Enrollment
	Small	Medium	Large	
1. Rural	10	*	*	75 – 372
2. Non-Metropolitan Stable	6	2	*	297 – 793
3. Independent Town	1	2	*	435 – 784
4. Other Central City Suburban	2	7	*	55 – 1,547
5. Other Central City	*	1	1	2,435
6. Major Suburban	*	2	*	2,038
7. Major Urban	*	*	*	*

Note. The classification of Non-Metropolitan: Fast Growing was not evident. *High Schools of this size were not present in the district type.

In Region V, the average start time among 36 high schools was 7:51 a.m. with a mode of 7:55 a.m. in the participating high schools. Table 4.6 showed the district type, size, and start times of 36 high schools. In the Other Central City type, the start times were on average earlier with a mean of 7:20 in the morning. The latest start time of 8:01

a.m. was found in the Other Central City Suburban. The earliest start time of 7:15 a.m. occurred in a medium sized school described as an Independent Town with the latest start time of 8:25 a.m. found in a medium sized school with the Other Central City Suburban classification.

Table 4.6

Region V District Type and High School Start Times: 2017-2018

Location	School Start Times			Mean Start Time
	Small	Medium	Large	
1. Rural	7:40 – 8:00	*	*	7:53:18
2. Non-Metropolitan Stable	7:40 – 8:00	7:45 – 8:15	*	7:53:20
3. Independent Town	8:00	7:15 – 7:55	*	7:43:20
4. Other Central City Suburban	7:20 – 8:15	7:50 – 8:25	*	8:01:07
5. Other Central City	*	7:20	7:20	7:20:00
6. Major Suburban	*	7:20 – 7:45	*	7:32:30
7. Major Urban	*	*	*	*

Note. All times refer to Central Standard A.M. *High Schools of this size were not present in the district type.

Region VI High Schools

In this study, 169 high schools participated from Region VI with an average enrollment of 852.10 students. Table 4.7 depicted the descriptive demographics of Region VI. The minimum enrollment was 18 students with the maximum at 4,415. The frequency of small, medium, and large sized high schools were found in the study as follows: small (60.9%), medium (30.4%), and large (8.7%). Most high schools were classified as Rural; while, the smallest classification was the largest school district in the Region VI classified as Major Suburban with 4,415 students. All community types were represented as follows in Region VI: Major Suburban (1.4%), Independent Town (10.1%), Non-Metropolitan stable (14.5%), Other Central City (15.9%), Other Central City Suburban (23.2%), and Rural (34.8).

Table 4.7

Region VI: Location, Size, and Enrollment of High Schools 2017-2018

Location	School Size			Enrollment
	Small	Medium	Large	
1. Rural	24	*	*	61 – 403
2. Non-Metropolitan Stable	10	2	*	18 – 453
3. Independent Town	3	4	*	45 – 458
4. Other Central City Suburban	5	10	3	34 – 4,336
5. Other Central City	2	4	3	65 – 2,435
6. Major Suburban	*	1	3	1784 – 4,415
7. Major Urban	*	*	*	*

Note. The classification of Non-Metropolitan: Fast Growing was not found. *High Schools of this size were not present in the district type.

The average start time in Region VI was 7:48 a.m. with a time of 8:00 a.m. that appeared 20.3% of the time among 69 schools. Table 4.8 showed the district type, size, and start times of 69 high schools. The Independent Town classification had the earliest start time of 6:55 a.m. with a high school enrollment of 1,471 students. The latest start time of 8:30 a.m. was found in two medium sized high schools in Other Central City Suburban classification. The latest start time average among the different classifications was 7:53 a.m. located in the Rural high schools; while, 7:37 a.m. was the earliest start time mean for the Independent Town classification.

Table 4.8

Region VI District Type and High School Start Times: 2017-2018

Location	School Start Times			Mean Start Time
	Small	Medium	Large	
1. Rural	7:15 – 8:15	*	*	7:53:30
2. Non-Metropolitan Stable	7:20 – 8:00	8:00	*	7:46:13
3. Independent Town	7:15 – 7:51	6:55 – 7:55	*	7:37:17
4. Other Central City Suburban	7:25 – 8:00	7:15 – 8:30	7:20	7:46:34
5. Other Central City	8:15 – 8:20	7:20 – 8:25	7:10 – 8:12	7:45:38
6. Major Suburban	*	7:45	*	7:45:00
7. Major Urban	*	*	*	*

Note. All times refer to Central Standard A.M. *High Schools of this size were not present in the district type.

Superintendents

The qualitative data were obtained from a total of 15 Superintendents who participated in individual, in-depth interviews. Data in the form of race/ethnicity and gender were gathered at the time of the interview. Table 4.9 depicted the gender, race/ethnicity, and location of participating superintendents. Eight of the participants were white males between the ages of 45 and 65. Seven superintendents were female with an age range of 45 to 55 with five Caucasian and two Hispanic. The experience of the 15 superintendents ranged from first year to 12 years in a superintendent's role. Superintendents were represented from Region IV, V, and VI.

Table 4.9

Demographics of Participating Superintendents

Demographics	Type	Participants (n)	%
1. Gender	Female	7	46.7
	Male	8	53.3
2. Race/Ethnicity	African American	3	20.0
	Asian	0	0.0
	Caucasian	10	66.7
	Hispanic	2	13.3
3. Location	Region IV	5	33.3
	Region V	5	33.3
	Region VI	5	33.3

Research Question One

Research question one**,** *Is there a relationship between start times of high schools and achievement scores on STAAR EOC Exams in English I, English II, Algebra, Biology, and U.S. History?*, was answered by conducting Pearson's product moment correlations (*r*) between high school start times and English I, English II, Algebra, Biology, and U.S. History STAAR EOC Exams. Tables 4.10 – 4.49 depicted the descriptive statistics of Region IV, V, and VI for the 2017 – 2018 school year in regard to achievement scores, size of schools, and school start times.

All Regions IV, V, VI High Schools

English I. In the area of STAAR English I EOC, the mean scores per region were as follows: Region IV (62.2%), Region V (61.0%), and Region VI (60.7%). The English I EOC scores ranged from 13.0 % to 100.0 %; reporting an average score of 61.7% between all three Regions. The average scores on English I per size of high schools were as follows: small (63.0%), medium (58.9%), and large (63.5%). The lowest mean for English I was 58.9% found in the medium size schools from Region IV, V, and VI with a 7:30 a.m. average start time; while, the highest English I scores occurred in the large size schools with a 7:17 a.m. start time. Table 4.10 displays the descriptive results of start times and English I achievement.

Regarding the relationship between high school start times and English I EOC scores of the participating high schools, findings from this research suggested a statistically significant relationship did not exist between all school start times and English I scores, r = .006, and p = .924. Table 4.11 displays the results of the correlations between high school start times in Region IV, V, and VI and English I EOC scores. The results of the Pearson's r indicated there was not a statistically significant relationship between the size categories of high schools in Region IV, V, and VI and English I scores: (Small) r =.128, and p = .265; (Medium) r = -.022, and p = .829; (Large) r =.041, and p = .719. The size of high schools in Region IV, V, and VI did not have a relationship with English I scores.

Table 4.10

English I Achievement and High School Start Times in Regions IV, V, and VI

School Size	English I Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	63.00	64.50	20.32	7:45
2. Medium	58.94	57.00	18.36	7:30
3. Large	63.54	64.00	18.07	7:17
4. All	61.70	62.00	18.95	7:30

Note. All times refer to Central Standard a.m. times.

Table 4.11

Correlations: Start Times and English I Achievement

School Size	N	*r*-value	*p*-value
1. Small	78	.128	.265
2. Medium	97	-.022	.829
3. Large	81	.041	.719
4. All	256	.022	.728

*Statistically Significant ($p < .05$)

English II. In the area of STAAR English II EOC, the mean scores per region were as follows: Region IV (68.88%), Region V (66.34%), and Region VI (64.47%). Table 4.12 indicated the English II scores among Region IV, V, and VI. The medium sized high schools had a mean English II score of 65.37% which was the lowest with a

7:31 a.m. start time. The highest average English II score of 69.45% was found in large sized high schools with the earliest start time of 7:17 a.m. in all regions.

The findings of the Pearson's *r* indicated there was not a statistically significant relationship between high school start times in Region IV, V, and VI and English II results, $r = -.044$, $p = .486$. Table 4.13 shared the findings of the Pearson's product moment correlation of English II in Region IV, V, and VI. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size categories and English II achievement scores: (Small) $r = .114$, $p = .317$; (Medium) $r = -.085$, $p = .426$; (Large) $r = -,058$, $p = .607$. With these findings, the high school start times and high school size does not relate to the campus achievement scores on the STAAR English II EOC exams.

Table 4.12

English II Achievement and High School Start Times in Regions IV, V, and VI

School Size	English II Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	66.98	67.00	19.66	7:45
2. Medium	65.37	63.00	17.07	7:31
3. Large	69.45	72.00	14.02	7:17
4. All	67.19	68.00	17.07	7:31

Note. All times refer to Central Standard a.m. times.

Table 4.13

Correlations: Start Times and English II Achievement

School Size	N	*r*-value	*p*-value
1. Small	79	.114	.317
2. Medium	91	-.085	.426
3. Large	81	-.058	.607
4. All	251	-.044	.486

*Statistically Significant ($p < .05$)

Algebra. In the area of STAAR Algebra EOC, the mean scores per region were as follows: Region IV (80.05%), Region V (79.05%), Region VI (76.41%). Table 4.14 depicted the high school sizes, start times, and Algebra achievement scores for Region IV, V, and VI. The Algebra campus scores ranged from 31% to 100% with an average score of 78.95% among the three regions. In the small sized high schools, the most frequent start time was 8:00 with 21.5% among all regions; while, in the medium sized and large sized high schools the mode start time was 7:20 a.m. with 34.4% and 50.6% respectively. The highest average Algebra scores were found in large sized high schools with a 7:17 a.m. start time. The average Algebra achievement scores were as follows: Small (83.5%), Medium (80.0%), and Large (83.0%). Across all Region IV, V, and VI high schools, the median Algebra scores fell within the 80.0% to 83.5% range.

Regarding the potential relationship between high school start times, school size, and Algebra scores among the 253 participating high schools, findings suggested that there was not a statistically significant relationship between Algebra results, school size, and school start times, $r = .019$, $p = .766$. In fact, the results of the Pearson's r indicated there was not a statistically significant relationship between high school size, start times, and Algebra campus achievement scores: (Small) $r = .033$, $p = .779$; (Medium) $r = -.090$, $p = .381$; (Large) $r = .112$, $p = .320$. School start times did not correlate with the Algebra achievement on high school campuses whether they were small, medium, or large sized high schools. Table 4.15 displayed the statistical calculations regarding the correlations between high school size, start times, and Algebra scores.

Table 4.14

Algebra Achievement and High School Start Times in Regions IV, V, and VI

School Size	Algebra Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	79.94	83.50	16.74	7:45
2. Medium	77.11	80.00	14.05	7:31
3. Large	79.95	83.00	12.58	7:17
4. All	78.87	82.00	14.49	7:31

Note. All times refer to Central Standard a.m. times.

Table 4.15

Correlations: Start Times and Algebra Achievement

School Size	N	*r*-value	*p*-value
1. Small	76	.033	.779
2. Medium	96	-.090	.381
3. Large	81	.112	.320
4. All	253	-.008	.898

*Statistically Significant ($p < .05$)

Biology. On the STAAR Biology EOC, the mean scores per region were as follows: Region IV (85.8%), Region V (86.8%), and Region VI (85.0%). Table 4.16 displayed the findings from school size, start times, and Biology achievement. Biology scores ranged from 23% to 100% with an average score of 85.8% among the three regions. The highest mean Biology scores were found with large sized high schools with at 7:17 a.m. start time.

Table 4.17 depicted the correlations between Region IV, V, and VI High Schools, school size, and start times. Results of the Pearson's *r* indicated there was not a statistically significant relationship between Biology results, high school start times, and school size, $r = .093$, $p = .143$; thus, the start time of high schools did not affect Biology achievement scores. In Region IV, V, and VI high schools the timing of school did not correlate with achievement scores on Biology. Results of the Pearson's *r* indicated there was not a statistically significant relationship between medium and large sized high schools, start times, and Biology scores: (Medium) $r = .051$, $p = .622$; (Large) $r = .160$, $p = .154$. In medium and large sized high schools, high school start times and Biology scores did not have a relationship. However, the findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, start times, and Biology scores, $r\ (75) = .310$, $p < .007$, $r^2 = .096$. The small size of high schools and start times correlated with a positive relationship with Biology scores. The proportion of variation in Biology scores attributed to high school size and start time was 9.6%.

Table 4.16

Biology Achievement and High School Start Times in Regions IV, V, and VI

School Size	Biology Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	85.66	88.00	14.07	7:45
2. Medium	84.78	87.00	10.48	7:31
3. Large	86.98	90.00	11.17	7:17
4. All	85.75	89.00	11.86	7:31

Note. All times refer to Central Standard a.m. times.

Table 4.17

Correlations: Start Times and Biology Achievement

School Size	N	*r*-value	*p*-value
1. Small	75	.310	.007*
2. Medium	96	.051	.622
3. Large	81	.160	.154
4. All	252	.093	.143

*Statistically Significant ($p < .05$)

U.S. History. With regards to the STAAR U.S. History EOC, the mean scores per region were as follows: Region IV (91.8%), Region V (89.0%), and Region VI (90.8%). Table 4.18 displays the U.S. History EOC average scores by size of high schools and average start times. The U.S. History scores per high school ranged from 59% to 100% with an average score of 91.1% among the three regions. In the large sized high schools, the earliest start time was found with the highest achievement rate of 93.6%. With 245 high schools, the mean achievement was 91.1% with a 7:31 a.m. start time for the 2017 – 2018 school year.

Table 4.19 shows the correlation between U.S. History EOC scores by size of high schools and start times. Regarding the potential relationship, between high school start times and STAAR U.S. History EOC scores, among the 245 high schools, the findings depicted no significant relationship between school start times and achievement on the U.S. History EOC test, $r = -.037$, $p = .561$. These results indicated that high school start times has no correlation with the achievement scores on the U.S. History EOC exams. Results of the Pearson's r indicated there was not a statistically significant relationship between school size, start times, and U.S. History scores: (Small) $r = .175$, $p = .127$; (Medium) $r = .047$, $p = .665$; (Large) $r = -.120$, $p = .286$. The size of school and start time had no relationship with U.S. History scores in Region IV, V, and VI.

Table 4.18

U.S. History Achievement and High School Start Times in Regions IV, V, and VI

School Size	U.S. History Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	90.59	93.00	8.85	7:45
2. Medium	89.24	91.00	7.95	7:31
3. Large	93.65	95.00	4.74	7:17
4. All	91.12	93.00	7.58	7:31

Note. All times refer to Central Standard a.m. times.

