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AN EXAMINATION OF THE IMPACT CAREER AND TECHNICAL EDUCATION
(CTE) PROGRAMS HAVE ON HIGH SCHOOL GRADUATION RATES

by

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DISSERTATION

Presented to the Faculty of
The University of Houston-Clear Lake

In Partial Fulfillment

Of the Requirements

For the Degree

DOCTOR OF EDUCATION

in Educational Leadership

THE UNIVERSITY OF HOUSTON-CLEAR LAKE

MAY, 2021

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Acknowledgements

I owe a debt of gratitude to many. Craig Bouchard and Kathryn Barton Bouchard are the best parents a guy can ask for. I started this journey armed with the confidence that I can do anything. That, perhaps, is the greatest gift a parent can give a child. My wife, Angelina, is kind, patient and ever supportive. She has sacrificed time and energy to allow me to follow my dreams, and without her encouragement I would not have finished.

A school administrator can get very little done without the strength and support of his team. Thank you to my fellow administrators Paul House, Mandy Scott, Klarye Lewis, Donna Baggs, Cirena Blacksmith, Sven Schultz, Jade Stenger, Mandy Psarovarkas, Kevin McDonald and Angela Piedras. You were always willing to cover for me when my work commitments conflicted with my night-time classes. This would not have been possible without your support.

My Dissertation Chair, Dr. Antonio Corrales, is amazing. Thank you for believing in me and for the motivation. Your greatest gift was your ability to help me identify when I was being lazy and calling me out during my frequent bouts of procrastination. Thank you to Dr. Lastrapes, Dr. Cothorn and Dr. Divoll for serving on my dissertation committee. Each of you have served as a role model and a constant source of expertise, guidance, and support.

Finally, my daughters. Aria and Charlotte, you may have sacrificed the most. Thank you. Your mother gave you your *grace* and your *intelligence*. I hope you look at my journey as an example of *persistence*, which I think is equally important.

ABSTRACT

AN EXAMINATION OF THE IMPACT CAREER AND TECHNICAL EDUCATION (CTE) PROGRAMS HAVE ON HIGH SCHOOL GRADUATION RATES

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University of Houston-Clear Lake, 2021

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The purpose of this study focuses on the effects of enrollment in Career and Technical Education (CTE) courses on high school graduation rates. The study utilized archival data from 16,953 high school students from the Drowsy Willow Independent School District (DWISD), a large suburban school district in southeast Texas. Archived transcript and demographic data were collected of each high school student enrolled in DWISD between 2010-2016. Chi-square Tests of Independence and Logistic Regression were used to evaluate the relationship between the students' enrollment in CTE coursework and their probability for graduating high school. Additionally, 12 CTE educators were interviewed to determine their perceptions of how CTE coursework influence and affect students at-risk of dropping out of school.

The results of this study reveal that a significant relation exists between CTE enrollment and student dropout behavior. These findings offer new insight regarding the

extent to which students should enroll in CTE coursework and as to how CTE educators can engage students at-risk of dropping out.

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CHAPTER I: INTRODUCTION

While the national high school dropout rate has decreased since 1972, it remains a significant issue today (Bloomfield, Foster, Hodes, Konopnicki & Pritz, 2013; Fan & Wolters, 2014; Stark & Noel, 2015). When students drop out of school, there are adverse consequences for the dropouts, their families, and the community. According to Fan and Wolters (2014), high school dropouts are more likely to develop health problems, yet less likely to obtain health insurance. Dropouts become involved with criminal activity and substance abuse at higher rates than high school graduates, are employed in lower-paying jobs, and are more likely to become dependent on welfare or other assistance programs (Fan & Wolters, 2014; Stark & Noel, 2015). Stark and Noel (2015) wrote that because dropouts make less money over time, pay fewer taxes, and rely more on Medicare and Medicaid, each dropout costs the American economy over \$250,000. Bloomfield, et al. (2013) estimate that there are over 1,000,000 dropouts every year, and urge that the dropout rate, or conversely, the graduation rate, should be used as a barometer for society.

Research Problem

Addressing the dropout rate is a complicated matter, for which there is no singular solution. As Dupere et al., (2014) suggest, students are frequently at risk of dropping out of school before they ever enroll. The authors posited that dropping out of high school is not an event, rather the endpoint from a long process of disengagement that, at times, begins before the child enters school (Dupere et al., 2014). While school officials need to be aware of the external conflicts students face at home, or have faced in the past, schools need to provide a variety of instructional programs that address the post-secondary needs of all students. Not all high school graduates go on to graduate from college. Schwartz

(2014) found that while approximately 90% of high school students plan on going to college, only 42% of high school graduates earn a meaningful post-secondary credential by their mid-twenties. Schwartz posited that high school curricula is designed to prepare half of the students for college but questioned if the education system does enough to prepare the other half of students who go directly into the workforce. Many high school dropouts agree. Bloomfield et al., (2013) found that 81% of dropouts surveyed report that schools do not do enough to connect school to the workforce.

There is much research that indicates schools can address the dropout problem by offering comprehensive Career and Technical Education (CTE) programs (Bloomfield et al., 2013; Plank, 2001; Plank, DeLuca, & Estacion, 2008; Reese, 2005; Ruiz-Gallardo, Verde, & Valdés, 2013; Schwartz, 2014; Stone & Alfeld, 2004). These researchers found that schools with CTE programs can reduce their dropout rates and better prepare students for post-secondary success. By implementing CTE programs, school districts can appeal to a wider variety of student interests. Students in these programs are frequently engaged in project-based learning opportunities that allow them to access and present information in a multitude of ways (Fletcher, Lasonen, & Hernandez, 2014; Ruiz-Gallardo et al., 2013). Bloomfield et al. (2013) wrote that CTE coursework is based on technical profiles that allow students to engage in personalized learning. As a result, students are more successful and form better relationships with their teachers. This is particularly important because, as Äärelä, Määttä and Uusiautti (2015) found, students' relationships with their teachers, or the lack thereof, can be a significant factor in whether the students drop out of school. Bloomfield et al. (2013) found that CTE courses blend student interest with academic and technical curricula, which increase students' likelihood of staying in school. Stone and Alfeld (2004) wrote that CTE coursework

allows students to apply the curriculum to real world contexts which increases student engagement and motivation.

While the research described above indicates that CTE programs have a positive effect on dropout rates, there is little research that addresses whether all CTE programs have the same effect. Given that CTE courses differ in their size and curriculum, they frequently are designed to meet the needs of a targeted student population (Ruiz-Gallardo et al., 2013). An engineering career pathway, for instance, will appeal to an entirely different group of students than a cosmetology program or a computer maintenance repair pathway. Because the engineering program will likely attract college-bound high school students who show an aptitude for math and the sciences, the program mission will be to promote college readiness for these students. The cosmetology and computer maintenance programs, however, promote workplace readiness by design. Professionals in these fields obtain industry certifications, either through a community college or through an alternate certification program, rather than through a traditional four-year university.

Bloomfield and colleagues' (2013) study of the Virginia Beach City Public Schools described how the district's comprehensive CTE program enabled over 30,000 students to earn the Virginia Workplace Readiness Credential between 2001 and 2013. The study illustrated how a large school district infused industry credentials in a comprehensive CTE program to better equip its non-college bound students for the workforce. There is, however, little dropout research when it comes to industry credentials and their impact student graduation rates.

Significance of the Study

Understanding how recent at-risk students perceive their high school education, and what factors caused them to drop out of school, could prove beneficial to any school

official. With that understanding, school officials will be better prepared to design a comprehensive CTE program that will appeal to both college-bound and non-college bound students. The available research identifies that there exists a correlation between CTE coursework and reduced dropout rates (Bloomfield et al., 2013; Plank, 2001; Plank, et al., 2008; Reese, 2005; Ruiz-Gallardo et al., 2013; Schwartz, 2014; Stone & Alfeld, 2004). This study contributes to current dropout research by establishing whether all CTE courses have the same effect on students' probability for dropping out.

Research Purpose and Questions

The purpose of this study focused on the effect of enrollment in Career and Technical Education (CTE) courses on high school students who are at risk of dropping out. At-risk students who struggle in the core academic courses experience a loss of self-esteem which causes them to lose motivation and, at times, develop disruptive behaviors (Fan & Wolters, 2014). The goal of this study was to determine if there exists a correlation between CTE coursework and reduced dropout rates. It was also important to evaluate if all CTE programs are equally effective on dropout prevention, and if they are not, to analyze what aspects of a CTE program significantly contribute to dropout prevention. This study addressed the following research questions:

1. What is the relationship, if any, between students' ethnicity and the graduation rates of DWISD students?
2. What is the relationship, if any, between student's ethnicity and CTE course enrollment?
3. What is the relationship, if any, between students' gender and CTE enrollment?
4. What is the relationship, if any, between students' gender and graduation rates?

5. Do students enrolled in a coherent sequence of CTE courses have a greater probability of graduating than students enrolled in fewer than 3 credit hours of CTE coursework?
6. Do students enrolled in courses from each of the 13 CTE Career Clusters have the same probability of graduating from high school?
7. What are the perceptions of CTE educators concerning the impact of Career and Technical Education courses on graduation rates?