Table 4.19

Correlations: Start Times and U.S. History Achievement

School Size	N	*r*-value	*p*-value
1. Small	77	.175	.127
2. Medium	88	.047	.665
3. Large	81	-.120	.286
4. All	245	-.037	.561

*Statistically Significant ($p < .05$)

Region IV High Schools

English I. In Region IV, 46.4% of the high schools start at 7:20 a.m. with an average of 7:18 a.m. start time. Table 4.20 described Region IV high schools, English I scores, and start times. The latest start time for Region IV was found in small sized high schools with an average English I score of 67.5%; while, the medium and large sized schools had lower mean scores of 58.8% and 62.9% respectively. The standard deviation between all start times was 19 minutes with a range of two hours from 6:30 a.m. till 8:30 a.m. in Region IV High Schools.

Results of the Pearson's *r* indicated there was not a statistically significant relationship between high schools start times and English I scores of the participating Region IV high schools, $r = .067$ and $p = .434$; thus, no significance was found between Region IV high schools and school start times in regard to English I scores. Table 4.21 reflected the statistical calculations for Region IV and achievement for the 2017 – 2018 school year. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, start time, and English I scores: (Small) $r = .316$, $p =. 233$; (Medium) $r = -.054$, $p = .684$; (Large) $r = .088$, $p = .458$. Results indicated no relationship between high school size, start times, and achievement on the English I EOC in Region IV.

Table 4.20

English I Achievement and High School Start Times in Regions IV

School Size	English I Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	67.50	73.00	29.41	7:25
2. Medium	58.81	55.00	20.60	7:17
3. Large	62.91	64.00	18.18	7:16
4. All	61.86	61.00	20.76	7:18

Note. All times refer to Central Standard a.m. times.

Table 4.21

Correlations: Start Times and English I Achievement

School Size	N	*r*-value	*p*-value
1. Small	16	.316	.233
2. Medium	60	-.054	.684
3. Large	74	.088	.458
4. All	150	.067	.434

*Statistically Significant ($p < .05$)

English II. In Region IV, 145 high schools had English II scores with four schools excluded due to freshmen only enrollment. Table 4.22 depicted the high schools, size, school start times, and achievement. Out of the participating high schools, 28.5% opened school at 7:19 a.m. with an average success rate of 67.3%. Table 4.23 described Region IV high schools, English II scores, and start times for the 2017 – 2018 school year. The latest start time for Region IV was found in small sized high schools with an average English II score of 73.2%; while, the medium and large sized schools had lower mean scores of 66.2% and 68.9% respectively. The standard deviation between all start times was 17 minutes with a range from 6:30 a.m. till 8:30 a.m. in Region IV high schools.

The results of the Pearson's *r* indicated there was not a statistically significant relationship in Region IV between size of schools, start times, and English II scores, $r = .056$, $p = .653$; whereas, the start times of schools did not have a significant impact on achievement with English II scores. When school size was addressed with small schools, the results of the Pearson's *r* confirmed that there was not a statistically significant relationship between school start times and achievement: (Small) $r = .277$, $p = .266$; (Medium) $r = -.151$, $p = .275$; (Large) $r = -.043$, $p = .716$. Thus, English II scores did not have a relationship between high school size, school start times or English II scores. Table 4.24 portrayed the statistical correlations of Region IV school start times, size of school, and English II scores.

Table 4.22

English II Achievement and High School Start Times in Regions IV

School Size	English II Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	73.72	75.00	24.66	7:25
2. Medium	66.24	68.50	19.28	7:20
3. Large	68.93	71.50	14.09	7:16
4. All	67.33	68.00	17.18	7:30

Note. All times refer to Central Standard a.m. times.

Table 4.23

Correlations: Start Times and English II Achievement

School Size	N	*r*-value	*p*-value
1. Small	18	.277	.266
2. Medium	54	-.151	.275
3. Large	74	-.043	.716
4. All	146	.056	.653

*Statistically Significant ($p < .05$)

Algebra. In Region IV, 149 high schools had Algebra scores for the 2017 – 2018 school year. Table 4.25 showed the high schools by size, scores, and start times. The small sized high schools had the highest Algebra scores with an average of 85.9%; while, the medium sized high schools had the lowest average of 78.0%. The large sized high schools had the earliest start time average of 7:16 a.m. with an 80.0% average for Algebra results. In Region IV the highest Algebra result of 85.9% started schools on average at 7:25 a.m. with a standard deviation of 19 minutes between all schools. In Algebra results, 46.4% of all schools in Region IV started at 7:20 a.m. with a mode score of 89%.

In Region IV High Schools, Algebra results proved that there was not a significant relationship between start times and achievement. Table 4.26 depicted the results of the Pearson's product moment correlations. The results of the Pearson's *r* indicated there was not a statistically significant relationship between high school start times, size, and Algebra results, $r = .037$, $p = .655$; thus, the start times of schools did not impact Algebra scores in Region IV High Schools for the 2017 - 2018 school year. When controlling for size of high schools, the results of the Pearson's *r* indicated there was not a statistically significant relationship in Region IV between high school size, high school start times, and Algebra scores: (Small) $r = .265$, $p = .304$; (Medium) $r = -.200$, $p = .128$; (Large) $r = .217$, $p = .064$. There is not an indication that the size of high schools, start times, and Algebra scores are related in Region IV. Thus, there is no correlation between achievement and high school size or start times.

Table 4.24

Algebra Achievement and High School Start Times in Regions IV

School Size	Algebra Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	85.94	89.00	14.88	7:25
2. Medium	77.74	81.00	14.34	7:20
3. Large	80.04	83.00	12.51	7:16
4. All	79.80	82.00	13.66	7:18

Note. All times refer to Central Standard a.m. times.

Table 4.25

Correlations: Start Times and Algebra Achievement

School Size	N	*r*-value	*p*-value
1. Small	17	.265	.304
2. Medium	59	-.200	.128
3. Large	74	.217	.064
4. All	150	.037	.655

*Statistically Significant ($p < .05$)

Biology. In Region IV High Schools, 150 high schools were analyzed to determine if school start times had an impact on Biology scores. Table 4.26 portrayed the high schools classified by size, Biology scores, and mean start times. In small, medium, and large sized high schools, 7:20 a.m. was the mode start time. The highest achievement scores on Biology were reflected in the large sized high schools with a 7:16 a.m. mean start time. The lowest mean Biology scores were reflective in the medium sized high schools with a 7:20 a.m. start time.

In Table 4.27, Region IV was portrayed with the statistical calculations to determine if correlations existed between high school start times, size, and Biology scores. The results of the Pearson's *r* indicated there was not a statistically significant relationship between high school start times, school size, and Biology results, $r = .037$, $p = .655$; thus, the start times of high schools whether small, medium, or large did not affect Biology scores in 2017 – 2018. The results of the Pearson's *r* indicated there was not a statistically significant relationship between size of high schools, start times, and Biology scores: (Small) $r = .265$, $p = .304$; (Medium) $r = -.200$, $p =$,128; (Large) $r = .217$, $p = .064$. There was no correlation between high school size, high school start times, and Biology scores in Region IV.

Table 4.26

Biology Achievement and High School Start Times in Regions IV

School Size	Biology Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	85.50	92.50	18.02	7:25
2. Medium	84.49	87.00	11.74	7:20
3. Large	86.72	90.00	11.50	7:16
4. All	85.70	90.00	12.47	7:18

Note. All times refer to Central Standard a.m. times.

Table 4.27

Correlations: Start Times and Algebra Achievement

School Size	N	*r*-value	*p*-value
1. Small	17	.265	.304
2. Medium	59	-.200	.128
3. Large	74	.217	.064
4. All	150	.037	.655

*Statistically Significant ($p < .05$)

U.S. History. In Region IV, 140 high schools were analyzed to determine if a relationship exist between school start times and achievement. Table 4.28 described the high schools that participated by size, start time, and achievement scores on U.S. History for the 2017 – 2018 school year. The highest achievement rate was 93.4% in the large sized high schools of Region IV with an average start time of 7:16 a.m.; while, the latest start time of 7:25 a.m. reflected 92.0% mean score for U.S. History.

In Table 4.29, Region IV High Schools were analyzed with school start times, size, and U.S. History results. Results of the Pearson's *r* indicated there was not a statistically significant relationship between school start time, size, and U.S. History scores, $r = -.037$, $p = .561$; whereas, a relationship between school start times, size of schools, and U.S. History achievement did not exist in all Region IV high schools. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and U.S. History scores: (Small) $r = .344$, $p = .192$; (Medium) $r = .044$, $p = .757$; (Large) $r = -.118$, $p = .317$. There was no indication that U.S. History scores were impacted by high school size or high school start times.

Table 4.28

U.S. History Achievement and High School Start Times in Regions IV

School Size	U.S. History Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	92.05	96.00	9.83	7:25
2. Medium	89.29	91.00	8.94	7:20
3. Large	93.45	95.00	4.83	7:16
4. All	91.79	94.00	7.42	7:18

Note. All times refer to Central Standard a.m. times.

Table 4.29

Correlations: Start Times and U.S. History Achievement

School Size	N	*r*-value	*p*-value
1. Small	16	.344	.192
2. Medium	51	.044	.757
3. Large	73	-.118	.317
4. All	140	-.037	.561

*Statistically Significant ($p < .05$)

Region V High Schools

English I. In Region V, 25.0% of the high schools start at 7:55 a.m. with an average of 7:51 a.m. start time. Table 4.30 described Region V high schools, English I scores, and start times. The latest start time for Region V was found in both small and medium sized high schools with an average English I score of 64.0% and 61.31% respectively; while the large sized high schools had one participant that started at 7:20 a.m. with a 60.0% English I average score. The standard deviation between all start times was 16 minutes with a range from 7:15 a.m. till 8:25 a.m. in Region V High Schools.

Results of the Pearson's *r* indicated there was not a statistically significant relationship between high schools start times and English I scores of the participating Region V high schools, $r = .075$ and $p = .669$; thus, no significance was found between Region V high schools and school start times in regard to English I scores. Table 4.31 displayed the correlations between Region V high school start times and achievement. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and English I scores in Region V: (Small) $r = -.251$, $p = .315$; (Medium) $r = .320$, $p = .226$. The large sized high school category could not be calculated due to only one participating school was listed in this category. It was clear there was not a relationship between English I scores, high school size, and high school start times.

Table 4.30

English I Achievement and High School Start Times in Regions V

School Size	English I Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	64.00	64.50	17.74	7:52
2. Medium	61.31	63.50	16.27	7:52
3. Large	60.00	60.00	**	7:20
4. All	60.08	64.00	17.08	7:51

Note. All times refer to Central Standard a.m. times. **Only one participant in category.

Table 4.31

Correlations: Start Times and English I Achievement

School Size	N	*r*-value	*p*-value
1. Small	18	-.251	.315
2. Medium	16	.320	.226
3. Large	1	**	**
4. All	36	.075	.669

*Statistically Significant ($p < .05$). **Only one participant in category.

English II. In Region V, 36 high schools participated in the study. Table 4.32 displayed the Region V high school by size and start times. Among the participating high schools, the earliest start time was 7:15 a.m. with 8:25 a.m. in Region V High Schools. In the small sized high schools, the mode start times were 7:55 a.m. with 71.0% English II scores. The latest start time average of 7:52 a.m. for Region V was found in both the small and medium sized high schools with an average English II score of 68.2% and 63.9% respectively. The earliest start time of 7:20 a.m. was found to have the highest English II mean score of 66.0% in the large size school category.

The results of the Pearson's *r* indicated there was not a statistically significant relationship between Region V English II Scores, start times, and size of schools; whereas, $r = .171$, $p = .318$. Thus, the start times of schools in Region V did not correlate with the English II scores in achievement. Further analysis showed the results of the Pearson's *r* portrayed no statistically significant relationship between sizes of schools whether small, medium, or large with start times and English II scores. Table 4.33 showed the results of the statistical correlations of Pearson's *r* in relation to Region V, start times, size, and English II scores. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and English II scores; (Small) $r = -.321$, $p = .181$; (Medium) $r = .433$, $p = .094$. There was not a relationship found that would show that high school size or start times impacted English II scores in Region V.

Table 4.32

English II Achievement and High School Start Times in Regions V

School Size	English II Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	68.26	67.00	11.61	7:52
2. Medium	63.93	66.00	15.55	7:52
3. Large	66.00	66.00	**	7:20
4. All	66.16	67.00	13.16	7:51

Note. All times refer to Central Standard a.m. times. **Only one participant in category.

Table 4.33

Correlations: Start Times and English II Achievement

School Size	N	*r*-value	*p*-value
1. Small	19	-.321	.181
2. Medium	16	.433	.094
3. Large	1	**	**
4. All	36	.171	.318

*Statistically Significant ($p < .05$). **Only one participant in category.

Algebra. Among the 36 high schools, the medium sized schools showed the highest average in achievement. Table 4.34 depicted the high school averages and start times within categories of small, medium, and large sizes. The small and medium sized high schools within Region V both had an average start time of 7:52 a.m. with a median of 86.0% on Algebra results. Only one school was shown for a large size category in Region V with a start time of 7:20 a.m. and average Algebra score of 65.0%.

Table 4.35 analyzed the correlations between Region V Algebra scores and high school start times. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school start times, size, and Algebra results, $r = .110$, $p = .528$; whereas, the school start times did not impact the achievement scores. Results of the Pearson's *r* indicated there was not a statistically significant relationship between size of high schools, high school start times, and Algebra scores in Region V: (Small) $r = -.229$, $p = .361$; (Medium) $r = .252$, $p = .347$. The correlations did not show that high school size and start times had an impact on Algebra scores. There were not enough large sized high schools in Region V to conduct correlations. In all sizes of high schools in Region V the correlations did not show a relationship between Algebra achievement and high school start times.

Table 4.34

Algebra Achievement and High School Start Times in Regions V

School Size	Algebra Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	81.38	86.00	15.78	7:52
2. Medium	77.31	86.00	14.89	7:52
3. Large	65.00	*	*	7:20
4. All	78.83	84.50	15.69	7:51

Note. All times refer to Central Standard a.m. times.

Table 4.35

Correlations: Start Times and Algebra Achievement

School Size	N	*r*-value	*p*-value
1. Small	18	-.229	.361
2. Medium	16	.252	.347
3. Large	1	**	**
4. All	36	.110	.528

*Statistically Significant ($p < .05$). **Only one participant in category.

Biology. In Region V, 35 high schools participated in the study. Table 4.36 displayed the high schools by size, achievement scores, and start times. Both the small and medium sized high schools had a 7:52 a.m. mean start time. The highest Biology results were in the small classification with an 88.7%. The most frequent start time was 7:55 a.m. in Region V with a standard deviation of 16 minutes. In the large size, one school with a 7:20 a.m. start time represented the large sized high schools with an 85.0% average on Biology.

In Table 4.37, 35 high schools were analyzed to determine if a relationship existed with high school start times, school size, and Biology achievement. Results of the Pearson's *r* indicated there was not a statistically significant relationship between school start times, school size, and Biology achievement, $r = .238$, $p = .176$; whereas, the start times of high schools do not correlate with the Biology achievement results. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and Biology scores: (Small) $r = -.046$, $p = .861$; (Medium) $r = .429$, $p = .097$. Thus, the correlations show that there is no impact on Biology scores in Region V due to high school size or high school start times.

Table 4.36

Biology Achievement and High School Start Times in Regions V

School Size	Biology Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	88.70	90.00	9.00	7:52
2. Medium	86.50	89.50	9.09	7:52
3. Large	85.00	**	**	7:20
4. All	87.55	89.50	8.84	7:51

Note. All times refer to Central Standard a.m. times. **Only one participant in category.

Table 4.37

Correlations: Start Times and Biology Achievement

School Size	N	*r*-value	*p*-value
1. Small	17	-.046	.861
2. Medium	16	.429	.097
3. Large	1	**	**
4. All	35	.238	.176

*Statistically Significant ($p < .05$). **Only one participant in category.

U.S. History. In Region V, 36 high schools were analyzed by school size, achievement, and start time mean. Table 4.38 depicted the mean averages of start times, U.S. History achievement, and school sizes. Both small and medium sized high schools had a later start time of 7:52 a.m. with 90.6% and 87.6% respectively in achievement scores; however, the earliest start time had the highest score with 92.0% in the large sized high schools.

In Table 4.39, Region V High Schools were analyzed to determine if a correlation between high school start times, size of school, and achievement existed. Results of the Pearson's *r* indicated there was not a statistically significant relationship between school size, school start times, and U.S. History achievement, $r = .199$, $p = .244$; thus, timing of high schools does not have anything to do with the achievement of campuses on U.S. History in Region V. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and U.S. History scores in Region V: (Small) $r = .049$, $p = .841$; (Medium) $r = .384$, $p = .142$. The correlations portrayed no relationship between high school size, high school start times, and U.S. History scores in Region V.

Table 4.38

U.S. History Achievement and High School Start Times in Regions V

School Size	U.S. History Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	90.63	89.00	7.98	7:52
2. Medium	87.66	90.00	7.85	7:52
3. Large	92.00	**	**	7:20
4. All	89.40	90.00	7.84	7:51

Note. All times refer to Central Standard a.m. times. **Only one participant in category.

Table 4.39

Correlations: Start Times and U.S. History Achievement

School Size	N	*r*-value	*p*-value
1. Small	19	.049	.841
2. Medium	16	.384	.142
3. Large	1	**	**
4. All	36	.199	.244

*Statistically Significant ($p < .05$). **Only one participant in category.

Region VI High Schools

English I. In Region VI, 60.0% of the high schools start at 7:20 a.m. with an average of 7:48 a.m. start time. Table 4.40 described Region VI high schools, start times, and scores from English I. The latest mean start time of 7:51 a.m. was found in small sized high schools with an average English I score of 60.6%; while, large sized high schools averaged 71.8% on English I scores with 7:27 a.m. which was the earliest average start time in the large sized high schools. The standard deviation between all start times was 20 minutes with a range from 6:55 a.m. till 8:30 a.m. in Region VI High Schools.

Results of the Pearson's *r* indicated there was not a statistically significant relationship between high schools start times and English I scores of the participating Region VI high schools, $r = .056$ and $p = .653$; thus, no significance was found between Region VI high schools and school start times in regard to English I scores. Table 4.41 showed the statistical calculations for Region VI High Schools and school start times. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and English I scores in Region VI; (Medium) $r = .075$, $p = .748$; (Large) $r = -.729$, $p = .653$. The correlations showed no impact on English I scores due to high school size or high school start times. However, the findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, start times, and English I scores in Region VI, $r\ (42) = .455$, $p = .002$, $r^2 = .207$. The proportion of variation in English I scores attributed to high school start times was 20.7%. The scores were impacted by high school start times and high school size.

Table 4.40

English I Achievement and High School Start Times in Regions VI

School Size	English I Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	60.64	63.50	16.47	7:51
2. Medium	58.61	57.00	12.77	7:48
3. Large	71.83	77.50	17.67	7:27
4. All	60.36	62.00	15.82	7:48

Note. All times refer to Central Standard a.m. times.

Table 4.41

Correlations: Start Times and English I Achievement

School Size	N	*r*-value	*p*-value
1. Small	42	.455	.002*
2. Medium	21	.075	.748
3. Large	6	-.729	.101
4. All	69	.056	.653

*Statistically Significant ($p < .05$)

English II. In Region VI, 69 high schools participated in the study. Table 4.42 displayed the Region VI high schools by size and start times. Among the participating high schools, the earliest start time was 6:55 a.m. with 8:30 a.m. as the latest in Region VI high schools. In the small sized high schools, 28.6% of the schools started at 8:00 a.m. with a 63.5% mean English II score. The highest English II average had the earliest start time mean of 7:26 a.m. in the large sized high schools among Region VI. In the small sized high schools, the English II scores averaged 63.5% with an average of 7:51 a.m. start time in high schools. The highest median average of 81.5% on English II occurred in the large sized high schools.

In Region VI, the results of the Pearson's *r* indicated there was not a statistically significant relationship between high school sizes, high school start times, and English II scores, $r =. 475$, $p =. 475$. The correlations for all sizes do not have an impact on English II scores. Table 4.43 portrayed the results of the correlations between school size, achievement, and start times for 2017 - 2018. Findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, high school start times, and English II scores, $r\ (42) = .430$, $p =.004$, $r^2 = .185$. The proportion of high school start times that impacted English II scores were 18.5% which means that as the English II scores increased so did the start times. While the results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, high school start times, and English II score: (Medium) $r = .090$, $p = .698$; (Large) $r = -.543$, $p = .266$. The medium and large sized high schools and start times had no impact on English II scores.

Table 4.42

English II Achievement and High School Start Times in Regions VI

School Size	English II Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	63.52	65.00	19.78	7:51
2. Medium	61.57	60.00	11.57	7:47
3. Large	76.50	81.50	13.44	7:27
4. All	64.05	64.00	17.44	7:48

Note. All times refer to Central Standard a.m. times.

Table 4.43

Correlations: Start Times and English II Achievement

School Size	N	*r*-value	*p*-value
1. Small	42	.430	.004*
2. Medium	21	.090	.698
3. Large	6	-.543	.266
4. All	69	.088	.475

*Statistically Significant ($p < .05$)

Algebra. In Region VI, 66 high schools had an average start time of 7:48 a.m. with a mean Biology score of 84.9%. Table 4.44 described the Region VI high schools in relation to high school start time, size, and Algebra achievement. The earliest start time of 7:27 a.m. had the highest Algebra results with 90.5%. in the large sized classification. The small sized high schools had the latest start time of 7:51 a.m. with an 84.4% average.

Table 4.45 depicted the relationship between high school start times, size, and achievement for the 2017- 2018 school year. Regarding the potential relationship between high school start times, school size, and Algebra scores findings suggested that there was not a statistically significant relationship between Algebra results, school size, and school start times, $r = .073$, $p = .556$. Table 4.28 displayed the statistical calculations regarding the correlations between high school size, start times, and Algebra scores. Results of the Pearson's *r* indicated there was not a statistically significant relationship between school size, high school start times, and Algebra scores: (Small) $r = .281$, $p = .075$; (Medium) $r = .134$, $p = .573$. High school start times and size did not correlate with the Algebra achievement on high school campuses that were sized medium or small.

However, findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between large sized high schools, start times, and Algebra scores, $r(6) = -.875$, $p = .023$, $r^2 = .765$. The proportion of variation in Algebra scores attributed to large sized high school start times was 76.5%. The large sized high schools and start times had an impact on Algebra scores.

Table 4.44

Algebra Achievement and High School Start Times in Regions VI

School Size	Algebra Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	76.82	81.00	17.45	7:51
2. Medium	73.61	76.00	12.20	7:47
3. Large	81.33	87.50	14.16	7:27
4. All	76.56	80.00	15.69	7:48

Note. All times refer to Central Standard a.m. times.

Table 4.45

Correlations: Start Times and Algebra Achievement

School Size	N	*r*-value	*p*-value
1. Small	41	.281	.075
2. Medium	20	.134	.573
3. Large	6	-.875	.023*
4. All	67	.073	.556

*Statistically Significant ($p < .05$)

Biology. In Region VI, 66 high schools had an average start time of 7:48 a.m. with a mean Biology score of 84.9%. Table 4.46 described the Region VI high schools in relation to high school start time, size, and Biology achievement. The earliest start time of 7:27 a.m. had the highest Biology results with 90.5%. in the large sized high school classification. The small sized high schools had the latest start time of 7:51 a.m. with an 84.4% average.

Table 4.47 depicted the statistical calculations of Region VI high schools, size, and start times. Results of the Pearson's *r* indicated there was not a statistically significant relationship with all Region VI schools between start times, school size, and Biology scores, $r = .104$, $p = .406$; however, in the area of large sized high schools in Region VI, the findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between all large sized high schools, school start times, and biology scores, $r(6) = -.874$, $p = .023$, $r^2 = .763$. The proportion of variation in biology scores attributed to school start times was 76.3%. Findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, start times, and Biology scores, $r(40) = .475$, $p = <.002$, $r^2 = .225$. The proportion of variation in start times for small sized high schools attributed to Biology scores was 22.5%. However, results of the Pearson's *r* indicated there was not a statistically significant relationship between medium sized high schools, start times, and Biology scores, $r = -.117$, $p = .624$. In the medium sized high schools with an average start time of 7:55 a.m. there was no relationship with Biology scores.

Table 4.46

Biology Achievement and High School Start Times in Regions VI

School Size	Biology Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	84.45	85.50	13.98	7:51
2. Medium	84.28	85.00	7.55	7:47
3. Large	90.50	92.50	7.12	7:27
4. All	84.94	85.00	11.82	7:48

Note. All times refer to Central Standard a.m. times.

Table 4.47

Correlations: Start Times and Biology Achievement

School Size	N	*r*-value	*p*-value
1. Small	40	.475	.002*
2. Medium	20	-.117	.624
3. Large	6	-.874	.023*
4. All	66	.104	.406

*Statistically Significant ($p < .05$)

U.S. History. Table 4.48 depicted 67 high schools from Region VI with high school start times, size of schools, and mean achievement scores on U.S. History for the 2017- 2018 school year. The large sized high schools had the highest achievement percentage of 96.3% and highest median of 97.5% with a 7:27 a.m. start time.

Table 4.49 displayed the correlations between U.S. History scores, size of high schools, and average start times. After results were examined in small sized high schools in Region VI, the findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between school size, start times, and U.S. History scores, $r(41) = .365$, $p = .019$, $r^2 = .133$. As the school start times increased in the small sized high schools, the U.S. History scores improved. The proportion of variation in U.S. History scores attributed to school start times for small sized high schools was 13.3%.

Results of the Pearson's *r* indicated that there was not a statistically significant relationship between medium and large sized high schools and all high sized high schools, start time, and U.S. History scores: (Medium) $r = -.124$, $p = .604$; (Large) $r = -.708$, $p = .116$; (All) $r = .045$, $p = .718$. This correlation showed there was not a relationship between size, start times, and U.S. History scores except for the small sized high schools in Region VI.

Table 4.48

U.S. History Achievement and High School Start Times in Regions VI

School Size	U.S. History Achievement			Start Time
	Mean	Median	Standard Deviation	Mean
1. Small	89.97	91.00	8.95	7:51
2. Medium	90.23	91.00	5.07	7:47
3. Large	96.33	97.50	3.20	7:27
4. All	90.61	92.00	7.72	7:48

Note. All times refer to Central Standard a.m. times.

Table 4.49

Correlations: Start Times and U.S. History Achievement

School Size	N	*r*-value	*p*-value
1. Small	41	.365	.019*
2. Medium	20	-.124	.604
3. Large	6	-.708	.116
4. All	67	.045	.718

*Statistically Significant ($p < .05$)

Research Question Two

Research question two, *Is there a relationship between the start times of high schools and attendance rates?,* was answered by conducting a Pearson's product moment correlation (*r*) between high school start times, size of high schools, and attendance rates. The attendance rates for Region IV, V, and VI are as follows: (IV) 94.1%, (V) 94.4%, and (VI) 94.1%. The lowest attendance rate of 93.8% was found in the large sized high school classification in Region V; while, the highest attendance rate was 95.5% located in the large sized high school classification in Region VI. Table 4.50 displayed descriptive statistics for high school start times and attendance rates by size and region.

All Regions IV, V, and VI High Schools

Attendance. In Region IV, V, and VI, 248 high schools were categorized into small (30.0%), medium (37.0%), and large (37.0%) sizes with the following mean attendance rates: small (94.7%), medium (94.3%), and large (94.2%). Table 4.51 depicted the high school sizes, start times, and attendance rates. The highest attendance rate of 94.7% in the small sized high schools had the latest start time of 7:45 a.m. for all high schools that participated in this study from Region IV, V, and VI.

In Table 4.51, high schools were analyzed to determine if a correlation existed between high school start times, school size, and attendance rates. Findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between all high schools, start times, and attendance, $r(248) = .166$, $p = .009$, $r^2 = .027$. With all high schools and start times the relationship between attendance correlated with school start times. The proportion of variation in attendance attributed to high school start times was 2.7%. Findings of Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, start times, and attendance, $r(76) = .380$, $p = .001$, $r^2 = .144$. The proportion of variation in attendance rates attributed to

school start times and size was 14.4%. Results of the Pearson's *r* indicated there was not a statistically significant relationship between medium and large sized high schools, start times, and attendance: (Medium) $r = .095$, $p = .367$; (Large) $r = -.049$, $p = .668$. whereas, the start times of high schools in the medium and large size did not have an impact on attendance.

Table 4.50

Attendance and High School Start Times in Region IV, V, and VI High Schools

School Size	Attendance		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	94.71	3.26	7:45	0:18
2. Medium	94.30	2.37	7:31	0:26
3. Large	94.25	1.95	7:17	0:16
4. All	94.41	2.56	7:31	0:24

Note. All times refer to Central Standard A.M.

Table 4.51

Correlations: Start Times and Attendance

School Size	N	*r*-value	*p*-value
1. Small	76	.380	.001*
2. Medium	92	.095	.367
3. Large	80	-.049	.668
4. All	248	.166	.009*

*Statistically Significant ($p < .05$)

Region IV High Schools

Attendance. In Region IV High Schools, 146 schools were split into small, medium, and large size categories with the following attendance percentages: small (94.2%), medium (94.1%), and large (94.1%). The standard deviation rate for attendance ranged from 2.00 to 4.54. Table 4.52 depicted Region IV High Schools by size, attendance, and start times. The lowest mean average for attendance was 94.1% with the medium sized schools; while, the highest attendance percentage was 94.2% in the small sized high schools. The average start time for Region IV ranged from 7:16 a.m. to 7:25 a.m. with standard deviation which ranged from 16 minutes to 21 minutes. The later start time did average slightly higher on attendance with a 7:25 start time average and 94.2% attendance rates in the small sized schools.

In Table 4.53, the statistical analysis was conducted for Region IV for the 2017 - 2018 school year. The results of the Pearson's *r* indicated that there was not a statistically significant relationship between school start times, attendance, and school sizes, $r = .037$,

p = .658; thus, the school start times of Region IV, V, and VI did not have an impact on attendance.