Definition of Key Terms

At-Risk Indicator Code- “indicates whether a student is currently identified as at-risk of dropping out of school using state-defined criteria...” (Texas Education Agency, n.d.).

Academic Self-Esteem- a student’s perceived ability to be academically successful in a school setting (Fan & Wolters, 2014).

Career and Technical Education (CTE) - an educational program that offers a sequence of courses providing students rigorous content and technical skills that are aligned with academic standards need to prepare students for post-secondary success in higher education or in current or emerging careers (Carl D. Perkins Career and Technical Education Improvement Act of 2006, 2006).

Completion Rate- “(T)he percentage of students from a class of beginning ninth graders who graduate or continue in high school” (Texas Association of School Boards, nod).

Dropout Event- an event in which a student misses 30 or more consecutive school days, for a reason other than vacation, after initial enrollment in the ninth grade (Plank et al., 2008).

Event Rate- the proportion of students who, within a single year, dropout without completing high school (Lehr et al., 2004).

Public Education Information Management System (PIEMS)- a data management system Texas school districts use to submit data to the Texas Education Agency (TEA) for accountability purposes (Texas Education Agency, 2015).

School Leaver- a student that withdraws from a Texas public high school for a reason other than graduation (Texas Education Agency, 2015).

School Leaver Codes- TEA requires school districts to document and report the reasons students withdraw from school. Each student that withdraws before graduation is issued a school leaver code (Texas Education Agency, 2015).

Status Dropout Rate- measures the proportion of students who have not graduated with a high school diploma, and are not enrolled in school (Lehr et al., 2004).

Conclusion

Teachers and school administrators are working diligently to ensure that students attending public high school are productive and graduate with the requisite skills for post-secondary success. There exists, however, a large number of high school students who drop out, to the detriment of the student, family, and community. Schools need to proactively implement instructional programs that at-risk students perceive as relevant and valuable which, in turn, will help give the students an incentive to stay in school.

CHAPTER II: LITERATURE REVIEW

Defining the Dropout Problem

It is difficult to quantify the significance of high school dropouts in the United States. Much of the dropout literature illustrates how various government agencies and educational institutions differ in the ways in which they define dropouts and how they collect dropout data (Bowers & Sprott, 2012; Hamil-Luker, 2005; Plank et al., 2008; Stone & Alfeld, 2004). Hamil-Luker (2005) defined a dropout as a person between the ages of 16 and 24, who is not currently enrolled in school, and has not obtained a high school diploma. Plank et al. (2008) measured dropouts by what they referred to as dropout events. A dropout event occurs when a student is away from school for at least 30 consecutive school days for any reason other than an extended illness or vacation.

Some research differentiates between high school graduates, those who have dropped out yet have earned a General Education Degree (GED), and those who have dropped out of school but have not earned a GED (Bowers & Sprott, 2012; Caputo, 2005; Hamil-Luker, 2005; Stone et al., 2004). According to Stone et al. (2004), the federal government does not include GED data when calculating graduation and dropout rates. However, the use of GED data broadens the collective understanding of how students who drop out of high school function in society. Bowers and Sprott (2012) argued that earning a GED is not equivalent to earning a high school diploma and should not be considered as such. Caputo (2005) reported that over one million adults (who had originally dropped out of school) earned a GED in 2001. Caputo (2005) performed a longitudinal study that tracked high school graduates, dropouts that had earned their GED's, and dropouts that have not earned their GED's. Caputo (2005) found that there exists a correlation between high school graduation status and mid-life health and

economic well-being. While those who attained a GED are healthier and have a higher earning potential than dropouts, GED earners were disadvantaged compared to high school graduates. Hamil-Luker (2005) also found that earning a GED will increase a dropout's earning potential, but according to Yates (2005), only 42% of dropouts will ever go on to earn a GED.

Societal Impact

When students drop out, they trigger negative consequences for themselves, the communities, and for the economy (Bloomfield et al., 2013; Cappelli, 2015; Caputo, 2005; Jarjoura, 1993; Yates, 2005). Bloomfield et al. (2013) estimate that over a million high school students drop out annually and are ill-equipped to move to the workforce. Cappelli (2015) posited that American employers require applicants to have certain skill sets that high school dropouts simply do not possess. According to Yates (2005), students learn both hard skills (facts, learning processes, academic skills, etc.) and soft skills (deference to authority, punctuality, the ability to follow directions, etc.) in school. When students drop out of school, they miss learning both hard and soft skills, which affect their ability to find and keep jobs. Hamil-Luker (2005) found that dropouts are three times more likely to depend on public assistance as adults.

The dropout rate has psychological and sociological implications as well. Caputo (2005), as previously discussed, illustrated the correlation between dropping out of high school and one's mental health, and Jarjoura (1993) asserted that a correlation exists between dropping out of school and one's probability of exhibiting criminal or delinquent behavior. Jarjoura (1993) also found that those who dropped out of school because of pregnancy or early marriage were more likely to be involved in domestic violence later in life.

Dropout research indicates that there are certain segments of the population that are more at-risk of dropping out of school and will be less likely to overcome the deficits that come with dropping out of school. Bost and Riccomini (2006) studied dropout rates of students receiving special education services in school. They found that students with an emotional or behavioral disability (EBD) have a 51% dropout rate, while 27% of students diagnosed with a learning disability (LD) drop out of school. Yates (2005) found that males (12.6%) have higher dropout rates than females (10.6%), and that female dropouts have a lower earning potential in adulthood. She also found that black students (17%) drop out more frequently than white students (10.2%), but Hispanic and Latino students (22.7%) experience the most pronounced dropout rates. Bowers and Sprott (2012) wrote that the dropout rate in urban areas range from 20% to 50%. Each statistic is daunting, but worse when they are combined. Consider the African American or Latino boys, who have been diagnosed with emotional or behavioral disabilities, and live in urban areas; their probability of dropping out is compounded (Bost & Riccomini, 2006; Bowers & Sprout, 2012; Yates, 2005).

Contributing Factors

While there is consensus among the research community that the dropout rate is a significant problem, there is no single factor that explains the phenomena. Since it is difficult to identify specific factors that effect a student's decision to drop out of school, most researchers focus their attention on solutions and dropout prevention measures. There are, however, researchers that have offered insight to possible factors that contribute to the dropout rate.

Dupere et al. (2014) wrote that students who drop out experience a prolonged process of disengagement before they drop out. They found that this process of

disengagement usually begins before the student ever attends school. Dropping out of school is simply the endpoint in a lengthy line, or trajectory, of negative experiences.

Jarjoura (1993) used strain theory to explain why students drop out of schools. He defined strain theory as a theoretical framework that addresses the problems students face when forced to adjust to the school setting. Jarjoura (1993) argued that those students who developed strong social bonds within the school setting successfully acclimated to school, while those who could not develop positive social bonds were more likely to drop out.

Fan and Wolters (2014) studied how students' motivation influenced their likelihood of dropping out. They found that there exists a correlation between student ability beliefs and behaviors leading to dropping out of school. Fan and Wolters (2014) found that when students did not believe that they had strong academic foundations in mathematics and English courses, they were more likely to drop out. In other words, there is a correlation between poor academic self-esteem and dropout behavior.

Bowers and Spratt (2012) used Growth Mixture Modeling (GMM) to classify dropouts into four categories they referred to as *dropout typologies*. The typologies included (a) students who were consistently disruptive; (b) students who chronically struggled in their classes; (c) students who have grown bored of the education process; and (d) quiet dropouts. Quiet dropouts, according to Bowers and Spratt (2012) are students who have recently experienced a change in their circumstance (i.e. pregnancy, abuse, drug use etc.), and quickly drop out of school. The authors found that low teacher-assigned grades are a strong predictor for dropouts, and by utilizing non-cumulative grade point average (GPA) data school administrators can identify potential dropouts.

Some research illustrates how federal law impacts dropout rates (Bost & Riccomini, 2006; Caputo, 2005). The Individuals with Disabilities Education

Improvement Act (IDEA, 2004) and No Child Left Behind (NCLB, 2001) increased school accountability, which in turn increased dropout rates (Bost & Riccomini, 2006; Caputo, 2005). Caputo (2005) wrote that the passage of these laws cause pressure for school administrators to jettison marginal or underperforming students so the school can meet *adequate yearly progress* (AYP) as defined by NCLB.

McCallumore and Sparapani (2010) asserted that the transition between junior high school and high school is a strong contributing factor for dropouts. They found that more students fail one or more classes in their ninth-grade year than at any other time in their education because they are unaccustomed to the rigor of high school work, maintaining a cumulative GPA, and the pressure of earning credits for graduation.

Solving the Dropout Problem

Just as there are multiple factors that contribute to dropout rates, there are multiple strategies school officials, social workers and community leaders can employ to decrease dropout rates. Dropout literature describes how instructional strategies, systemic educational programs, and community partnerships can enhance student engagement and decrease dropout rates (Bost & Riccomini, 2006; Fan & Wolters, 2014; Reese, 2005).