Results of the Pearson's r indicated there was not a statistically significant relationship between high school size, start times, and attendance: (Small) r = .466, p = .060; (Medium) r = -.068, p = .617; (Large) r = -.089, p = .455. There was no relationship between size of high schools, start times, and attendance rates.

Table 4.52

Attendance and High School Start Times in Region IV

School Size	Attendance		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	94.21	4.54	7:25	0:20
2. Medium	94.10	2.58	7:20	0:21
3. Large	94.16	2.00	7:16	0:16
4. All	94.14	2.61	7:18	0:19

Note. All times refer to Central Standard A.M.

Table 4.53

Correlations: Start Times and Attendance

School Size	N	*r*-value	*p*-value
1. Small	17	.466	.060
2. Medium	56	-.068	.617
3. Large	73	-.089	.455
4. All	146	.037	.658

*Statistically Significant ($p < .05$)

Region V High Schools

Attendance. Region V High Schools had 34 schools that participated in this study with 52.9% small sized high schools and 44.1% medium sized schools. In Table 4.54, Region V High Schools are described with attendance rates, school sizes, and start time rates. The earliest start time for Region V was 7:15 a.m. with 8:25 a.m. the latest; while 7:51 a.m. was the mean start time. In Region V, the highest attendance rate of 94.7% in the small sized high schools had a 7:52 a.m. mean start time.

In Region V, the statistical calculations were listed in Table 4.55 to determine the correlations. The results of the Pearson's *r* indicated there was not a statistically significant relationship between all high schools in Region V, school start times, and attendance, $r = .288$, $p = .098$; whereas, the attendance rates had no correlation with the school start times regardless of the size of the school. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, start times, and attendance: (Small) $r = -.131$, $p = .603$; (Medium) $r = .411$, $p = .129$. There was no relationship between high school size, start times, and attendance for Region V.

Table 4.54

Attendance and High School Start Times in Region V

School Size	Attendance		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	94.79	1.45	7:52	0:11
2. Medium	94.48	2.57	7:52	0:20
3. Large	93.80	*	7:20	*
4. All	94.62	1.99	7:51	0:16

Note. All times refer to Central Standard A.M. *Only one school in large size.

Table 4.55

Correlations: Start Times and Attendance

School Size	N	*r*-value	*p*-value
1. Small	18	-.131	.603
2. Medium	15	.411	.129
3. Large	1	**	**
4. All	34	.288	.098

*Statistically Significant ($p < .05$). **Only one school in large size.

Region VI High Schools

Attendance. In Region VI, 68 high schools were represented in the study. Table 4.56 depicted the school size, attendance rate, and start times of Region VI high schools. The range of start times began at 6:55 a.m. until 8:30 a.m. with the range of attendance with 81.1% to 98.2%. The highest attendance percentage was in the large sized high schools with a 7:27 start time. The lowest attendance rate was found in the medium sized high schools with a mean of 7:47 a.m. start time. In Table 4.57 the statistical calculations were displayed to determine if there was a correlation between attendance rates, school size, and start times. The results of the Pearson's *r* indicated there was not a statistically significant relationship between school attendance rates, school size, and school start times, $r = .230$, $p = .059$; thus, school start times have no relationship with attendance rates.

Findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small high schools, start times, and attendance, $r\ (41) = .447$, $p < .003$, $r^2 = .199$. This portrayed that the small sized high schools with an average start time of 7:51 a.m. had an impact on attendance rates. The proportion of variation in attendance rates attributed to small sized high schools and start times was 19.9%. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, start times, and attendance: (Medium) $r = .180$, $p = .455$; (Large) $r = .053$, $p = .920$. The medium and large sized schools and start times had no impact on attendance rates.

Table 4.56

Attendance and High School Start Times in Region VI

School Size	Attendance		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	94.88	3.27	7:51	0:13
2. Medium	94.71	1.53	7:47	0:27
3. Large	95.51	0.72	7:27	0:22
4. All	94.88	2.68	7:48	0:20

Note. All times refer to Central Standard A.M.

Table 4.57

Correlations: Start Times and Attendance

School Size	N	*r*-value	*p*-value
1. Small	41	.447	.003*
2. Medium	21	.180	.435
3. Large	6	.053	.920
4. All	68	.230	.059

*Statistically Significant ($p < .05$).

Research Question Three

Research question three, *Is there a relationship between high school start times and graduation rates?,* examined whether or not a correlation existed between high school start times, high school size, and graduation rates. This was answered by conducting a Pearson's product moment correlation (*r*) between high school start times, high school sizes, and graduation rates among the participating high schools from Region IV, V, and VI. The mean graduation rate from all regions was 92.8% with a minimum graduation rate of 89.3% and 94.4% being the highest graduation average. Table 4.58 depicted the statistics of high school start times, size of high schools, and graduation rates.

All Regions IV, V, and VI High Schools

Graduation. In Region IV, V, and VI, the graduation rates averaged 92.8% with a 7:31 a.m. start time. Table 4.59 depicted the graduation averages for Region IV, V, and VI classified by small, medium, and large sized high schools. The lowest average graduation rate occurred with the medium sized high schools with 92.4% and a 7:32 a.m. start time. The earliest start time rate of 7:17 a.m. carried an average of 92.7% which was the highest average in Region IV, V, and VI for the 2017- 2018 school year. The standard deviation between graduation rates ranged from 4.46 in the large sized high schools to 10.01 in the small sized high schools. The most frequent start time was 7:20 a.m. with the earliest at 6:30 a.m. and latest at 8:30 a.m. in all high schools that participated from Region IV, V, and VI.

In Table 4.59, statistical calculations were derived to determine if there was a correlation between graduation rates and start times in Region IV, V, and VI high schools. The findings from the Pearson's *r* suggested that a statistically significant positive relationship existed between all high school start times and graduation rates, *r*

(232) = .147, p <.001, r^2 = .021. As the school start times increased, so did the graduation rates. The proportion of variation in graduation rates attributed to high school start times was 2.1%.

In the small sized category, the findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between high school start times, size, and graduation, $r(70)$ = .293, p=.014, r^2 = .085. As the high schools in the small sized category started later, the graduation rates increased by 8.5%. Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, start times, and graduation rates: (Medium) r = .094, p = .400; (Large) r = .033, p = .774. The medium and large sized high schools with an average start time of 7:32 a.m. and 7:17 a.m. respectively have no relationship with graduation rates.

Table 4.58

Graduation and High School Start Times in Region VI, V, and VI High Schools

School Size	Graduation		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	93.62	10.01	7:45	0:17
2. Medium	92.48	6.50	7:32	0:24
3. Large	92.73	4.46	7:17	0:17
4. All	92.87	7.23	7:31	0:23

Note. All times refer to Central Standard A.M.

Table 4.59

Correlations: Start Times and Graduation

School Size	N	*r*-value	*p*-value
1. Small	70	.293	.014*
2. Medium	82	.094	.400
3. Large	80	.033	.774
4. All	232	.140	.033*

*Statistically Significant ($p < .05$).

Region IV High Schools

Graduation. In Region IV High Schools, the average graduation rate was 92.1% with an average 7:18 a.m. start time. Table 4.60 described the correlations between Region IV High Schools, school size, graduation rates, and start time averages. The latest start time average was found in the small sized high schools with 7:25 a.m. which averaged the lowest graduation rate of 89.3%. While the earliest start time average was 7:16 a.m. in the large sized schools with the highest graduation average of 92.6%. In the large sized high schools in Region IV the standard deviation was 4.62 among the schools with a low standard deviation in school start times with 16 minutes.

Table 4.61 depicted the correlations between school size, graduation rates, and school start times. The results of the Pearson's *r* indicated there was not a statistically significant relationship between high school start times, school size, and graduations rates, $r\ (137) = .086$, $p = .318$. Thus, the earlier or later start time does not affect the graduation rates of small, medium, and large sized high schools in Region IV. The likelihood that high school start affected graduation rates was seven tenths of a percent.

Results of the Pearson's *r* indicated there was not a statistically significant relationship between high school size, start times, and graduation rates: (Small) $r = .196$, $p = .467$; (Medium) $r = .098$, $p = .512$; (Large) $r = .028$, $p = .816$. In Region IV, the high school size and start times did not impact graduation rates.

Table 4.60

Graduation and High School Start Times in IV High Schools

School Size	Graduation		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	89.38	17.5	7:25	0:20
2. Medium	92.10	7.71	7:22	0:21
3. Large	92.61	4.62	7:16	0:16
4. All	92.12	8.16	7:18	0:19

Note. All times refer to Central Standard A.M.

Table 4.61

Correlations: Start Times and Graduation

School Size	N	*r*-value	*p*-value
1. Small	16	.196	.467
2. Medium	47	.098	.512
3. Large	73	.028	.816
4. All	137	.086	.318

*Statistically Significant ($p < .05$).

Region V High Schools

Graduation. In Region V, the high schools that participated in this study were separated into sizes classified as small (18), medium (15), and large (1). Table 4.62 depicted the average graduation rates, start time, and standard deviations. The highest graduation rate was found in the medium sized schools with 92.8%; while, all schools had an average of 91.8%. In both small and medium sized high schools, start times were later with 7:52 a.m. shown as the average for both groups. Overall, the start time averages ranged from 7:20 a.m. to 7:52 a.m. with graduation rates that ranged from 91.0% to 91.8%.

In Table 4.63 listed below, the statistics showed the correlations between Region V High Schools, size of schools, graduation rates, and start times. Results of the Pearson's *r* indicated there was not a statistically significant relationship between all Region V high school sizes, graduation rates, and start times, $r = -.194$, $p = .280$; therefore, the start times of high schools does not affect the graduation rates among all

Region V High Schools. There is less than a 3.7% percent chance that school start times affected these high schools for graduation in this study.

Results of the Pearson's *r* indicated there was not a statistically significant relationship between medium high school size, start times, and graduation rates, $r = .255$, $p = .359$. Thus, there was not impact on graduation rates with medium sized high school or start times. Findings of the Pearson's *r* suggested that a statistically significant positive relationship existed between small sized high schools, start times, and graduations rates, $r(18) = -.598$, $p = .009$, $r^2 = .357$. In the Region V small sized high schools, the high school start times impacted the attendance rates. The proportion of variation in graduation rates attributed to high school start times for small sized schools was 35.7%.

Table 4.62

Graduation and High School Start Times in Region V High Schools

School Size	Graduation		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	91.00	21.76	7:52	0:11
2. Medium	92.83	5.45	7:52	0:20
3. Large	91.30	*	7:20	*
4. All	91.83	16.2	7:51	0:16

Note. All times refer to Central Standard A.M. *Only one school in large size.

Table 4.63

Correlations: Start Times and Graduation

School Size	N	*r*-value	*p*-value
1. Small	18	-.598	.009*
2. Medium	15	.255	.359
3. Large	1	**	**
4. All	33	-.194	.280

*Statistically Significant ($p < .05$). **Only one school in large size.

Region VI High Schools

Graduation. In Region VI, 62 high schools participated in this study with 59.6% small sized schools, 32.2% medium sized schools, and 9.6% large sized schools. In Table 4.64, high schools were grouped by size which described the average graduation rates, standard deviations, and mean start times. The highest average graduation rate fell in the large sized schools with 94.4% and 7:27 a.m. start time. The lowest graduation rate was found in the medium sized schools with a 7:47 a.m. start time. The highest standard deviation between graduation rates was 7.18 among the small sized high schools.

In Table 4.65, the descriptive statistics for Region VI High Schools between school size, graduation rates, and start times were shown. The results of the Pearson's *r* indicated there was not a statistically significant relationship between school sizes, start times, and graduation rates, $r = .000$, $p = .999$; thus, there is no relationship between school start times and graduation nates. In this study, there is a one tenth chance of a correlation with start times and graduation rates. Results of the Pearson's *r* indicated

there was not a statistically significant relationship between high school size, start times, and graduation rates; (Small) $r = .199$, $p = .238$; (Medium) $r = -.226$, $p = .337$; (Large) $r = -.377$, $p = .462$. In other words, the size of high school and start times in Region VI have nothing to do with graduation rates.

Table 4.64

Graduation and High School Start Times in Region VI High Schools

School Size	Graduation		Start Time	
	Mean	Standard Deviation	Mean	Standard Deviation
1. Small	94.08	7.18	7:51	0:13
2. Medium	93.09	3.65	7:47	0:27
3. Large	94.43	1.45	7:27	0:22
4. All	93.87	5.89	7:48	0:20

Note. All times refer to Central Standard A.M.

Table 4.65

Correlations: Start Times and Graduation

School Size	N	*r*-value	*p*-value
1. Small	37	.199	.238
2. Medium	20	-.226	.337
3. Large	6	-.377	.462
4. All	63	.000	.999

*Statistically Significant ($p < .05$).

Research Question Four

Research question four, *What are the perceptions of school superintendents concerning the influence of high school start times on student attendance, achievement, and graduation rates?*, was answered by conducting an inductive thematic coding process of 15 semi-structured interviews of superintendents in small, medium, and large sized districts. In an attempt to capture a more in-depth understanding of the influence of high school start times on student attendance, achievement, and graduation rates, 15 school district superintendents were interviewed for their perceptions on this issue.

The characteristics of the superintendents were not easily categorized into small, medium, or large sized school districts due to their expertise in the field of education. In the group, 80% were high school principals at one point which conveyed multiple years of experience within different sizes of districts. In fact, many of the participants have served in more than one school district with sizes varying from small to large sized school districts. Clustering comments from superintendents were based on topics rather

than school district sizes due to the varying levels of expertise in different sizes of school districts.

From the interviews, the responses derived three distinct themes concerning high school start times and their perceptions of the correlation with attendance, achievement, and graduation rates: (a) *sleep deprivation*, (b) *high school start times*, (c) *start times, and achievement*. These themes were provided below along with a sampling of the superintendent's comments. For purposes of this study, each superintendent was assigned a name, based on cookie preference, to protect their identities. To understand the influence of start times in high schools on achievement, attendance, and graduation, the superintendents' perceptions were analyzed during the interview process. Given all responses from participants, themes emerged that portrayed the viewpoint of superintendents, centered around sleep deprivation and high school start times among teenagers in high schools. The challenges superintendents faced when considering high school start times were categorized into sub themes based on high school start time experience: (a) *early*, (b) *late*, (c) *after school activities*, (c), *attendance,* and (d) *transportation*.

Role of Sleep Deprivation

As superintendents discussed the sleep habits of teenagers many personal stories surfaced. A superintendent of a medium sized school district shared personal experience: "kids stay up late and sneak to stay up late" which 40% of the superintendents acknowledged personal experiences of *sleep deprivation* in their family during the interviews. The superintendent continued to express that "if you've got really voracious readers, they're sneaking under their covers with their flashlights to read a book, which has morphed into technology, where they are sneaking their devices under their covers to stay up late." Another superintendent, Dr. S'more in a larger sized school district

mentioned “first-hand knowledge” with high school boys in athletics: “they are very studious and as a result they need their sleep.” The superintendent addressed the competitive nature in his own children which constantly required sufficient sleep to function during the school day.

A superintendent from a small sized school district, Dr. Snickerdoodle, shared his own experience with teenagers, regarding sleep habits: “my kids were getting to bed later and falling asleep later as they grew up.” While a superintendent from a medium sized school district, reflected on his own personal trials with raising six kids: “if they do not get enough sleep, you can certainly see it in how they behave in the morning, you know quickly, if they slept, by what they are willing to do and what they are not willing to do.” Dr. Toffee further commented that some of his kids needed “five to six hours of sleep and some needed about ten hours, every kid is different.” These personal stories shared by the superintendents allowed reflection of their own parenting experiences which morphed into in-depth discussions of the sleep habits of teenagers and *sleep deprivation* among teens. The conversations which centered around personal experiences were similar yet different depending on the needs of their own personal children. The interviews opened with personal reflections of their own children which developed a comfortable environment for the superintendents to express their concerns with the sleep habits of teenagers.

After the personal experiences of sleep habits were shared, superintendents were asked about *sleep deprivation* of students in high schools. The topic shifted easily into the knowledge of *sleep deprivation* among teenagers in classrooms in their districts. With the unique perspectives of superintendents in small, medium, and large sized school districts, 80% of the superintendents responded with their experience on campuses as principals, teachers or superintendents. The term *sleep deprivation* was selected to encompass the

common views of unhealthy sleep habits among teenagers. The researcher found similar responses while the sleep habits of teenagers and the role of sleep deprivation were discussed in the interviews. Most of the stories were reflective of experience as principals. Surprisingly, 80% of the superintendents shared high school principal experience as they dealt with *sleep deprivation* among teens. When superintendents were asked about *sleep deprivation* in high schools, a superintendent of a small district shared his classroom memories: "students in the sleep zone or what is considered the zombie state" were definitely missing out on sleep in Algebra classes. Dr. Gingersnap further commented that the earlier in the school day, such as first or second period, the students experienced daytime sleepiness with a decreased attention span. Another superintendent of a small district had the following response:

> I believe secondary students' sleep patterns vary based on their level of engagement outside of school. Students who are actively engaged in their school or participate in community-based events tend to go to bed earlier than non-active students. Students who have more time to engage in video games and social media tend to stay up later navigating those avenues.

A superintendent of a large school district, Dr. Hershey, mentioned that "students slept in classes, complained of being exhausted, and typically run late to first period." She conveyed the difficulty teachers face with teenagers when they do not get the recommended amount of sleep. In a smaller sized school district, a superintendent shared a scenario to explain *sleep deprivation* among teenagers:

> When looking at discipline reports to determine what causes the discipline, I find out what is considered disruptive behavior according to teachers. Typically, a student will have laid his head down on the desk. Then the students fall asleep and the teacher comes up to the student and immediately request that they pay

> attention. Teachers say, "wake up, wake up" but basically, they wake up the student, no pun intended, from the wrong side of the bed.

This scenario explained teacher interactions with students that suffer from *sleep deprivation* which the superintendent commented happens on a routine basis according to his discipline reports. Most of the superintendents shared experiences of *sleep deprivation* in classrooms and campuses with teenagers in their districts. These examples described *sleep deprivation* among high school classrooms. It was clear that *sleep deprivation* occurred in the classrooms and on campuses throughout their districts. These comments resonated with the theme of *sleep deprivation* which were reflective of teenagers' lack of sleep and difficulty staying awake in school.

When questioned why *sleep deprivation* resided in the classrooms and campuses, 60% of the superintendents alluded to prevalent research on sleep habits of teenagers. Dr. Gingersnap, a superintendent of a small sized school district, commented, "sleep habits are pretty much sporadic, and kids are not getting the recommended eight hours of sleep." Dr. S'more, a superintendent of a medium sized school district, expressed that "sleep deprivation definitely causes emotional, disciplinary, academic, and psychological issues." While a superintendent of a large sized school district, Dr. Lemon, commented: "secondary students get less than the recommended sleep on average each night." A superintendent with experience from both small and large sized districts conveyed that s*leep deprivation* stemmed from their "natural biorhythms that are not conducive to being engaged in classrooms prior to 8:30 or 9:00 in the morning."

The conversations that surrounded *sleep deprivation* naturally led to superintendents' knowledge of previous research which prompted the question, *how do you perceive the relationship of high school start times with sleep deprivation,* which introduced the second theme in this study.

High School Start Times

In regard to superintendents' perceptions about *sleep deprivation* and *high school start times*, responses from superintendents with experience in small, medium, and large sized school districts evolved through stories of sleep deprivation and various start times in high schools. In small, medium, and large sized school districts, superintendents responded with 73% direct experience and 27% indirect experience in changing the school start times for a district. Direct experience referred to establishing changes from the superintendent seat as well as serving on planning committees established by superintendents. Some superintendents spoke from indirect experience when they shared struggles from surrounding superintendents that encountered harsh feedback over a change in start times. The direct experience varied from exploration, proposal, and planning to implementation stages in small, medium, and large sized school districts either as principals or superintendents. Dr. Samoa, a superintendent of a small sized school district commented: "we have changed from early to late and back to early within two years in my experience as a principal." The district reverted back to an early start time, after the community expressed concerns, over the later start time which disrupted their family routines. Parents wanted their teenagers to be home to take care of younger siblings. Another superintendent of a small sized school district shared that he has changed school start times at the high school level multiple times as a campus and district leader due to the needs of the community. In these experiences, the term *high school start times* was chosen to incorporate the various early and late start times that were addressed in the responses from the superintendents.

Start Times and Achievement

Another area addressed during interviews centered around the correlation of start times and achievement. When discussing *high school start times* and *sleep deprivation*,

the topic of achievement whether it would be impacted by *high school start times* was examined among the superintendent participants. Among the superintendents, 73% did not believe there was a relationship with *high school start times* and *achievement.* These superintendents were from small and large sized school districts.

The constant resonation of lack of correlation was quite evident among the participants. Over and over the superintendents confirmed that they did not see a relationship. Dr. Lemon, a superintendent from a large sized school district, shared: "start times do not have an impact on student *achievement*. I really don't think it matters when it comes to achievement." A superintendent with small and large sized school district experience, Dr. Gingersnap, commented:

> Start times do not matter. It is about those students, who are concerned about their education, will be engaged regardless of the start time. On the other hand, students, who don't care, will not be concerned with when classes start.

Dr. Gingersnap expressed his perceptions of the reality of teenagers in his response to the correlation of *high school start times* and *achievement*. This superintendent shared an example of teenage reasoning in a school system regarding *high school start times* and *achievement*:

> Kids don't really go into the counselors' office to ask for math first period. And, they don't really care what time math starts, whether it is first or seventh period. And, to be honest with you most math teachers teach the same lesson all day with the lessons getting better at the end of the day. So, I don't necessarily think high school start times have an impact on student achievement.

The deliberation o*f high school start tim*es and *achievement* fostered seemingly honest responses from all participants. The candor among the superintendents allowed rich feedback to understand the perspectives of superintendents. A large sized school district

superintendent, Dr. Molasses, shared that "the highest performing school in the district had the earliest start time. I can't really say that there is a correlation between student performance and start times. "

However, 27% of the participants, three from medium sized districts and one from a large sized school district, were passionate about late start times negatively impacting *achievement* scores. This group felt that students were lacking sleep with the early start time due to late nights which led to poor performance. They felt the late start times would lead to positive gains in student *achievement*. One superintendent of a large sized school district, Dr. S'more, commented:

> These kids were failing because they were not getting enough sleep. Our school district went from required improvement to met standard shortly after we pushed our start time twenty minutes later. We found kids slept longer and scores improved.

Dr. S'more shared that he could see the changes on the campus just by walking the hallways after changing the start times. High school students were able to sleep longer before heading to class since they were not transporting their siblings to school. Dr. Sugar, a superintendent of a medium sized school district, shared, "Starting school later reflects research of student circadian cycle and sleep patterns. I think ultimately you will get the best performance when you reflect what works best for student needs." He was not sure if late start times would correlate with achievement in a statistically significant manner, but he felt that it would impact in a positive way when the start times mirror the research.

Four out of fifteen superintendents, who had experienced late start times, were avid supporters of moving to a later start time. Dr. Sugar commented that to "impact positively the performance of students the start times should mirror research." Although

it was a small percentage of the participants, the consensus in this group was centered around the whole child needing sleep at night to function during the day.

While the previous comments from superintendents demonstrate that the majority do not see a relationship between start times and student *achievement,* many did feel that the timing of subjects did affect *achievement* and recognized the best time for learning within a high school schedule. A superintendent of a small sized school district, Dr. Sprinkles, provided a specific situation that described the academic timing within the school day:

> The impact on various content areas is based on time of the day the students take the subjects. For instance, a student who takes English IV after lunch, with an early start time, may become academically disengaged by the end of the day.

Dr. Sprinkles shared similar comments with other superintendents about the timing of certain subjects taught on campus. A superintendent of a medium sized school district discussed the lack of relationship between *high school start times* and *achievement*; however, she summed up the reality of timing in high schools as it relates to *achievement*:

> So, what I do believe to be true is that courses served in the first half of the day get the greatest amount of attention from the students. I don't think it is a start time issue. Overall there is a sweet spot for learning. I don't think it matters if it is an hour before or hour after.

Based on most of the responses, the superintendents did not see a correlation between *achievement* and *high school start times*. Among the responses, comments regarding timing of the day correlated with the total group of participants. Most superintendents recognized the best time for learning within a high school schedule. The in-depth conversations regarding achievement and *high school start times* during the

interviews led to a common understanding of the "sweet spot" for learning which must be protected.

High School Start Time Experience

Responses were categorized further into early and late start categories for the purposes of analysis of the perspectives of superintendents from small, medium or large sized school districts. The superintendents' perceptions are clustered from the theme *high school start times* into the challenges the participants encounter when changing high school start times into four sub themes: (a) *early,* (b) *late*, (c) *after school activities*, and (d) *transportation*.

Early. The term *early* denoted descriptions of superintendents' experience with schools that started before 8:00 a.m. in the morning. Superintendents from large sized school districts, revealed that students were "picked up starting at 5:15 in the morning by transportation for a 7:15 start time" according to Dr. Lemon. In the *early* start times, teenagers were non-responsive in interactive lessons which was conveyed by two of the large sized superintendents. While another superintendent from a large sized school district, Dr. Hershey, shared that their school had a pick-up time as *early* as 6:00 a.m. which left classrooms silent in the mornings as high school students were struggling to answer questions and participate in the lessons. The superintendents commented that high school teachers and staff are challenged to keep students awake especially before 8:00 in the morning. In the larger sized school districts, transportation seemed to be the leading factor to open schools at earlier times; this will be discussed in detail in a latter section.

Across participants, common responses emerged as superintendents shared their direct and indirect experiences with *high school start times*. Dr. Thin Mint, a superintendent of a medium sized school district, commented that "teens should have the latest start times, but there's plenty of opposition for a variety of reasons." The

superintendent elaborated that the primary opposition was due a lack of supervision, after school from older siblings, with a *late* high school start time; thus, the superintendent felt opposition to align the campus start time with the sleep habits of teenagers due to parental opposition. The *early* start times allowed high school students to be "pseudo parents" when their siblings got out of school.

Dr. S'more, a superintendent of a large sized school district, reported high school students with an *early* start time had a "bigger component" due to the inability to transport "little brother or sister to school." As a superintendent, the bigger component of caring for siblings must be addressed when changing school start times. In this large sized school district, the superintendent shared:

> In a large district, high school students were not making it to school on time due to dropping off little brother or sister. Then students without siblings were just not making it to school on time because they had trouble waking up for an *early* start time. In the larger school district, we saw improvements by moving the start time from *early* to late because the kids were sleeping later. Now in a smaller school district, if every school starts at the same time, my experience has been that high school students couldn't make it to school on time because they were dropping off siblings. And, the parents were quite reliant on the older siblings to take care of the younger ones.

This was a broad perspective shared regarding a superintendent experience in *early* start times in a large and small sized school district. Dr. Molasses, a superintendent of a large sized school district, stated the "cost of childcare is the greatest political ramification" when changing start times; thus Dr. Molasses stated, "parents prefer high school students to go home first." The superintendent shared that the high school students were expected to serve as after school daycare when younger siblings got off the bus. This example

supported 100% of the superintendent responses, whether from small, medium, or large sized school districts, which referred to child care concerns whether *early* or *late* high school start times. Three superintendents from large sized school districts commented that most districts have oppositional views due to parents with young children and those without. A superintendent from a large sized school district commented:

> From a political standpoint, the number one concern with the biggest opposition derived from one group of parents, who say they need kids to have a later start time, and those were the parents who didn't have young children at home. Then you have parents with multiple kids in the home and no one wants their elementary kids to be home an hour and a half before the high school or middle school sibling comes home. It is a matter of safety for the parents with multiple children since the parents work.

Dr. Snickerdoodle, a superintendent with large sized school district expertise, voiced that each district has two types of parents with distinct needs when it comes to high school start times. "We have parents nearing the empty nest stage and those with their first high school student." A superintendent of a large sized high school conferred with the prior comments:

> With the parents getting close to being empty nesters, they want their kids to start later because they don't have to fight the morning routine. Then the parent who has a high school student, who takes care of youngest sibling, wants early start times, to avoid coming home to an empty house.

These superintendents shared how they struggle to find a balance with "competing interests of parents" according to Dr. Snickerdoodle. "There is a benefit and cost on each side of that equation" especially with high school start times according to a medium size school district superintendent, Dr. Cranola. In summation, a superintendent

from a small sized school district, insightfully chuckled as he shared, “no one is ever really happy with high school start times whether early or late.” Indeed, the responses portrayed a variety of early start time issues whether it was from a superintendent in a small, medium, or large sized school district.

An area where consensus among superintendents, of medium and large sized school districts, agreed fell into the area of zero-hour classes when discussing *early* start times. Several superintendents of medium and large sized school districts mentioned zero-hour classes that provided *early* options for students with their own transportation. In fact, 27% of the superintendents interviewed brought up zero-hour start times when questioned about experience in changing school start times. Dr. Hershey, a superintendent of a large sized school district, commented that “zero-hour could be beneficial for studying” as well as” modeling high schools after colleges with optional start times.” Among these discussions, the superintendents shared the advantages from the scheduling aspect of zero-hour start times as well as academic perks. The zero-hour concept allowed students to take additional classes to boost their grade point averages or increase their credits while in high school. Among the four superintendents that addressed zero-hour as a benefit for *early* start times in high schools, all stated that transportation was not provided for this type of *early* start. Dr. Molasses, a superintendent of a large sized school district, shared a few comments below regarding zero-hour as an *early* start time:

> We gave zero-hour at the secondary schools where the students started as early as 7:00 in the morning. Some kids had one through six period schedules, two through seven period schedules or one through seven period schedules. This allowed choice in scheduling to accommodate the different needs of parents. At the same time, it benefitted those who wanted additional credits to improve class

ranking or perhaps get out earlier to care for their siblings. This was the highest performing high school I had ever witnessed with different options.