A review of the dropout literature indicates that schools often try to implement instructional strategies to prevent student disengagement, thus decreasing dropout rates (Bost & Riccomini, 2006; Fan & Wolters, 2014; Reese, 2005). Bost and Riccomini (2006) posed 10 principles of effective instruction. The principles included (a) active engagement; (b) students must experience success; (c) opportunities to learn; (d) grouping; (e) scaffolding; (f) form of knowledge; (g) organizing knowledge; (h) thinking strategically; (i) explicit learning; and (j) sameness. The authors believed that a high school curriculum that incorporated each of the ten principles would increase student

engagement and reduce the dropout rate. Reese (2005) found that if schools have a system that allowed teachers and administrators to perform early interventions, institute basic instructional strategies, and take advantage of community partnerships, they could prevent school dropouts.

Changing a school's infrastructure can address student failure and reduce its dropout rate as well. McCallumore and Sparapani (2010) wrote that a high school can address the dropout rate by focusing on the freshman class. They argue that because most high school dropouts begin experiencing problems in their ninth-grade year, school administrators should pay deliberate attention to how they assign teachers to ninth grade classes, and how they designate room assignments. They found that schools that created ninth grade academies experience lower failure rates among ninth graders, which in turn decreases dropout rates.

A History of Federal Legislation to Address Graduation Rates

As previously mentioned, current high school dropout rates contribute to a myriad of societal problems, but this is hardly a new phenomenon and the United States Congress has been enacting federal legislation to address national dropout rates since the turn of the twentieth century (American Vocational Association, 1998; Dortch, 2012; Granovski, 2016; Granovski, 2018; 1998; Murnane, 2013; Threton, 2007). Murnane (2013) found that the United States witnessed extraordinary growth regarding its high school graduation rates for the first 70 years of the twentieth century. The national graduation rate grew from just 6% in 1900 to roughly 80% in 1970 (Murnane, 2013).

Prior to the twentieth century Congress legislated the Morrill Act of 1862 and the Second Morrill Act of 1890. These pieces of legislation were some the country's first attempts at workforce development (Granovski, 2016). The Morrell Acts were significant because they provided federal land and funds to establish land-grant colleges

that would teach agricultural and mechanical arts to lower and middle-class students (Granovskiy, 2016).

Much of the education legislation passed in the first half of the twentieth century was designed to promote and enhance vocational education for younger students in the public schools. Those who advocated for vocational education reform, in 1905, were concerned with the fact that only eight percent of the nation's youth were graduating from high school. They argued that something had to be done to ensure that the United States could successfully compete in the world's agricultural and industrial markets (American Vocational Association, 1998).

In 1914, Congress authorized President Woodrow Wilson to appoint a commission to study the need for national aid for vocational education. President Wilson appointed Senator Hoke Smith, of Georgia, to serve as Chairman to the study. The commission's final report found that there existed an urgent social and educational need for vocational education in the United States, and that the problem was so pervasive that it could not be solved at the state or local level. The commission recommended to give out federal grants to promote vocational education (American Vocational Association, 1998).

Once the commission proved that there was a need for legislation, the Congressmen serving on the commission wrote and introduced bills that would address the country's growing need for vocational education. On December 7th, 1915, Senator Smith introduced Senate Bill 703,

To provide for the promotion of vocational education; to provide for the cooperation with the States in the promotion of such education in agriculture and the trades and industries; to provide for cooperation with the States in preparation of teachers

of vocational subjects; and to appropriate money and regulate its expenditures (as cited in American Vocational Association, 1998, p. 5).

On February 10th, 1916, Rep. Dudley M. Hughes, who also served as a member of the commission, introduced a similar bill in the House of Representatives. The House Bill highlighted the fact that the existing education system in 1916 did little to prepare non-college bound students for “common occupations in which the great mass of our people find useful employment” (American Vocational Association, 1998, p. 5). President Wilson signed the Smith-Hughes Vocational Education Act into law on February 23, 1917 (American Vocational Association, 1998).

The Smith-Hughes Vocational Education Act was significant because it established an infrastructure for a national vocational education system. First, the Act provided funding. The Act originally called for \$1.7 million in appropriations in the 1917-18 school year. Those appropriations were to grow incrementally to \$7.2 million in 1925-26. The Act also established a federal Board for Vocational Education, that would include the Secretaries of Commerce, Agriculture and Labor, the Commissioner of Education, and three appointed citizens. Finally, the Act required the States to create state boards for vocational education to prepare a plan for federal board approval. Furthermore, the Act required that states or local communities match the dollar value appropriated by the federal government each year (American Vocational Association, 1998).

This investment in vocational education proved beneficial during and after the First and Second World Wars (WWI and WWII respectively). By the end of 1929, over 900,000 Americans were utilizing what they had learned in their vocational education classes to help rebuild the post-WWI economy. By the end of WWII, the American vocational education system had become an integral part of the National Defense

Training System, which had trained roughly 7,500,000 people for defense and war production employment (American Vocational Association, 1998).

While the Smith-Hughes Vocational Act was perhaps the most significant piece of vocational education legislation in the first half of the twentieth century, vocational educators in the 1950's and 1960's started to suggest that there was a need to expand vocational education in the United States (American Vocational Association, 1998). Doing so would require Congress to either update or replace the Smith-Hughes Vocational Act. In 1963 Rep. Carl D. Perkins introduced a bill through the House of Representatives that would replace expiring legislation. President Lyndon B. Johnson signed this bill into law as the Vocational Education Act of 1963. The Act authorized the federal government to allocate \$800 million for the 1970 fiscal year (American Vocational Association, 1998).

According to the Granovskiy (2016), the Vocational Education Act of 1963 and the Vocational Education Amendments of 1968 expanded the federal government's influence over vocational education. These acts specified how federal funds could be allocated, increased support for the construction and maintenance of vocational education schools and provided funding for research and development in vocational education. The Vocational Education Amendments of 1963 were significant because they increased federal funding for vocational education by five-fold (Granovskiy, 2016)

According to Threeton (2007) the funds stipulated through the Vocational Education Act of 1963 and the amended Act in 1968 could be used for;

...(1) high school and post-secondary students, (2) students that had completed or left high school (3) individuals in the labor market in need of retaining, (4) individuals with academic, socioeconomic, or other obstacles, (5) individuals that were considered mentally retarded, deaf, or otherwise disabled, (6) construction

of area vocational schools, (7) vocational guidance, and (8) training and ancillary services such as program evaluations and teacher education” (Threeton, 2007, p. 67-68).

The Vocational Education Amendments of 1963 were significant in that they specifically targeted underrepresented populations who had been excluded from previous legislation, including disabled and socio-economically disadvantaged Americans. This became an emergent theme in the vocational education legislation for years to come.

The Carl D. Perkins Act of 1984 (Perkins I) provided resources and structure to address vocational education for students with disabilities, those who were economically disadvantaged, adult students including single parents and homemakers and students continuing their education in correctional facilities. Perkins I required that each state spend at least 57% of its funds on programs and services that target vocational education for special populations (Granovskiy, 2016).

The legislators behind the Carl D. Perkins Vocational and Applied Technical Education Act Amendments of 1990 (Perkins II) sought to improve the program by making the following revisions. First, the legislative body found that the allocations for special populations under Perkins I were excessive. So, Perkins II was designed to reallocate how state funds should be distributed. The Act required states to allocate at least 75% of their funds to local recipients. Consequently, lesser funds were to be allocated to special populations. Second, Perkins II created the Tech Prep program which was designed to bridge, and vertically align secondary and post-secondary vocational education programs. Perkins II required vocational educators to organize vocational curriculum into a coherent sequence of courses, and to create and implement measurable performance standards (Granovskiy, 2016).

While the Carl D. Perkins Vocational and Technical Education Act of 1998 (Perkins III) increased the amount of money that could be allocated to local recipients (from 75% to 85%), the main purpose of the act was to ensure increased accountability. Perkins III required states to introduce core indicators for performance. The Act allowed each state to negotiate the terms of the performance indicators with the Secretary of Education, and defined sanctions that would be doled out to those states that failed to achieve their performance measures. The Act also defined incentives that would be given to those states that exceeded expectations (Granovskiy, 2016).

President George W. Bush signed The Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) into law on August 12, 2006 (Granovskiy, 2016). This iteration of the law sought to redefine what had been known as “vocational education” by introducing the term “career and technical education (CTE).” Perkins IV defined CTE as organized activities that...

- offer a sequence of courses that provide individuals with coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in current or emerging professions; provide technical skill proficiency, an industry-recognized credential, a certificate, or an associate degree; and may include prerequisite courses (other than a remedial course)... *and*
- include competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of an industry, including entrepreneurship, of an individual (Dortch, 2012).

In addition to defining career and technical education (CTE), Perkins IV introduced the following changes: (a) the act implemented core indicators of performance for the Basic State Grants (BSG) program; (b) the indicators required grantees to meet at least 90% of their adjusted performance for each core indicator; (c) state improvement plans would need to be written if the 90% target was not met for at least one indicator; (d) CTE provisions would be linked to the academic standards set forth under the Elementary and Secondary Education Act (ESEA); (e) each state was required to develop and define CTE *programs of study* (Granovskiy, 2016). Dortch (2012) defined *programs of study* as programs that, "... incorporate secondary and post-secondary education elements into a coordinated, nonduplicated progression of courses leading to an industry-recognized credential, certificate or degree" (Dortch, 2012).