This provided a choice among high school students to leave school earlier to greet their siblings at home if needed.

After School Activities. Activities held after school were mentioned by superintendents when *early* start times were addressed in the interviews. The responses from superintendents of small, medium, and large sized school districts indicated the influence of activities regarding *early* start times. Starting earlier allowed students more time for after school activities such as jobs, extracurricular programs, and study time for upcoming assignments, according to Dr. Lemon. A medium size school district superintendent stated, "if high schools start earlier, you will support activities without impacting academics." The superintendent, Dr. Peanut Butter, conveyed that extra-curricular activities tend to pull students off campus for competition; however, the e*arly* start times protected class time for academics more than late start times when extra-curricular have competitions. Two superintendents from medium sized school districts referenced the critical aspect of students working after school for themselves or their families. According to a small sized school district superintendent, "when you have high levels of economically disadvantaged students, the *early* start time is better to allow students to work which is a necessity for their families." Superintendents from all sizes of districts were able to articulate the benefits of *early* start times in high schools. Only 27% of the superintendents stated they had an *early* start time preference with a split between small and large sized school districts. Of these responses, a consensus was found that *early* start times were beneficial for extra-curricular and work schedules among all sizes of districts.

Attendance. Another topic, student attendance, that surfaced with *early* start times among high schools was 27% of the larger sized school district superintendents acknowledged that they had the lowest attendance rates with *early* start times, according to their interviews. Dr. Cranola, a superintendent of a medium sized school district shared:

> Only my opinion, not sure what research shows but you know I would think *early* start times would negatively impact student attendance. The logical side of me thinks like a high school student. If I am a high school student and I wake up late, why would I get up to go through the hassle of getting a tardy slip when I could stay home all day instead.

A superintendent from a large school district commented that with "seven high schools the schools with the earliest start times have the most crucial attendance rates as they struggle to meet standards." Dr. Hershey further addressed high school students must meet the bus at 6:00 in the morning which continues to be a struggle especially in a large sized school district. A superintendent of a small sized school district voiced that "early high school start times is one factor to consider when looking at student attendance especially with the nature of the community being served." This superintendent elaborated on *early* start times impacting attendance when students work late to support their families. The *early* start times would be challenging for students that work to attend school on a routine basis according a superintendent of a medium sized school district.

Most superintendents referenced research to indicate that *sleep deprivation* and *early* start times were a key factor for many teens that attributed to low attendance rates. According to Dr. Thin Mint, research implies sleep deprivation leads to high absenteeism due to early start times. Superintendents of small, medium, and large sized school districts conveyed a strong knowledge of recommendations from medical research on

starting school after 8:00 in the morning. Dr. Snickerdoodle, represented 33% of the superintendents' comments, regarding sleep deprivation and attendance when he described the knowledge of research by saying, "Changes in their internal clocks, as teenagers, conflicts with daily attendance." As soon as superintendents acknowledged research on sleep deprivation this opened the channel of conversation into the challenges that parents face raising teenagers especially when trying to get them to school each day. A superintendent with both small and large sized school district experience, commented:

> Teenagers are not necessarily going to bed when parents say to go to bed. They are not regimented as the older generation experienced. We had to go to bed at a certain time and the television was turned off at a certain time. Not to mention the phone was connected to a wall in the central part of the house, so no late phone calls after you went to bed. So how do we know how much sleep teenagers are getting at night?

This superintendent's comment moved into a discussion of parents, who struggle to wake up their teenagers, which many superintendents conferred that sleep deprivation could impact attendance especially with an *early* start time. Superintendents shared parent complaints surrounding the struggle with teenagers in the mornings which often led to absences. Another superintendent stated, "Changing a start time doesn't guarantee additional sleep in teenagers." This statement seemed to shift the ownership of sleep deprivation on to the parents verses the *early* start times of high schools.

Late. While many superintendents commented on early start times, others addressed *late* start times and the impact on high school students. When superintendents were asked how high school start times affected sleep deprivation in teenagers; 53% of superintendents deliberated the process involved in changing start times which led to in-depth discussions on *late* start times. The process of changing start times was more

evident when discussing *late* start times as most high schools start early. These superintendents had experience in moving to *late* start times or reverting to early start times whether they were from small, medium or large sized school districts. For example, for over 20 years, a medium sized school district had a high school start time of 7:25 a.m. with an intermediate school that had an 8:30 start time. The superintendent of this medium sized school district, Dr. Cranola, shared the change process in the comments below:

> We surveyed parents about start times and the outcome was mixed. We didn't want to make a district decision based on parent care. We did what is the best for the chronological age of the kids and crucial to their development. That is how we made our decision.

This medium sized school district moved to a *late* start time of 8:30 a.m.at the high school with an *early* start time of 7:30 a.m. for the elementary campuses. The superintendent of this medium sized school district shared that within the first few months negative feedback surfaced due to the initial shock of change in the district. During this time period, Dr. Cranola and her staff were consistently delivering unified messages to the community, parents, and staff by saying "this change is research-based and the healthiest thing to do for our students- so let's try it first." According to Dr. Cranola, for the past three years, criticism of *late* start times has mainly surfaced from teachers not the parents or students. Teachers had personal concerns with medical appointments and banking needs that couldn't be handled after school. Even with changes in superintendent leadership, the *late* start time has been maintained with an 8:30 a.m. start time at the high school. The superintendent felt that *late* start times led to decreased *sleep deprivation* among teenagers.

Dr. S'more, a superintendent of a large sized school district, changed from *early* to *late* start times due to high school students not making it to school or falling asleep in classes. He shared, "We didn't have many concerns about changing start times, when it was implemented because we got stakeholder input with buy-in from everyone." He expressed this district has drastically improved attendance rates with the change from an *early* start time to a *late* start time. This large sized school district has continued with a later start time of 8:20 a.m. for multiple years. The superintendent was passionate that *late* start times decreased *sleep deprivation* among his students.

Another notable benefit of a *late* start time, according to some of the participants, was a topic of discussion by a small sized school district superintendent. Dr. Sprinkles shared that *late* start times gave "the opportunity to provide time for the older sibling to see other siblings off to school." Dr. Sprinkles, a superintendent of a small sized school district, further shared that parents must train their teenagers to caretake for their siblings to reap the benefits. This was discussed previously with early start times; however, *late* start times dealt with siblings taking responsibility for their brothers and sisters as well. While another small sized school district superintendent felt students would watch over their siblings, a superintendent of a large sized school district, Dr. Molasses, shared a comparable statement:

> In a family with several children, with a late high school start time, the parents are already gone so you are trusting that a 16-year old will get up when the alarm goes off, get dressed, and get their siblings to the bus stop. Then drive to school without stopping at Starbucks. It is a matter of responsibility which reverts to parenting.

Although both superintendents shared different views of teenagers getting their siblings ready for school with a *late* start; both superintendents agreed that the responsibility falls

on the parental training within the home to caretake younger siblings. They both mentioned without parent training and a sense of student responsibility, “students struggle to get to school” especially with a *late* start time, when “parents are not home” during morning routines.

After School Activities. Small, medium, and large sized school district superintendents focused on late start times in high schools and how it affected travel and *activities* after school. With the early start times, the superintendents shared that more time after school protected academics during the day; while, the conversation over late start times led to lack of academic time due to the travel involved in competitions. Dr. Toffee, a superintendent of a medium sized school district, shared: “late high school start times is one factor to consider when looking at students’ attendance especially with the nature of extra-curricular activities” which resounded with comments from other superintendents, with direct experience of late start times. The superintendents further discussed the numerous *activities* held after school hours which makes a late start time more appealing to teenagers to recover from the long nights full of practice and games.

After school activities tended to be the biggest issue with late start times which should not be the determining factor for superintendents; however, in Texas it is an issue to consider according to Dr. Sugar. When this superintendent of small and large sized school district experience, addressed extra-curricular activities, his experience with late start times occurred in both districts. Dr. Sugar shared, “with a later start time, students miss more class due to extra-curricular competitions” regardless of the size of district. In small districts, travel to other high schools often required 60 to 120 minutes due to distance of nearest school according to a small school district superintendent, Dr. Shortbread. The travel required in small sized school districts pulled students out of academics for extra-curricular *activities*. While in large sized school districts, the travel

time between competitions would be less; yet, typically additional competition events pulled students from academics more often. The superintendents shared knowledge of late start times from experience with small and large sized school districts. The superintendent responses shared the perspectives of late start times regarding extra-curricular travel in small and large sized school districts.

Attendance. When discussing late start times in high schools, the topic of extra-curricular activities led to considerations for *attendance* as it relates to late start times. In this sub theme of late start times, 27% of the superintendents with late start time experience commented on increases in *attendance* with late start times. A medium sized school district superintendent, Dr. Toffee, stated "starting later is a better opportunity to have higher attendance to get your kids there on time." He also commented on the extra time needed to sleep after participating in school activities the night before. Another medium sized school district superintendent commented, "This is only my personal opinion; however, a little more time to get up and get ready would most likely increase attendance for teenagers. Of course, data would need to be examined." A superintendent who has experience in both small and large sized school districts, shared:

> I think that you are going to see an attendance spike if you start school later. Students have such a hard time waking up because they are up all night whether they are studying or chatting on cell phones all night. They just don't have anyone making them go to bed so I think you will see attendance improve with *late* start times.

When clustering the comments from superintendents regarding the relationship between high school start times and *attendance*, a pattern seemed evident with small, medium, and large sized school districts, according to the superintendents' perceptions. Among

superintendents with experience in late start times, a consensus emerged that *attendance* would be positively impacted.

A common thread among 40% of the superintendent perceptions focused on the fact that start times do not have a correlation with *attendance*. Large sized school district Superintendents expressed with a high confidence level that no matter what time you start, early or late, "it doesn't make one bit of difference." Dr. Gingersnap, a superintendent with both small and large sized school district experience, believed "students are going to miss because students want to miss, students are there if they want to be there." A superintendent from a large sized school district conferred start times do not have a relationship with attendance; "either a student is going to come to school or not" and "there is not relationship with late start times and attendance." Another large sized school district superintendent stated," If you push the start time back the kids are just going to stay up longer. They're still going to get the same amount of sleep." Dr. Peanut Butter, a superintendent with small and large sized school district experience, agreed with no relationship between attendance and late start times; yet, she stated," rule followers will follow rules. It depends on how your families respond to following rules." Among these perceptions, superintendents were rather opinionated that late start times had no relationship; yet, they deferred to the role of parenting as a "key factor in attendance."

Transportation. In the large sized school districts, 33% had early start times for high schools with two districts that reverted from late to early start times due to *transportation* needs. When the district expanded to late start times with three routes, the cost of gas increased and drivers' hours decreased which led to the district reverting to an early start time with two tiers of *transportation*. When superintendents proposed late start changes to high schools, they typically do not account for the additional buses required

and increases in part time employees. According to a large sized school district superintendent, a late start for high schools led to three routes which caused drivers to "only get six hours versus a full day which means drivers quit because they can't afford the job" especially since it is one of the lowest paying jobs in the district. Additionally, Dr. Hershey said, "changing start times drastically impacts transportation due to the triple-tiered routes; thus, high school start time changes always required board approval."

In the medium sized school districts, the superintendents reported that 13% were from early high school start times and 20% were from late high school start times. According to a medium sized school district superintendent, "we started our routes at 5:15 a.m. in the morning with never enough drivers and the price of gasoline continues to increase in cost." Another medium sized school superintendent, Dr. Toffee, expressed that "staggered start times with elementary, middle, and high schools provided three tiers rather than one tier with multiple routes and the same start times which has been cost effective for this district." The medium sized superintendents shared that *transportation* often depicts the start times due to the financial demand of buses, gas, and drivers.

Responses from the small sized school district superintendents stated that 60% had early high school start times while 13% had late start times. Dr. S'more, a small sized school district superintendent, shared that superintendents faced roadblocks in high school start times since they "are tied to the demands of the bus barn which dictated high school start times." Another superintendent, of a small sized school district, commented: "In our district, we had staggered start times since we use the same buses to save money. All high schools would start at 7:30 a.m. which blocked most late start time proposals." It seemed whether participants were from small, medium, or large sized districts, *transportation* ruled the district superintendents' decisions regarding start times due to the cost of drivers, gasoline, and buses. A superintendent from a small sized school

district discussed that “working out the logistics of transportation” to change start times is major hurdle for superintendents to avoid additional cost. “Transportation tends to be the leading concern” when addressing high school start times according to Dr. Lemon, a superintendent of a large size school district. The expertise in the superintendent participants varied from first year to multiple years in the field of education as superintendents of small, medium, and large sized districts. In sum, 80% of the superintendents commented that transportation served the biggest role in decision-making of high school start times. It was summed up well by a superintendent of a large sized school district who simply said,” if a superintendent is intelligent at all, they leave it the hell alone.”

Summary of Findings

This chapter presented the results of the quantitative and qualitative data analysis of this study. This study examined the relationship between high school start times, high school size, achievement, attendance, graduation, and superintendent perceptions in public high schools. A Pearson’s product moment *r* correlation was utilized to determine if a relationship existed between high school start times and achievement, attendance, and graduation. Achievement was represented by the campus average on the English I, English II, Algebra, Biology, and U.S. History EOC examinations for each size of high school that participated from Region IV, V, and VI.

In research question one, the researcher examined whether a relationship existed between high school start times, size, and achievement. Extensive evidence was found to justify the acceptance of the null hypothesis when all high schools from Region IV, V, and VI were analyzed with English I, English II, Algebra, Biology, and U.S. History. Findings indicated that there was not a statistically significant relationship between high school start times and achievement in these specific areas. The relationship between

school start times and achievement scores were not evident in the grouping of Region IV, V, and VI except in the area of Biology. Findings indicated that there was a statistically significant relationship between high school start times which averaged at 7:45 a.m. and Biology scores in all small sized high schools in Region IV, V, and VI.

When investigating more in-depth about size of high schools in Region IV, V, and VI, the findings indicated a statistically significant relationship between small sized high schools and start times that impacted English I, English II, Biology, and U.S. History in Region VI High Schools. Small sized high schools with an average start time of 7:51 a.m. were found to show a stronger relationship with achievement scores in English I, English II, Biology, and U.S. History. However in Algebra, small sized high schools from all regions with an average start time of 7:45 a.m. did not show a relationship; however, large sized high schools with an average start time of 7:27 a.m. from Region VI impacted the Algebra scores. The smaller sized high schools along with later start times impacted the relationship between achievement.

When examining the relationship between regions, school size, start times, and achievement, findings indicated that small sized high schools in Region VI impacted the achievement scores in English I, English II, Biology, and U.S. History. Additionally, a statistically significant relationship was found to exist between small sized high schools, achievement, and Region VI. Another category in Region VI that found a statistically significant relationship was analyzed within the large sized high schools in the area of Algebra and Biology. These correlations although a slight significance support the acceptance of the null hypothesis.

This led the researcher to question two, *Is there a relationship between the start times of high schools and attendance rates?,* which examined high school start times and campus attendance averages to determine if a relationship existed. The results of the

Pearson's *r* indicated that there was a statistically significant relationship between attendance and start times in all high schools from Region IV, V, and VI. Results from correlations with small sized high schools from Region IV, V, and VI indicated a statistically significant relationship existed between size of high school, start times, and attendance averages. This would suggest attendance was impacted by school size and start times. When investigating the relationship further, Region IV and V did not have a statistically significant relationship between start times and attendance; while, Region VI in the small sized high schools with an average start time of 7:51 a.m. were found with a statistically significant relationship between size, start time, and attendance averages. Thus, the study found the null hypothesis should be accepted after conducting this research.

When research question three, *Is there a relationship between high school start times and graduation rates,* was examined, high school start times and campus graduation averages were analyzed by Pearson's product moment *r* correlation to determine if a relationship existed. The results suggested that a statistically significant positive relationship existed between high school start times, size of schools, and graduation with all Region IV, V, and VI participants. The results showed that the later the start times, the higher the graduation rates. The proportion of variation in graduation rates attributed to high school start times was 2.1%.

In addition to examining all the high schools, the small sized high schools were found to have a statistically significant positive relationship that existed between high school start times, size, and graduation rates. As the high schools in the small sized category started later, the graduation rates increased. When investigating the relationship further, Region V small high schools, who had an average start time of 7:52 a.m., were found to show a statistically significant relationship between size, start times, and

graduation. This study found that small verses medium or large sized high schools were found to have a statistically significant relationship with graduation averages. The proportion of variation in graduation rates attributed to start times was 35.7% for the small sized high schools in Region V which carried a 7:52 a.m. average start time; whereas, the proportion of variation in graduation rates attributed to start times was lower with 1.9% in all high schools and 8.5% in the small sized category of all high schools in Region IV, V, and VI.

Among the superintendent participants, 40% expressed start time decisions should relate to research; however, "competing forces in education sometimes delay common sense improvements" according to Dr. Thin Mint. They face competing interest groups when considering changing school start times especially in high schools. These competing forces were evident in the findings of the study with robust discussions of research along with the logistics of running a district. A few superintendents were compelled to follow research and shared the results of their success. Other superintendents desired the alignment with research; yet, the financial and political issues were a controlling factor in their decisions. A common thread among the superintendent participants was extensive knowledge and experience in sleep deprivation among teenagers. The semi-structured interviews opened with personal experience to explore sleep deprivation among teenagers with ease. When probing questions shifted to more of a campus perspective, the participants seemed comfortable sharing their expertise. Although the superintendents were often very political in their responses, they conveyed a sense of realism in their roles as superintendents. In their roles, they juggle research-based decisions with logistics to ensure proposals to change have been vetted before implementation.

The responses from participants were conclusive that the decision-making role of superintendents typically involved research and data to support their opinions or decisions when serving as superintendents. Superintendent comments fell into early and late start times when discussing achievement and attendance. A few of the school district superintendents with late start times were confident that the alignment with research resulted in the growth in attendance and achievement. On the contrary, several school district superintendents were adamant that high school start times do not matter when it relates to attendance and achievement. Although all parties acknowledged the sleep deprivation research, a few superintendents voiced that the parental role is essential in teenagers getting the proper amount of sleep at night regardless of the high school start time.

The superintendents, with experience in late start times, have shared late start times matter; however, parenting was mentioned 100% by all participants as the key factor in improving attendance. Among all interviews, 20% of the superintendents, from medium and large sized school districts, stressed the importance of parenting in the home to enforce attendance. The large sized school districts were knowledgeable of research in relation to late start times and attendance; however, 53% wanted to see data to support this relationship. All superintendents were knowledgeable about research regarding late start times; hence, the superintendents with direct experience anticipated an increase in attendance with late start times.

In the next chapter, the findings of this study were compared to prior studies on school start times documented in research literature. Additionally, the implications of this study's results were discussed with consideration of high school start times, whether early or late, and the relationship of high school success in the area of achievement,

attendance, and graduation. Further avenues for research were identified to explore the relationship further in Chapter Five.

CHAPTER V:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

Research over the years has been publicized regarding sleep deprivation among teenagers especially in the school settings (Perkinson-Gloor et al., 2012; Urrila et al., 2016; Valdez et al., 2014). Most researchers have voiced the detrimental impact of early start times on teenagers in school systems (Owens et al. 2014a; Wahlstrom, 2002). Chronic sleep deprivation leads to an internal imbalance between adolescents' circadian system and school schedules (Winsler, Deutsch, Vorona,Payne & Szklo-Coxe, 2015). The American Academy of Pediatrics (2014b) recommends high schools start class at 8:30 a.m. or later; while, the American Medical Association (2016) calls on school districts to start high schools no earlier than 8:30 a.m. in the morning. With 43% of high schools (Wahlstrom, 2016) starting at 7:00 a.m. in the morning, our teenagers are facing a sleep crisis. Although many studies have been conducted to understand the impact of late start times on school settings, few studies have investigated achievement, attendance, and graduation averages in relation to their school start times among 256 high schools. This study acquired high school start times resourcefully through web pages, emails, and phone calls to ascertain the participating high schools in Region IV, V, and VI. Then data from the Texas Student Data System (TSDS) on achievement, attendance, and graduation were analyzed to complete this investigation. Finally, 15 superintendent interviews were conducted to provide realistic perspectives of the issues surrounding changing school start times from the viewpoint of small, medium, and large sized school district superintendents. This chapter provides a detailed discussion of the findings, along with the implications of these results and future recommendations for research.

Summary

Throughout the investigation, the findings analyzed whether high school start times influenced achievement scores in high schools. The participating high schools were categorized into small, medium, and large sized high schools as well as analyzing the all high school category. These results found a positive relationship in English I, English II, Biology, and U.S. History with an average start time of 7:51 a.m. in the small sized high schools. These results were consistent in the findings from Carrell, Maghakian, & West (2011) and Perkinson-Gloor, Lemola, & Grob (2013), who reported late start times showed a positive effect on student achievement. However, in the large sized high schools of Region VI, which had an average start time of 7:27 a.m., the relationship was inconsistent with previous research on start times and achievement. The positive relationship in the large sized high schools with the early start times were contrary to the findings of Edwards (2012), Thatcher & Onyper (2016), and Valdez, Ramirez & Garcia (2014).

Another contrasting viewpoint was found in Region VI where 17% of the participating large sized high schools started school at 7:20 a.m. with the highest achievement scores which doesn't support results from Kelley et al. (2017) and Hansen et al. (2005). While the latest start time of 8:12 a.m. had the lowest Algebra and Biology scores among these large sized high schools in Region VI. Previous related studies tend to analyze on-line surveys, time of day protocol, self-reported surveys, and wristband actigraphy. However, these studies lacked generalizability due to the participants consisting of homogenous populations in private, boarding or military school settings.

The viewpoint of most superintendents that participated in this study did not believe there would be a correlation with achievement. Although, superintendents with late start time involvement expressed that the results would show a relationship based on

their experience. One superintendent of a large sized school district reported evidence of improvement with a late start time; while, another superintendent of a large sized school district was confident the results would not show a correlation. Thus, the intense data analysis of achievement scores and interview transcripts fell on both sides of the issue. The results of the interview analysis mirrored the results of the study which portrayed variances between opinions on the relationship between school start times and achievement. The results of the data analysis and superintendent interviews depicted a wide range of outcomes without full consensus on matters.

The simple statement that late start times impacted attendance has been highly controversial since the release of recommendations from the American Academy of Pediatrics (2014b), American Academy of Sleep Medicine (2018), and American Medical Association (2016) to start high schools at 8:30 a.m. or later. In this study, the analysis of high school start times and attendance found significance in specific areas aligned to previous research. In the semi-structured interviews, a few superintendents anticipated positive results while many were cautious to confirm a relationship between attendance and school start times. Superintendents stressed the importance of parenting as well as the students' responsibility to attend school in a timely manner, which would impact the attendance rates more than school start times.

In this study, a significant relationship was found with attendance and school start times among all high schools in Region IV, V, and VI, as well as a higher significance with small sized schools as compared to medium or large sized high schools. The average start time for all participating small sized high schools was 7:45 a.m. with an attendance average of 94.7%. Specifically, the small sized high schools from Region VI was found with an average start time of 7:51 a.m. and 94.8% attendance average. These results were reflective of a small sized high school, with only four miles surrounding the school, that

experienced a 30% increase in attendance after the implementation of a late start time (Wechsler, 2018). Thus, this study found that the later the start time the higher the attendance average which supported research from Kelley et. al (2017), Edwards (2012), McKeever & Clark (2017), Owens et. al (2010), Wahlstrom (2002), and Wechsler (2018).

Although these findings were consistent with previous research, the all high school category, whether small, medium, or large sized high schools, had an average start time of 7:31 a.m. with 94.4% attendance averages which showed a slightly significant statistic as compared to the all small sized high schools and Region VI small sized high schools. This depicted 55.8% of high schools in Region IV, V, and VI start at 7:25 a.m. or earlier and 44.0% of high schools started at 7:30 a.m. or later in Region IV, V, and VI. Furthermore, in Region VI, the data portrayed 88% of the small sized schools started at 7:30 a.m. or later, while 12% of the small high schools started at 7:30 a.m. or earlier. This data described the typical start times in high schools among Region IV, V, and VI which trended consistently with previous research from Kelley et al. (2017), Owens et al. (2010), and Wechsler (2018).

The generalizability of previous researchers was difficult to compare to this study: an English funded state school, a boarding school, and a small high school without transportation needs. In summary, the findings of this research are consistent with previous findings across studies. Many superintendents immediately addressed research when considering changing start times. The superintendents felt that regardless of the start time, the end results will depend on the motivation of students, as well as parental expectations to maintain appropriate sleep at night and high attendance in school.

When this study analyzed the relationship of graduation averages and high school start times, 80% of the superintendents stated that high school start times would not have

an impact on the graduation averages. While 20% of the superintendents felt that later start times impacted graduation rated due to increased attendance averages. In this study, significance was found in all high schools from Region IV, V, and VI with a graduation average of 92.8%. These findings supported previous researchers' findings (McKeever & Clark, 2017; Sabit et al., 2016; Wechsler, 2018) portraying increases in graduation with later start times. In the small sized high schools, the average for all small high schools was 93.6% for graduation; yet, Region V was found to have a 91.0% graduation average with a 7:52 a.m. average start time. Although previous research indicated later start times of 8:30 a.m. or later, the latest start time average that showed significance for this study was 7:52 a.m. in Region V small sized high schools. In a previous study, it was reported that graduation improved from 70% to 88% with a delayed start time (McKeever and Clark, 2017). The results of this data analysis reflected superintendent comments on the importance of intrinsic motivation among seniors, to reach their educational attainment of graduation, in order to see a relationship between start times and graduation rates. The findings correlated with the superintendents' perceptions of graduation rates which was often shared that seniors will figure out a way to graduate regardless of the start time of the high school.

Implications

As this study has found, even the slightest increase in start times portrayed a relationship with attendance, achievement, and graduation percentages in small sized high schools. Often small sized high schools were found in rural settings which could require additional time for transportation. Superintendents with small sized school districts experienced issues with limited transportation which included single routes and same start times for the entire district. Thus, school district superintendents should check the pulse of the district to see if shifting all start times by fifteen minutes would possess

positive outcomes in achievement, attendance, and graduation especially in small sized high schools. In small sized high schools, the increase in attendance alone would benefit any school district due to attendance being a direct source of funding (Jones et al., 2008). With a crisis in school funding in Texas, attendance rates have been critical to school districts; whereas, small sized high schools should shift to later start times to seize the opportunity of increased funding.

After all, this study referenced an average start time of 7:51 a.m. verses the claims from the American Academy of Pediatrics (2014a) and American Medical Association (2016) that recommended starting an 8:30 a.m. or later. With 256 high schools, the average start time was found at 7:31 a.m., perhaps a slight shift in scheduling would improve achievement and attendance averages. However, the challenge in changing start times must be weighed carefully due to the disruption of the family, community, and transportation routines.

Information from superintendents indicated the risk of changing start times in a district would not be worth the trouble due to the drastic differing opinions superintendents faced when changing traditional routines in a district. However, the superintendents who have addressed this issue by changing to a later start time have been successful when they implemented change through strategic planning with key stakeholders. A recommended pathway would be to follow the components of Michael Fullan's Change Theory when working through the exploration stages of educational reform when considering changing start times in a district (Fullan, 2006; Johnson, 2012).

This study had few data points with significance; thus, superintendents should move cautiously when approached to change high school start times. The high schools that showed significance had a start time average of 7:51 a.m. which is not close to the recommended start time of 8:30 in the morning. The in-depth interviews with

superintendents were indicative of the struggles they face when considering shifting or flipping start times. Policy makers should consider start times as a reportable indicator to aid in further research; however, start times should be a local decision due to the financial aspect tied to changing start times.

Large sized school districts, according to superintendent interviews, were faced with funding issues linked to transportation costs such as buses, fuel, and drivers after switching to later start times. It would be beneficial if larger sized school districts shifted all routes at least fifteen to twenty minutes later to avoid students waiting sometimes as early as 5:30 a.m., along dark streets, for their ride to school. A delayed start of fifteen to twenty minutes would attribute to higher attendance rates; thereby, the districts would receive more funding from the state for the higher attendance rates. Students that gained a 90% attendance rate for the year would count towards additional Average Daily Attendance (ADA) funds which could be between $3,500 to $6,000 per student from the state (TEA, 2019a; CERPS, 2018). The larger sized school districts which typically averaged a 7:17 a.m. start time should consider the impact of shifting start times to 7:45 a.m. or 7:50 a.m. without changing the order of elementary, middle, or high school routes. When large sized school districts have flipped start times with the elementary and high school schedules, they received negative feedback from parents due to lack of after school care for the younger siblings. Thus, a shift of all school start times would eliminate this occurrence. This would require a consortium of superintendents united to take a stance against early start times to propose plans for the after-school activities such as fine arts and athletics as a group. This coordination would be necessary for the logistics of handling daily high school functions among multiple school district competitions. The financial gain of later start times would be a primary advantage to

larger sized school districts not to mention the healthy alignment of the circadian rhythms among teenagers.

Those superintendents experiencing success in changing start times tend to apply research and theorical concepts to adjust the mindset of their district and community. This means alignment of school schedules with the unique health needs of teenagers. The medium and small sized high schools with later start times focused on the teenagers first in relation to the logistics of the district. These superintendents described the battles with parents regardless of an early or late start time; however, the data found that small sized high schools with an average 7:51 a.m. start time experienced success in achievement, attendance, and graduation. These small sized high schools function with fewer funds; hence, students matter in relationship to attendance averages. The funding aspect alone pushes superintendents to figure out what works to improve attendance. Superintendents mentioned conversations with multiple parents stressing out over the struggle to wake their teenagers. These struggles turn into battles in the classrooms as teachers rattle teenagers out of deep slumber to engage in the learning process. Even moving the start time by fifteen to twenty minutes would impact attendance averages according to this study. Superintendents from small sized school districts should adhere to later start times to not only accommodate the sleep and wake cycles of teenagers but increase funding from improved attendance averages among high school students.