In 2018 Congress reauthorized the Perkins Act by passing the Strengthening Career and Technical Education for the 21st Century Act (Perkins V). Perkins V was signed into law by President Donald Trump on July 18, 2018 (Granovskiy, 2018). Congress strengthened Perkins V by amending how federal funds were to be allocated to state recipients, requiring that local CTE providers align their programs with local labor markets and modifying the accountability framework applied to state and local CTE recipients (Granovskiy, 2018).

Using Career and Technical Education to Prevent Students from Dropping Out

It is vitally important for high school educators to prepare their students for future success. Not only must they provide strong college preparatory courses and programs to prepare students for post-secondary institutions of education, but they must also develop programs intended to prepare non-collegebound students for the workforce. Not all high school students are on a path to obtain a college degree, and if school administrators just focus on college preparatory curriculum, they neglect a large segment of their student

population. Schwartz (2014) asserted that schools adequately prepare college bound students, but they do not prepare the other half. Schwartz (2014) found that when surveyed, 90% of students reported that they planned to attend college, but only 70% of students actively enroll in institutions of high education. While 70% enroll, only 32% graduate from a four-year university, and an additional 10% earn an associate degree or some other industry credential from a two-year junior college. Therefore, since only 42% of high school students earn a meaningful postsecondary credential, Schwartz (2014) concluded that the American education system is failing 58% of its students. Schwartz (2014) posited that this is a contributing factor to the dropout rate and that schools must do a better job of preparing non-college bound students.

There are studies that analyze how school districts have enhanced student engagement, decreased dropout rates and better prepare non-college bound students for the workforce by implementing Career and Technical Education (CTE) programs (Bloomfield et al., 2013; Fletcher, Lasonen, & Hernandez, 2014; Plank et al., 2008; Reese, 2005; Ruiz-Gallardo et al., 2013; Stone & Alfeld, 2004). Bloomfield et al. (2013) described how CTE courses (which include courses in engineering, agriculture, computers, culinary arts etc.) allow students to pursue their interests while they gain the technical skills they will need in the workplace.

Plank et al. (2008) wrote that CTE courses have evolved from vocational education, where troubled or underperforming students were placed when school officials deemed that they were not college material. Plank et al. (2008) found that students who spend too much or too little time in CTE courses are prone to dropping out. Rather, schools that allow their students to take a 5:4 ratio of academic to CTE courses, will see the optimal benefits of a CTE curriculum for potential student dropouts. Reese (2005)

and Stone et al. (2004) also wrote that a ratio of CTE to academic courses should be employed to address student needs and effectively prevent students from dropping out.

Implementing a strong and well-designed CTE program can elicit positive results, and there have been several studies conducted that illustrate success. Bloomfield et al. (2013) conducted a study of the Virginia Beach City Public Schools, a school district serving approximately 69,000 students annually. Concerned with student disengagement and high dropout rates, the district implemented a CTE program that allowed students to earn the Virginia Workplace Readiness Credential in 2001. Since 2001, over 31,284 students have earned a credential and the Virginia Beach City Public School District has seen dramatic decreases in its dropout rates (Bloomfield et al., 2013).

Ruiz-Gallardo et al. (2013) documented how a public school in suburban Spain implemented a Garden-Based Learning program to reengage at-risk students who had previously failed their classes and have exhibited what the authors described as disruptive behavior disorder episodes (DBD). They conducted a longitudinal study that tracked a sample of 63 students over five years. They found that the students who went through the Garden-Based Learning program were less likely to dropout, experienced fewer DBD's, had higher GPA's and had better attitudes about attending school (Ruiz-Gallardo et al., 2013).

Barrick, Heinert, Myers, Thorton and Stofer (2018) posited that existing CTE curriculum could be used to supplement and support instruction in other science, technology, engineering, and math (STEM) related fields. The researchers' study utilized a panel of 117 experts to identify 162 core ideas that that were commonly found in both STEM curriculum and Agriculture, Food and Natural Resources (AFNR) career pathways. They asserted that drawing cross-curricular connections between the STEM and AFNR related fields will not only increase student learning and engagement. It will

help supply an educated workforce for agricultural careers that increasingly require scientific knowledge. (Barrick, Heinert, Meyers, Thoron, & Stofer, 2018).

Clark and Mortorell (2014) used the concept of *market signaling* to assess the value of a high school diploma. The authors theorized that while a high school diploma is merely a sheet of paper and has no direct effect on productivity, the act of obtaining the diploma has value for the employee. Having obtained the diploma represents an educational outcome that can be seen as a signal or as evidence of ability. The authors sought to determine a high school diploma's signaling value by using administrative data that linked high school records, post-secondary records and on earnings from two states, Florida and Texas. Clark and Mortorell found that high school diploma signal values were less significant than what was reported in previous research. They found that a high school diploma has little effect on earnings. They estimated that workers who possess a high school diploma had an earning potential less than 5-6% higher than the workers who have not earned a high school diploma (Clark & Mortorell, 2014).

Fletcher Jr., Warren and Hernández-Gantes (2018) conducted a case study on the National Academy Foundation Information Technology Academy. The researchers sought to determine characteristics of a highly functional Career and Technical Education (CTE) Academy. Utilizing the data from 77 semi-structured interviews, the researchers identified three central themes: a shared and universally understood direction, the ability to promote college and career readiness and the capacity to facilitate high impact, work-based learning opportunities (Fletcher Jr et al., 2018).

Gottfried and Plasman (2017) acknowledged that there are numerous studies that focus on the “efficacy of career and technical education (CTE) courses on high school outcomes” (Gottfried & Plasman, 2017). The researchers’ study sought to provide find a link between the timing of CTE course enrollment and student outcomes. They found

that CTE course taking in high school was linked to lower dropout rates and increased chances of on-time graduation when the courses were taken later in high school. Those students who took more CTE courses in the 11th and 12th grades were linked to lower odds of dropping out of high school (Gottfried & Plasman, 2017).

Mobley, Sharp, Hammond, Withington and Stipanovic (2017) conducted a study to determine whether career and technical education (CTE) and non-CTE students differed in how they prepared for post-secondary success. The researchers investigated how CTE students and non-CTE students interacted with their guidance counselors, the levels to which they participated in career planning, and their perceptions about the relevance of career planning. The researchers found statistically significant differences in student responses. CTE students reported higher levels of engagement in career planning and career related activities than their non-CTE counterparts (Mobley et al., 2017).

Toppin (2018) sought to analyze the workforce shortage in the skilled and building trades in the United States. The researcher's study was designed quantify the extent to which a workforce shortage existed, determine what factors contributed to the shortage, and what strategies could be employed to address the shortage. Toppin (2018) found that contributing factors included declines in the number of high school technical education programs, misconceptions that high education equates to higher pay, students do not fully appreciate the ramifications of taking on student loan debt, and that a recent national trend towards stricter immigration laws has prevented potential workers from entering the United States workforce (Toppin, 2018).

Theoretical Framework

There are many factors that influence students' decisions to drop out. Dupere et al. (2014) wrote that a dropout event is usually seen as an endpoint, resulting from many precipitating factors and a long period of disengagement. The authors described how

social, developmental, intellectual, and socio-economic deficits can contribute to whether a student is likely to drop out. This study will utilize Strain Theory (Jarjoura, 1993) as a theoretical framework. Jarjoura (1993) wrote that when students believe that they are unlikely to succeed in school, they become frustrated and exhibit delinquent behaviors, which increases the probability that they will drop out of school. Strain Theory suggests that when students struggle in school, they become frustrated, which, in turn, cause some students to adapt delinquent behaviors. The students reason that if they are unsuccessful in high school, they will be unable to attend a university, which eventually will prevent them from getting a well-paying job. A barrier to academic advancement leads to frustration and apathy or delinquency, and if this cyclical pattern is left unchecked, delinquency can lead to a student dropping out from school. This study will determine if school administrators can effectively use a comprehensive CTE program to break the cyclical pattern described by Strain Theory. If school administrators can identify students at-risk of dropping out of school, perhaps they can change the students' perceptions about academic success and increase their probability of obtaining a high school diploma.

Summary

The American dropout rate is a serious problem that must be addressed by the country's educational system. Those students that dropout from school are more likely to suffer poor mental health, have a lower earning potential as adults. They are more likely to engage in delinquent or criminal behaviors as adults and are more likely to depend on public assistance. Fortunately, by implementing instructional strategies that boost student engagement, and by offering Career and Technical Education (CTE) programs, schools can better prepare college bound and non-college bound students for postsecondary success. The following chapter discusses the study's methodology, a description of the

Drowsy Willow Independent School District (DWISD) student population, the study's proposed sample, and the study's operational definitions.

CHAPTER III: METHODOLOGY

This study focused on the effect enrollment in Career and Technical Education (CTE) courses has on high school students who are at-risk of dropping out. At-risk students that struggle in the core academic courses experience a loss of self-esteem which causes them to lose motivation and, at times, develop disruptive behaviors (Fan & Wolters, 2014). This mixed methods study analyzed the extent to which enrollment in CTE courses has on students from a large suburban school district in the south-central region of the United States. In this chapter, the researcher defined population and sample sizes, identified operational definitions, and discussed research design, data collection and analysis procedures.

Overview of the Research Problem

While the national high school dropout rate has decreased since 1972, it remains a significant issue today (Bloomfield et al, 2013; Fan & Wolters, 2014; Stark & Noel, 2015). When students drop out of school, there are adverse consequences for the dropouts, their families, and the community. According to Fan and Wolters (2014), high school dropouts are more likely to develop health problems, yet less likely to obtain health insurance. Dropouts become involved with criminal activity and substance abuse at higher rates than high school graduates, are employed in lower-paying jobs, and are more likely to become dependent on welfare or other assistance programs (Fan & Wolters, 2014; Stark & Noel, 2015). Stark and Noel (2015) wrote that because dropouts make less money over time, pay fewer taxes, and rely more on Medicare and Medicaid, each dropout costs the American economy over \$250,000. Bloomfield, et al. (2013) estimate that there are over 1,000,000 dropouts every year, and urge that the dropout rate, or conversely, the graduation rate, should be used as a barometer for society.

Operationalization of Theoretical Constructs

This study consisted of the following constructs: (a) CTE enrollment and (b) graduate status. CTE enrollment and graduation status were determined using archived transcript data for each of the students enrolled in the DWISD high schools between 2010 and 2016. After an analysis of the transcript data, the students were categorized based on their enrollment in CTE coursework. Students who did not enroll in CTE coursework, or those who participated but did not earn credit for any CTE courses were categorized as *CTE Non-participants*. Students who enrolled in CTE courses and earned between .5 and 2.5 CTE course credits on their transcripts were categorized as *CTE-Participants*. Graduation status was determined by analyzing each student's transcript leaver code. Any time a student leaves a school, whether it is because of graduation, transferring to a new campus or dropping out, they are issued a school leaver code. In Texas, these codes are defined by the Texas Education Agency, and are universally applied in all Texas public schools (Texas Education Agency, 2015). As the purpose of this study is to evaluate the relationship between CTE enrollment and graduation status, the researcher limited the sample to those students with leaver codes indicating that they either graduated from a DWISD high school or that they dropped out of school. Students with leaver codes indicating that they transferred to a school in another district, or educational agency were not included in this study. Similarly, the data from those students who withdrew from school to participate in a homeschool program were excluded from the study.

Research Purpose and Questions

The purpose of this study was to determine if there exists a significant relationship between CTE coursework and reduced dropout rates. It was also important to evaluate if all CTE programs are equally effective regarding dropout prevention, and if

they are not, to analyze what aspects of a CTE program significantly contribute to dropout prevention. This study addressed the following research questions:

1. What is the relationship, if any, between students' ethnicity and the graduation rates of DWISD students?
2. What is the relationship, if any, between student's ethnicity and CTE Course Enrollment?
3. What is the relationship, if any, between students' gender and CTE Enrollment?
4. What is the relationship, if any, between students' gender and graduation rates?
5. Do students enrolled in a coherent sequence of CTE courses have a greater probability of graduating than students enrolled in fewer than 3 credit hours of CTE coursework?
6. Do students enrolled in courses from each of the 13 CTE Career Clusters have the same probability of graduating from high school?
7. What are the perceptions of CTE educators concerning the impact of Career and Technical Education courses on graduation rates?

Research Design

This mixed methods study was designed to utilize both quantitative archival data and qualitative interview data to determine if access to CTE programs influences dropout behavior. Archival data was used in the quantitative portion of the study. School transcripts and demographic data were analyzed from students who dropped out of Drowsy Willow Independent School District (DWISD) from 2010-2016. The analysis of each student's transcript and demographic data included the number of CTE courses taken, gender, ethnicity, at-risk indicators, socioeconomic status, and whether the student

dropped out of school. The qualitative portion of the study consisted of twelve interviews. Eight of the twelve interviews were conducted with teachers who taught CTE courses in DWISD between 2010 and 2016. The remaining four interviews were conducted with DWISD administrators who worked.

Population and Sample

According to the Texas Education Agency (2015), DWISD served over 41,000 students during the 2014-2015 schoolyear. The ethnically diverse student population was comprised as follows: 49.3% white, 28.7% Hispanic/Latino, 9.8% Asian, 8.1% Black or African American, .2% Native American, and .1% Native Hawaiian/ Pacific Islander. The school district is comprised of five comprehensive high schools, two alternative high schools. The district maintains a 98.5% completion rate and graduates roughly 3,000 students annually. The graduates range from 16 to 19 years of age. The sample included 16,953 students enrolled in one or more of the seven DWISD high schools between the 2010 and 2015 schoolyears.

Table 3.1

DWISD Student Population by Ethnicity and Gender

	N	Percent
Ethnicity		
Native American	69	0.4%
Asian	1737	10.2%
African American	1508	8.9%
White/Non-	9305	54.9%
Hispanic		
Multiracial	462	2.7%
Hispanic/Latino	3872	22.8%
Total	16953	100.0%
Gender		
Male	8651	51.0%
Female	8302	49.0%
Total	16953	100.0%

Participant Selection

A purposeful sample of DWISD educators was solicited to participate in semi-structured interviews. Of the 12 DWISD educators who participated, eight were employed as CTE teachers between 2010 and 2016, three served as campus administrators, and one served as a district administrator. All the teachers interviewed were veteran teachers, with at least 5 years of teaching experience within their CTE programs. Collectively they have taught coursework in six of DWISD's thirteen CTE Career Clusters. Of the four administrators, two served as campus Assistant Principals,

one as a Campus Head Principal, and one as the district's Career and Technical Education (CTE) Curriculum Coordinator.

Table 3.2

Interview Participants by Ethnicity and Gender and Job Description

	N	Percent
Ethnicity		
White/Non-Hispanic	9	75.0%
Hispanic/Latino	3	25.0%
Total	12	100.0%
Gender		
Male	9	75.0%
Female	3	25.0%
Total	12	100.0%
Job Description		
CTE Teacher	8	66.7%
Campus Administrator	3	25.0%
District Administrator	1	8.4%
Total	12	100.0%

Data Collection Procedures

This longitudinal study examined five years of archival data. After gaining approval from the Committee for Protection of Human Services (CPHS), for the University of Houston Clear Lake and Drowsy Willow Independent School District, the researcher utilized archival data from all the students that attended high school in DWISD at some point from 2010-2015. School transcripts and demographic data were

analyzed for all students from each cohort class, from the five-year period, spanning from 2010-2015. The archival data analysis of each student's transcript and demographic data included the number of CTE courses taken, gender, ethnicity, at-risk indicators, socioeconomic status, and whether the student dropped out of school. The archival data represented all students who had graduated, as well as all the students who attended, but dropped out of a DWISD high school between 2010 and 2016.

The study will use purposeful sampling to select 12 DWISD educators who have had extensive experience work with DWISD at-risk students who eventually dropped out of school. The participants will be asked to recount their experiences working with students who dropped out of school and report their perceptions of the dropout events. The researcher will conduct a 40-45-minute interview with each of the participants. The interview questions will be open ended to ensure that the participants have an opportunity to express what is most important to them. The interview questions will be designed to ask the participants about what causes dropout behavior in teens, what prevented the teens from being successful in the high school setting, and what, if anything, could have made the teens' high school experience better.

Data Analysis

This mixed-method study used Chi-square Tests of Independence and Logistic Regression to analyze the quantitative data. Logistic Regression is a statistical method used to analyze a dataset when one or more independent variables to determine an outcome by using a dichotomous or binary dependent variable (Logistic regression, n.d). The Chi-square Tests of Independence utilized to determine if students' participation in CTE courses directly or indirectly affect whether they graduate from high school (Chi-Square Test of Independence - Statistic Solutions, 2013).

To answer research question one, a Chi-square Test of Independence was done to determine the relationship between ethnicity (dependent variable) and graduation rates (independent variable). Each student who attended DWISD from 2010 to 2016 was issued a transcript *leaver code* indicating why the student ultimately left high school. Students left the district for a host of reasons: graduation, dropping out, homeschool, transferring to a school in another district, etc. For the purposes of this study, the researcher only included those students whose leaver codes indicated that they graduated from school or they dropped out. The Chi-square Test of Independence used the leaver codes to determine graduation frequencies by ethnicity.

To answer research question two, a Chi-square Test of Independence was done to determine the relationship between ethnicity (dependent variable) and enrollment in CTE courses (independent variable). To achieve this, transcript data were analyzed to categorize students as *CTE Non-Participants*, *CTE- Participants*, or *CTE Concentrators*. Students who were not ever enrolled in a CTE course were labeled as *CTE Non-Participants*. Those students who were enrolled in at least one CTE course but earned fewer than three CTE credits were labeled *CTE Participants*, and those who enrolled in at least two CTE courses and earned three or more CTE credits were identified as *CTE Concentrators*. The Chi-square Test of Independence was used to quantify the students' enrollment in CTE course work by ethnicity.