Many superintendents from small, medium, and large sized school districts commented that parental controls in the home environment were necessary to implement later start times. This supports research that healthy sleep concepts must be addressed to provide a successful implementation of late start times (Wechsler, 2018). Superintendents discussed teenagers go to bed but not to sleep with endless hours spent in a digital world which supported previous researchers' studies (Boergers, Gable & Owens, 2014;

Dimitriou et al., 2015). Legislatures should propose a health credit as a requirement across the state to address issues such as healthy sleep routines among teenagers. A health class along with parental training on the importance of teenage sleep habits would be essential with late start time proposals. The moodiness teenagers experience with sleep deprivation due to the misalignment of their internal clock verses school start times could drastically affect their daily routines with depression, anxiety, daytime sleepiness, and excessive caffeine use (Boergers et al., 2014; Valdez et al., 2014; Wahlstrom, 2016). Perhaps the combination of health classes, parent training, and implementation of late start times would eliminate the constant stream of students facing emotional turmoil in their lives due to unhealthy sleep patterns. Of course, the ultimate dream of all educators would be to put political and financial demands aside to align the timing of schools with the internal clocks among teenagers.

Recommendations for Future Research

Given the high school start times of small sized high schools influenced achievement and attendance, future research should be conducted to explore other regions to determine if the location or district type matters when analyzing data. With more extensive data, perhaps the outcomes would give a clearer indication of the impact of high school start times on achievement and attendance. Data should be gathered on the average of economically disadvantaged students per campus to factor in transportation, work, and community needs. Another consideration when recommending future research would be acquiring transportation information regarding routes, tiers, and financial costs per campus. A longitudinal research design would be recommended to study public school districts with recent changes in start times. With further research, perhaps a healthy alignment between teenagers' internal clocks and high school start times would be established.

It was evident to the researcher that more research would be needed to encourage massive proposals for late start times among high schools, especially without significant findings in medium and large sized high schools. The decision to start school at a certain time must remain within the boundaries of local policy makers. The dynamics of each district should not face regulation by state or federal lawmakers due to the various types of districts, financial situations, and transportation needs unique to each district.

In future research, the digital influence of technology on the sleep habits of teenagers should be addressed. The educational component of teaching teenagers the importance of shutting down technology to capture the recommended hours of sleep per night would be beneficial. If research were conducted to measure students who digitally detoxed and slept for 8.5 hours; then, analyzed their attendance, achievement, and graduation rates among early or late start times in high schools. The results of this type of study might find an educational alignment of internal clocks in teenagers and high schools which would warrant drastic changes in high school start times.

Future researchers should address the sleep deprivation of teenagers as it relates to the rising epidemic of depression, anxiety, and suicidal tendencies in high schools. The mental health component of teenagers could be compared with total sleep time and how it relates to school start times. This research could address sleep habits, mental health issues, and school start times with educational components to pretreat teenagers to determine if the training impacted their attendance, achievement, and graduation rates among high schools with early or late start times. Future researchers should explore the connection with sleep deprivation, high school start times, and the mental health component of teenagers to decrease the silent epidemic of mental illness in the high school settings.

Another aspect to consider would be interviews from High School Principals and Transportation Directors to receive different perspectives on high school start times. More information should be provided on the logistical, financial, and functional matters that superintendents must consider before the implementation of a new school start time in a district. A parent focus group could be included to understand the real struggles they face when establishing sleep time and morning routines for their teenagers in school. The more extensive the perspectives provided in future research will stimulate discussion among school district leaders considering changing school start times.

Previous research exists within military, private, boarding, and other unique situations. The methodologies utilized in these settings consisted of sleep diary studies, student and parent surveys, time-of-day protocols, administrator surveys, sleep habits survey, light treatments, magnetic resonance imaging, and general observations. For medium and large sized high schools to even consider the importance of aligning the healthy needs of teenagers by altering campus start times, data analysis on all public high schools must be obtained to provide relevant, insightful, and generalizable information.

Conclusion

Research has abounded over the years calling for a healthy alignment of the internal clocks in teenagers and school start times. Parents have been quick to demand late start times based on personal preferences whether they need teenagers to assist with siblings or difficulty in waking their teenagers. School districts have traditionally had early start times especially in high schools among the large sized school districts. Traditional school start times for high schools were established based on logistical and financial needs. When the American Medical Association (2016), American Academy of Pediatrics (2014a), American Academy of Sleep Medicine (2019), and the National Sleep Foundation (2006) stressed the importance of 8:30 a.m. or later start times in high

schools, this was a critical turning point for advocates of late start times. School districts were functioning with a traditional bus route system with high school students on the earliest start time which was often 7:40 a.m. or earlier (Wolfson and Carskadon, 2005). After reviewing literature on high school start times, sleep deprivation was prevalent among teenagers especially in high schools with early start times (Lin and Yi, 2015; Martin et al., 2016; Urrila et al., 2017). From a practical perspective, as a high school principal, the classrooms were full of students' heads on the desk, bodies curled up in hoodies, snoring, and even occasional drooling. The timing issue became evident as the research stated that "62% of high school students do not get a sufficient amount of sleep per night" (National Sleep Foundation, 2006). Clearly, the synchronization of teenage sleep patterns and school start times led to sleep deprivation over time which impacted attendance issues on campus (Barnes et al., 2016). Hence, the practitioner and researcher found that the average start time, for all high schools in Region IV, V, and VI, was 7:31 a.m. which carried a lower attendance rate than the small sized high schools with a start time of 7:45 a.m. on average. Based on the extensive research involved in this study, educational practices do not align with proven medical and psychological research when making healthy decisions for teenagers (Pradhan and Sinha, 2017; Valdez et al., 2014; Wahlstrom, 2002). After conducting 15 interviews of superintendents in small, medium, and large sized school districts, the slow and laborious process of changing start times was evident. Superintendents of small and medium sized districts were successful when they evoked a proposal of change with stakeholders input to gain community support. While other superintendents felt assured that changing school start times would lead to political suicide. The mismatch was unmistakable between school start times and teenagers, as well as superintendent viewpoints. These in-depth interviews of 15 superintendents weighed heavily with the researcher as they expressed their desire to

mirror research within the hallways and classrooms of high schools; however, all superintendents agreed regardless of the start time parents play a critical role in the daily struggle teenagers face with their irregular sleep and wake patterns in high school. Henceforth, researchers, parents, and practitioners should collaborate, communicate, and commit to obtain a healthy alignment between high school start times and teenage sleep patterns to improve achievement, attendance, and graduation.

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APPENDIX A:

LETTER TO SUPERINTENDENTS

November 26, 2018

Dear Dr. _____,

Greetings! I am requesting a short interview regarding secondary schools and late start times. As a high school principal and a University of Houston-Clear Lake doctoral student, this interview will assist in completing my dissertation. The purpose of this interview is to examine the knowledge, experience, and perceptions of high school start times among retired or current superintendents.

As your schedule is hectic and busy, a scheduled time frame at your convenience will be arranged for the interview. The questions are open-ended and should take no more than twenty minutes of your time. Your name and district will remain confidential with an assigned pseudonym for the purposes of this study. No obvious undue risks will be endured, and you may stop your participation at any time.

Your cooperation and willingness to participate in an interview will be greatly appreciated. A contact with your secretary will be made to arrange an appointment for a short interview. If you have any further questions, please feel free to contact me.

Sincerely,

High School Principal

APPENDIX B:

INFORMED CONSENT

Informed Consent to Participate in Research

You are being asked to participate in the research project described below. Your participation in this study is entirely voluntary and you may refuse to participate, or you may decide to stop your participation at any time. Should you refuse to participate in the study or should you withdraw your consent and stop participation in the study, your decision will involve no penalty or loss of benefits to which you may be otherwise entitled. You are being asked to read the information below carefully, and ask questions about anything you don't understand before deciding whether or not to participate.

Title: Timing of High Schools: Achievement, Attendance, and Graduation.

Principal Investigator(s): {Antonio Corrales, EdD
st & Last Name(s), degree - list all principal investigators}
Student Investigator(s): Holly La Roe, M.Ed.
Faculty Sponsor: Michelle Peters, EdD

PURPOSE OF THE STUDY
The purpose of this research is to examine the relationship between high school start times and student achievement, attendance, and graduation rates. Your interview will share a perspective of school start times on high schools.

PROCEDURES
At the beginning of the interview, I will review your rights as a participant in this process. I will ask to tape the conversation to validate the responses for accuracy. The questions will be provided before the interview is conducted. After the interview, I will compile the transcript and enter into a narrative form for your approval. Your name will be given a pseudonym along with the other superintendents to protect your responses to the questions.

EXPECTED DURATION
The total anticipated time commitment will be approximately twenty minutes.

RISKS OF PARTICIPATION
There are no anticipated risks associated with participation in this project. Your participation will assist the researcher in compiling a resourceful guide for superintendents when considering school start times in their own districts.

BENEFITS TO THE SUBJECT
There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand the impact of school start times on school district culture, logistics, and other factors associated with changing school start times.

SIGNATURES:

Your signature below acknowledges your voluntary participation in this research project. Such participation does not release the investigator(s), institution(s), sponsor(s) or granting agency(ies) from their professional and ethical responsibility to you. By signing the form, you are not waiving any of your legal rights.

The purpose of this study, procedures to be followed, and explanation of risks or benefits have been explained to you. You have been allowed to ask questions and your questions have been answered to your satisfaction. You have been told who to contact if you have additional questions. You have read this consent form and voluntarily agree to participate as a subject in this study. You are free to withdraw your consent at any time by contacting the Principal Investigator or Student Researcher/Faculty Sponsor. You will be given a copy of the consent form you have signed.

Subject's printed name: _____

Signature of Subject: _____

Date: _____

Using language that is understandable and appropriate, I have discussed this project and the items listed above with the subject.

Printed name and title _____

Signature of Person Obtaining Consent: _____

Date: _____

THE UNIVERSITY OF HOUSTON-CLEAR LAKE (UHCL) COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS HAS REVIEWED AND APPROVED THIS PROJECT. ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UHCL COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (281-283-3015). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT UHCL ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT. (FEDERALWIDE ASSURANCE # FWA00004068)

APPENDIX C:

INTERVIEW GUIDE

Interview Questions:

1. Please share your personal and professional background which led you to your role as a superintendent.
2. Can you talk to me about the sleep habits of secondary students?
3. What experience do you have with changing school start times?
4. What concerns do you have about changing school start times for secondary students? For instance, regarding athletics, transportation, work schedules, parent issues, community concerns and student activities.
5. Do you think the start times of high school students has a relationship with student attendance? Why or why not? Do you feel it would affect tardiness?
6. Would the start times of high school students or daytime sleepiness have an impact on student discipline in a school setting? Why or why not?
7. Do you think the start times of high schools has an impact on student achievement? What about different subject matters?
8. In your opinion, what are the benefits of starting school later for high schools?
9. Is there anything else you like to share that might be relevant to school start times and sleep deprivation in high school students? Or perhaps something that I didn't ask you that you would like to share with me?

APPENDIX D:

LITERATURE REVIEW

Table D.1

Literature Review A- L

Researchers	Description	Results	Implications
Boergers, Gable, & Owens, 2014	197 students moved from 8:00 to 8:25 with Pre/Post surveys	29-minute gain in Total Sleep Time	Decrease in daytime sleepiness
Carrell, Maghakian, & West, 2011	6,165 USAFA students in 7:00, 7:30, & 7:50 start times	Achievement performance improves	7:50 start times showed higher GPA
Dimitriou, Knight, & Milton, 2015	Sleep habits survey/ diaries compared with GPA	Total Sleep Time & GPA correlation	Digital Media/Caffeine factors
Eliasson et al., 2002	Self- reported surveys	Average sleep time 6.7 hours	Less sleep with higher GPA
Finley, 2012	1996-2006 comparison of students and standardized test	60-minute delay = gain in Math/Reading	60-minute delay = higher attendance
Hansen et al., 2005	Diary/ light treatments/ mood test correlated with exams of 60 AP students	Early time = low test scores	AP students stayed study later= low TST
Kelley, Lockley, Kelley, & Evans, 2017	4- year study A-B-A (A= 8:50) (B= 10:00) design	Late time = +academics Late time = + attendance	English funded State school
Lin & Yi, 2015	2,472 self-reported surveys in Taiwan	6 hrs. or less of sleep = decline in grades	Academics tied to failing classes

Table D.2

Literature Review M- V

Researchers	Description	Results	Implications
Martin et al., 2016	57 students 7:40/1:25 start time wearing actigraphic bracelets	1:25 = longer sleep weekdays and weekends.	No correlation Study only 7 days
McKeever & Clark, 2017	29 schools pre/post start time	delayed time = + graduation +attendance	Participants in sleep medicine study
Owens et al., 2010	sleep survey/diaries with delayed start.	8:30 start time = + TST and attendance	Rhode Island Boarding School
Perkinson-Gloor, Lemola, & Grob, 2012	2,716 Switzerland students on line survey compared to grades	20-minute delay= + TST + grades	TST of less than 8 hrs. = lower grades
Sabit, Wang, & Cesur, 2016	Longitudinal data with sleep duration & academics	8.5 to 9 hrs. = + academic +graduation	family history and descriptors
Thatcher & Onyper, 2016	45-min. delayed start time compared to attendance, mood, health, discipline, and achievement.	45 min delay = + TST with decrease in discipline	94% white with no transportation
Urrila et al., 2016	177 students with MRI self- reporting on GPA	Later bedtimes = - GPAs	Poor GPAs = small GMV
Valdez, Ramirez, & Garcia, 2014	Review analysis time-of-day protocol and forced desynchronization	Early start times = - academics	Poor grades = conflict in sleep/wake cycle

Table D.3

Literature Review W- Z

Researchers	Description	Results	Implications
Wahlstrom, 2002	4yrs. archival data 7 schools on attendance graduation	7:15 to 8:40 = + attendance Grades slight difference	Graduation difficult to measure with intrinsic factors
Wechsler, 2018	7:30 to 8:30 change in Glen Falls High School	Late start = + attendance + graduation	Healthy sleep concepts were promoted
Wolfson & Carskadon, 1998	First bell survey given to administrators from 1986 to 2001= 345 schools	1000 or more students = 15 minutes earlier	Times do not change on high school campuses
Zerbini et al., 2017	Chronotype survey compared with attendance and exams in the Netherlands.	Late chronotypes = + absences	Chronotypes matter in science subjects

Note: TST = Total Sleep Time. USAFA = United States Air Force Academy. GPA= Grade Point Average. Grey Matter Volume = GMV. MRI = Magnetic Resonance Imaging. HS = High School. MS = Middle School.