To answer research question three, a Chi-square Test of Independence was done to determine the relationship between gender (dependent variable) and CTE enrollment (independent variable). To determine gender, transcript data were used to issue each student a dichotomous code of male or female. The same data set that categorized students as *CTE Non-Participants*, *CTE- Participants*, or *CTE Concentrators* were used

to determine the extent to which students participated in CTE course work. This time, the Chi-square Test of Independence was run to quantify CTE enrollment by gender.

To answer question four, a Chi-square Test of Independence was done to determine the relationship between gender and graduation rates. The Chi-square Test for Independence was run using the dichotomous gender coding previously mentioned as the dependent variable and the *leaver codes* as the independent variable to determine dropout frequencies by gender.

To answer research question five, a binary logistic regression was used to determine if there existed a relationship between the extent students enrolled in CTE coursework (independent variable) and graduation rates (dependent variable). The graduation *leaver codes* were, once again, used to determine graduation frequencies, while the categorical data (*CTE Non-Participants*, *CTE Participants*, and *CTE Concentrators*) were used to determine the extent to which each student participated in CTE coursework.

To answer research question six, Direct Logistic Regression was done to determine if enrollment all CTE courses had the same relationship with graduation rates. To achieve this the researcher analyzed the DWISD course selection handbook and categorized the CTE courses into 13 CTE Career Clusters (Appendix A). The CTE courses within the course selection handbook had been assigned unique and individual course numbers. The courses numbers were included as part of the transcript data obtained from the district and were used to categorize each CTE course into 13 CTE Clusters. Once that data had been converted, direct logistic regression was done to determine if students enrolled in each of the 13 CTE Clusters shared the same probability of graduating from high school.

To answer research question seven, the researcher interviewed 12 DWISD high school teachers and administrators. He used thematic analysis to code and analyze the participants' interview responses. The interview participants were asked to describe their CTE programs and to speak to how they perceived enrollment in their CTE courses affects at-risk students. As they reported their observations and perceptions the researcher tracked emergent themes, regarding dropout behavior, using a categorical matrix.

Validity

To ensure validity of the qualitative data, the interviews were transcribed, and the interview participants were asked to member check the transcriptions. The transcriptions were sent to each interview participant as a PDF document via email. Each of the interview participants then had the opportunity to verify the accuracy of the interview transcription. Themes that emerged from the interview data were coded and triangulation was used to compare the coded interview themes to the quantitative data. The researcher then used peer reviews to ensure the data was correctly interpreted and coded.

Privacy and Ethical Considerations

This study was conducted after obtaining permission from the University of Houston-Clear Lake's Committee for the Protection of Human Subjects (CPHS) and from DWISD's Internal Review Board (IRB). Additionally, all interview subjects were required to sign an informed consent form before participating in the study. Both the school district's name and those of the interview participants were changed to pseudonyms, to ensure their identities are kept confidential. The quantitative data was coded for confidentiality and will be stored in the researcher's locked office for up to three years after the study was completed. All student identification data was destroyed upon the conclusion of the study.

Research Design Limitations

This study was limited to students between the ages of 14-and 19, who were enrolled as high school students in the Drowsy Willow Independent School District (DWISD) between 2010 and 2016. The study was also limited to the demographics of the suburban communities within the DWISD attendance boundaries. Of the DWISD students, 52% were white, 26% Hispanic/Latino, 9.8% Asian, 8.3% Black or African American, .3% Native American, and .1% Native Hawaiian/ Pacific Islander. As this study is limited to one suburban school district, the results may not be generalizable to national comparisons, which limits external validity. Another limitation to this study is the relatively small sample size of interview participants. Twelve public school CTE educators were interviewed, and all selected from one school district in southeast Texas. Their opinions and perceptions may not be representative to those from other school districts in Texas, or in the United States. Finally, the qualitative portion of this study did not include the opinions or perceptions of any DWISD students. As such, no conclusions can be made about the students' perceptions DWISD CTE programs or how they affected their high school experiences.

Conclusion

The goal of this study was to determine if there exists a correlation between CTE coursework and reduced dropout rates. This chapter included an overview of the research problem, operationalization of theoretical constructs, a description of the research population and sample, as well as the defined the procedures for data collection and analysis. This chapter also addressed privacy and ethical considerations, and research design limitations. Chapter IV contains a detailed description of this mixed-method study, including participant demographics, an analysis of five years of DWISD archival data, and qualitative data gathered from semi-structured interviews of CTE educators.

CHAPTER IV:

RESULTS

The purpose of the study was to examine the relationship between enrollment in Career and Technical Education (CTE) coursework and student dropout rates. The chapter begins with quantitative analysis of archival data gathered from 16,953 students that have attended the Drowsy Willow Independent School District (DWISD) at any point between 2010 and 2016. Next, qualitative data will be presented from twelve interviews of DWISD educators who have extensive experience working with at-risk students.

Participant Demographics

According to the Texas Education Agency (2015) the Drowsy Willow Independent School District (DWISD) served over 41,000 students during the 2014-15 school year, the final year of the 5-year quantitative study. The district had a relatively diverse student population: 49.3% white, 28.7% Hispanic/Latino, 9.8% Asian, 8.1% Black or African American, 0.2% Native American, and 0.1% Native Hawaiian/ Pacific Islander. Because there are relatively few numbers of students that identify as either Native American, Alaskan or Hawaiian/Pacific Islander, the researcher chose to combine each of the three indigenous groups. For the purpose of this study, the term Native American shall refer to all students who identify themselves Native American, Alaskan, or Hawaiian/Pacific Islander. Native American participants represent 0.4% ($n = 69$) of the population. Any student that identifies with two or more ethnic groups shall be referred to as multiracial. There are 2.7% ($n = 462$) multiracial participants.

Table 4.1

DWISD Demographic Data

	N	Percent
Ethnicity		
Native American	69	0.4%
Asian	1737	10.2%
African American	1508	8.9%
White/Non-Hispanic	9305	54.9%
Multiracial	462	2.7%
Hispanic/Latino	3872	22.8%
Total	16953	100.0%
Gender		
Male	8651	51.0%
Female	8302	49.0%
Total	16953	100.0%

Quantitative

Research Question One- *What is the relationship, if any, between students' ethnicity and the graduation rates of DWISD students?* This question was answered using a Chi-square test of independence comparing the frequency of dropouts by ethnicity.

Table 4.2 illustrates how the ethnic groups compare to one another in size, graduation rates and dropout rates. Of the 16,953 students that attended Drowsy Willow Independent School District (DWISD) from 2010 to 2016, 97.6% graduated and only 2.4% dropped out of school. While 2.4% is a relatively low percentage of the total

population there exists significant statistical differences when considering the dropout percentages within ethnic groups. While only 1.4% of Asian and 1.8% of White students dropped out of school, the other subpopulations had significantly higher percentages. 7.3% of Native American students, 3.1% of African American students and 3.8% of Hispanic/Latino students dropped out of school. Results of the Chi-square test show that there is a significant difference in dropout rates by ethnicity , $\chi^2(6, N = 16953) = 61.962$, $p < 0.05$. These findings reject the null hypothesis. Therefore there is sufficient empirical evidence to support that there is a relationship between ethnicity and graduation rates with Native Americans, African Americans and Hispanics showing the highest rates of student who drop out.

Table 4.2

Ethnicity and Leaver Code Crosstabulation

	NA	Asian	AA	NH/PI	White	His/Lat	Multi	Total
Ethnicity								
N	41	1737	1508	28	9305	3872	462	16953
% of Total	0.2%	10.1%	8.6%	0.2%	53.9%	22.0%	2.7%	100.0%
Graduate								
N	38	1712	1461	28	9135	3724	451	16549
% Grad	92.7%	98.6%	96.9%	100%	98.2%	96.2%	97.6%	97.6%
Dropout								
N	3	25	47	0	170	148	11	404
% Drop Out	7.3%	1.4%	3.1%	0.0%	1.8%	3.8%	2.4%	2.4%

Research Question Two- *What is the relationship, if any, between students' ethnicity and CTE course enrollment?* All the students in DWISD were categorized based on their level of CTE involvement, using data gathered from their transcripts. Students who were not ever enrolled in a CTE course are labeled as *CTE Non-Participants*. Those students who were enrolled in at least one CTE course but earned fewer than three CTE credits are labeled *CTE Participants*, and those who enrolled in at least two CTE courses and earned three or more CTE credits are *CTE Concentrators*. Research question two was answered using a Chi-square test of independence comparing students' ethnicity with the extent to which they enrolled CTE coursework, $\chi^2(12, N = 16953) = 31.54, p < 0.05$. There is sufficient evidence to reject the null hypothesis. Therefore, there is empirical evidence to support a significant relationship between ethnicity and CTE enrollment.

The results of this Chi-square test of independence are notable. When comparing the data in *Table 4.3*, it is important to note that the largest ethnic subgroups have similar data. The *Asian, African American, White, Hispanic/Latino and Reported 2+* subgroups had proportionate numbers of *CTE Non-Participants* (10-13%), *CTE Participants* (29-35%) and *CTE Concentrators* (55-58%). However, the two smallest subgroups, *American Indian and Native Hawaiian/Pacific Islander*, reported higher percentages of *CTE Non-Participants* (20% and 21% respectively), and lesser percentages of *CTE Concentrators* (51% and 50% respectively).

Table 4.3

Ethnicity and CTE Participation Crosstabulation

Ethnicity	CTE Non-Participants	CTE Participants	CTE Concentrators	Total
American Indian	8 (20%)	12 (29%)	21 (51%)	41 (100%)
Asian	208 (12%)	580 (29%)	949 (55%)	1737 (100%)
African American	157 (10%)	516 (34%)	835 (55%)	1508 (100%)
Nat. Hawaii/ Pac. Is.	6 (21%)	8 (29%)	14 (50%)	28 (100%)
White	1073 (12%)	3012 (32%)	5220 (56%)	9305 (100%)
Hispanic/Latino	352 (13%)	1340 (35%)	2180 (56%)	3872 (100%)
Reported 2+	56 (12%)	137 (30%)	269 (58%)	462 (100%)
Total	1860 (11%)	5605 (33%)	9488 (56%)	16953 (100%)

Research Question Three- *What is the relationship, if any, between students' gender and CTE enrollment?*, was answered using a Chi-square test of independence comparing students' gender with the extent to which they enrolled CTE coursework, $\chi^2(2, N = 16953) = 13.934, p < 0.05$. The results found that there is a significant difference in whether male and female students choose to enroll in CTE courses. *Table 4.4* illustrates that only 11% of males students and 11% of female students were reported to be *CTE Non-Participants*. In other words, roughly 89% of male and female students enrolled in at least one CTE course while enrolled in high school. There is, however, a significant difference in the the extent to which male and female students enrolled in CTE courses. Male students enrolled in more CTE courses than did their female classmates. 57% of the males that were enrolled in DWISD during this study were *CTE Concentrators*, while only 55% female students earned the prerequisite three CTE credits

to be considered *CTE Concentrators*.

Table 4.4

Gender and CTE Participation Crosstabulation

Gender	CTE Non-Participants	CTE Participants	CTE Concentrators	Total
Male	971 (11%)	2746 (31%)	4934 (57%)	8651 (100%)
Female	889 (11%)	2859 (34%)	4554 (55%)	8302 (100%)
Total	1860 (11%)	5605 (33%)	9488 (56%)	16953 (100%)

Research Question Four- *What is the relationship, if any, between students' gender and graduation rates?* This relationship was evaluated using a Chi-square test of independence comparing students' gender with their graduation status, $\chi^2(1, N = 16953) = 10.944, p < 0.05$. The results found that there is a relationship between gender and graduation status. While the overall graduation rate in DWISD between 2010 and 2015 was relatively high (97.6%), male students were more likely to drop out than female students. Of the 404 students that the district recored as dropouts, 239 or 59.2% were male.

Table 4.5

Leaver Code and Gender Crosstabulation

Graduation Status	Male	Female	Total
Graduates	8412	8137	16549
% of Graduates	50.8%	49.2%	100%
% of Total	49.6%	48.0%	97.6%
Dropouts	239	165	404
% of Dropouts	59.2%	40.8%	100%
% of Total	1.4%	1.0%	2.4%
Total	8651	8302	16953
% of Total	51.0%	49.0%	100%

Research Question Five- *Do students enrolled in a coherent sequence of CTE courses have a greater probability of graduating than students enrolled in fewer than 3 credit hours of CTE coursework?* This was answered using a binary logistic regression comparing the extent to which the students participated in CTE courses (CTE Coherent Sequence) with their graduation status (Leaver Code). Students who had earned three or more CTE credit hours were coded as CTE Concentrators. Students that took at least one CTE course and earned between .5 and 2.5 CTE credits were coded as CTE Participants, and those students that did not earn any CTE credits were coded as CTE Non-Participants.

The Hosmer-Lemeshow (H-L) test was not significant, which suggests that the logistic regression model was a good fit for these data. All three CTE coherent Sequence

categories proved to be significant predictors for graduating from high school as p values for CTE Non-Participants, CTE Participants, and CTE Concentrators were all < .05.

It was hypothesized that the more students participated in CTE coursework, the more likely they were to graduate. The results of the logistic regression support the hypothesis. Table 4.5 illustrates that the more CTE credits students earned, the more likely they were to graduate. The CTE-Non-Participants had a graduation odds ratio of .193. The CTE Participants had a graduation odds ratio of .589 and the CTE Concentrators had an odds ratio of 83.508. The CTE Concentrators, the students that enrolled in three or more CTE credits, were the most likely to graduate. They were 40% more likely to graduate than the CTE Participants, those who earned between .5 and 2.5 CTE credits and 82 times more likely to graduate than the CTE Non-Participants, those students who did not earn any CTE credits at all.

Table 4.6

Logistic regression examining CTE Coherent Sequence as a predictor for graduating from high school

Variable	<i>B</i>	<i>SE</i>	<i>OR</i>	Wald statistic	<i>p</i>
CTE Non-Participant	-1.647	.139	.193	141.292	.000
CTE Participant	-.529	.074	.589	50.725	.000
CTE Concentrator	4.425	.048	83.508	8339.175	.000

Note. *OR* = Odds Ratio

Research Question Six- Do students enrolled in courses from each of the 13 CTE Career Clusters have the same probability of graduating from high school? Direct logistic regression was utilized to determine if students' participation in CTE courses could predict the probability of the students completing high school. Logistic regression is a statistical analysis that is relatively free of restrictions allowing multiples predictors

to be analyzed together (Tabachnick & Fidell, 2013). In direct logistic regression, all independent variables enter the model simultaneously (Tabachnick & Fidell, 2013). Tabachnick and Fidell (2013) advise that direct logistic regression is the method of choice if there is no specific hypothesis about the importance or order of the independent, predictor variables.

The data were reviewed for linearity, multicollinearity, independence of errors, outliers, and missing cases (Field, 2013; Tabachnick & Fidell, 2013). No outliers were found in the data set. The data was checked to ensure that there were no missing data. Multicollinearity was evaluated and no independent variable exceeded the suggested tolerance or Variance Inflation Factor (VIF) levels, <0.10 or >10 , respectively (Hair et al., 1998).

The available research has established that enrollment in CTE courses can be used as a predictor for high school graduation (Bloomfield et al., 2013; Plank, DeLuca, & Estacion, 2008; Reese, 2005; Ruiz-Gallardo, Verde, & Valdés, 2013; Schwartz, 2014; Stone & Alfeld, 2004). This researcher, however, was interested in determining if student enrollment all CTE courses had the same effect on student graduation rates, or if students enrolled in certain CTE programs had a better probability of graduating from high school than others. To accomplish this, the dependent variable (DWISD students' leaver code), along 13 independent variables (covariates) were entered into SPSS. The covariates represented the 13 CTE clusters in which DWISD students were enrolled throughout the course of this study.

Table 4.7

Analysis of the frequency in which DWISD students enrolled in the 13 CTE Clusters

Variable	N	Valid Percent
Agriculture, Food & Natural Resources	5839	11.2
Architecture & Construction	885	1.7
Audio/Visual Technology	8256	15.8
Business	9507	18.2
Education Training	3983	7.6
Health Services	8708	16.7
Hospitality & Tourism	3097	5.9
Human Services	3452	6.6
Information Technology	259	.5
Manufacturing	190	.4
Marketing	1945	3.7
STEM	5656	10.8
Transportation Logistics	409	.8
Total	52186	100.0

After analyzing the DWISD transcript data, the researcher assigned an arbitrary code to each of the 13 career clusters. Business, the largest of the CTE clusters was selected and coded as the reference category. Direct logistic regression was completed in SPSS (using the enter function) and interpreted at the *alpha* level of .05, which was set *a priori*. It was determined that the model correctly predicted group membership 98.5% of the time, which is an indicator of good model fit. Model fit was also examined using the Omnibus Tests of Model Coefficients table presented by SPSS, which indicated a statistically significant chi-square statistic ($\chi^2=162.5, p<.001$) indicating that the independent variables included in the model made a statistically significant contribution to the prediction of the outcome (Tabachnick & Fidell, 2013).

Table 4.8

Analysis of Maximum Likelihood Estimates of how enrollment in CTE Clusters predict high school graduation

Variable	<i>B</i>	<i>SE</i>	<i>OR</i>	95% CI	Wald statistic	<i>p</i>
Ag. Fd. NatRes.	.445	.121	1.56	[1.23, 1.98]	13.47	.000
Arch.	.038	.229	1.04	[0.66, 1.63]	0.03	.868
AV. Tech.	.654	.115	1.92	[1.54, 2.41]	32.31	.000
Educ. Train.	.468	.142	1.60	[1.21, 2.11]	10.88	.001
Hosp. Tourism	1.463	.244	4.32	[2.68, 6.97]	35.89	.000
Health Sci.	.818	.120	2.27	[1.79, 2.86]	46.76	.000
Human Srvc.	.102	.131	1.11	[0.86, 1.43]	0.61	.437
Info. Tech.	.768	.584	2.16	[0.69, 6.77]	1.73	.189
Manufacturing	.454	.585	1.57	[0.50, 4.96]	0.60	.438
Marketing	.548	.200	1.73	[1.17, 2.56]	7.49	.006
STEM	1.624	.199	5.08	[3.44, 7.50]	66.54	.000
Trans. Logistics	.115	.343	1.12	[0.57, 2.20]	0.11	.736
Constant (Bus)	3.679	.061	39.60		3590.48	.000

Note. *OR* = Odds Ratio, CI = confidence interval for odds ratio (*OR*).

Each of the 13 CTE clusters produced an odds ratio larger than one, which indicates that enrollment in courses from each of the CTE clusters increased the odds that the students would graduate from high school. Tabachnick and Fidell (2013) explained, “an odds ratio of 1.5 means that the odds are increased by 50%. An odds ratio of 0.8 indicates that the odds of an outcome labeled 1 are 0.8 less with a one unit increase in the predictor; the odds decreased by 20%” (p. 463). However, only eight of the 13 CTE clusters were found to be significant predictors of high school graduation. *Architecture and Construction*, *Human Services*, *Information Technology*, *Manufacturing*, and *Transportation and Logistics* all produced *P* values > .05, indicating that they were not significant predictors for graduation. The remaining eight CTE clusters were significant predictors of high school graduation.

Given that the Business cluster was selected as the constant category, it was the category by which the other 12 clusters were compared and was also a significant predictor of graduation. The *Agriculture, Food and Natural Resource* cluster produced an odds ratio of 1.56 (Table 4.7), indicating that the probability of students who enrolled in courses within the *Agriculture, Food and Natural Resource* cluster graduating increased 1.56 times, or 56% than those in the business pathway. The *Audio/Visual Technology* cluster produced an odds ratio of 1.92, indicating that students enrolled in this CTE cluster increased their probability of graduating by 92%. The *Education Training* cluster produced an odds ratio of 1.60, or a 60% greater probability of graduating than the business students. The *Hospitality and Tourism* cluster produced an odds ratio of 4.32, or a 332% increase in graduation probability. The *Health Science* cluster produced an odds ratio of 2.27, indicating that students enrolled in this pathway had a 127% increased probability of graduating. The *Marketing* cluster produced an odds ratio of 1.73, indicating that Marketing students had a 73% increased probability of graduating. Finally, the STEM cluster produced the greatest odds ratio for graduation. The STEM odds ratio produced from the logistic regression was 5.08, indicating that the students enrolled in this cluster had increased their probability high school by 408% as compared to the Business students.

Qualitative

Research Question Seven- *What are the perceptions of CTE educators concerning the impact of Career and Technical Education courses have on graduation rates?* This was answered by utilizing an inductive thematic coding process to analyze 12 semi-structured interviews of DWISD educators. To gain a better understanding about the impact of Career and Technical Education on high school graduation rates the researcher interviewed eight high school CTE teachers, two high school campus assistant

principals, one campus principal, the DWISD Career and Technical Curriculum Coordinator. Once the interviews were completed, the researcher analyzed and coded the participants' responses concerning their experiences as CTE educators and their perceptions of the relationship between CTE courses and high school dropout rates. From their collective responses four themes emerged: (a) *student engagement*, (b) *increased student ownership*, and (c) *authentic experiences*, and (d) *capacity to build positive relationships and rapport*.

Student Engagement

All interview participants believed that students enrolled in Career and Technical Education (CTE) exhibited greater levels of student engagement than in their core academic courses (math, science, social studies, and language arts). While 100% of the CTE educators agreed that students found CTE coursework more engaging, they offered differing explanations as to why students found their courses engaging. Upon further analysis, *student engagement* was broken into three emergent sub-themes: (a) *student choice*, (b) *flexibility* and (c) *program competition*.

Student Choice

Six of the twelve interview participants defined *student choice* as a factor that led to increased student engagement among CTE courses. Three of the participants (Principal Avocado, Assistant Principal Blackberry and Teacher Mango) spoke about how students benefited and were more likely to engage in lessons when the subject matter was closely aligned to their areas of interest. These educators believed that a contributing factor to the high levels of student engagement in DWISD CTE classrooms was that the students had a plethora of CTE courses from which to choose, and that variety allowed students to align their interests with a potential career path. Three other participants (Teachers Orange, Lemon and Melon) approached the concept of *student choice* from a

different perspective. To these educators, the fact that CTE courses were not graduation requirements meant that a higher percentage of the students enrolled in the courses wanted to be there, which led to increased student engagement.

Principal Avocado spoke about how he loved having a strong, comprehensive CTE program on his campus because the various career clusters allowed his students to select from a large array of disciplines and career options. He highlighted two CTE programs from his campus that appealed to students' interests and allowed students an opportunity to explore a potential career path:

I think the advantage to it (CTE) is that students who really know what their interests are; have the opportunity to get a head start on a path towards a career.

So, if for example, if nursing is my thing, if I'm working towards that path and I take those medical courses, that's going to give me that advantage to be ahead...

Ag (the agriculture cluster) has so many branches off of it. So, you might be a vet tech (veterinary technician) or you might be interested in horticulture. And so really I think going into those classrooms you see that student interest, because it's the area, in many cases the area or the areas that they have interest in a career.

Principal Avocado recognized that when students were presented a variety of course options, they were more likely to find a course relevant to their interests, which promotes student engagement. Principal Avocado was not the only educator that spoke about student choice in this regard.

Assistant Principal Blackberry and Teacher Mango agreed that in many cases students enroll in CTE courses because they can see the relevance between what they can learn as part of the CTE program and what they want to do after they graduate. Assistant Principal Blackberry spoke about he frequently saw students approach CTE coursework with a long-term goal in mind:

This is not just something that kids want to experience in high school. This is a life choice. It's something they want to build on even after they leave (high school). It's like a foundation for something they want to do, like ag, but I want to be a veterinarian, or I want to do something, aquatic science, animal science, all of those things. So I would think that it's the buy-in of why the kid's taking it because that's a stepping stone for what they want to do.

He viewed CTE course work as an opportunity for students to develop a foundation on which to build a career. He reasoned that students understood that what they learned in these courses directly affected their future, thus they were more likely to engage in the classes. Teacher Mango was a chef who managed several restaurants before making a career change but has spent the last six years teaching CTE culinary courses in DWISD. She too mentioned how important it is that students have the choice to pursue their interests: “The amazing thing about CTE courses is that the students, besides the fact that they're learning the real-world experience and they're able to test the waters in different career paths that they might be thinking they're interested in...”

Teachers Orange, Lemon and Melon perceived that their students were more engaged in CTE courses because their courses were considered elective credits; courses the students were not required to take. Teacher Orange was the first to conceptualized *student choice* by comparing CTE courses to courses in the core departments (math, science, social studies and English language arts). He was well qualified to make this comparison as he spent part of his career teaching in his school's science department before becoming an engineering teacher in the CTE department. While the courses in each department were structured around curriculum that emphasized labs, experiments, and hands-on instruction, Teacher Orange noted that his engineering (CTE) students were more engaged:

Since I was teaching regular chemistry and regular physics, when you have a mandatory, required course, the students aren't in there because of a passion, or because of a desire, whereas in CTE, that was definitely the case. They usually were in there because they at least had an interest in the subject matter, so that was a big difference.

Teacher Lemon also had experience teaching in multiple departments. Like Teacher Orange, Teacher Lemon believed that the students in his Information Technology classes were usually more engaged than the ones he encountered in his history courses:

With world history every single kid has to go through it to graduate, and for CTE classes the student chooses the course. Most of the time the student gets to choose the course they want to go to. In a world history class, you're going to get kids who just absolutely love history, they read history on their own, they watch history documentaries. Then you have kids who can care less. So, from a motivational standpoint you have a little bit more challenge, because some kids, they're just not interested in that topic at the time.

Teacher Melon also noted that the students who chose to enroll in his Agriculture classes seemed to be more engaged because they had their choice of elective courses:

CTE is the choice. Students have that choice to be able to get in our classes. It's not a mandatory class where they have to take it, so they want to get in, they want to work, they want to learn about the material.

Teachers Orange, Lemon and Melon believed that because their CTE students were given the choice of which elective courses they wanted to take, they were more interested in the subject matter, which only led to increased student engagement.

Flexibility

Four of the twelve participants attributed higher levels of student engagement to the flexibility they enjoyed as CTE teachers to structure their courses and deliver instruction. Three of the participants agreed that the Texas Education Agency (TEA) has designed many of the CTE curricula in a way that allows CTE teachers greater flexibility regarding the delivery and timing of the content standards, the Texas Essential Knowledge and Skills (TEKS). These participants argued that they enjoyed greater flexibility because their students were not required to take the annual accountability tests required in other disciplines. The fourth participant mentioned that the TEKS for his CTE course gave him the flexibility to design more engaging instruction than teachers in other departments.

Teacher Melon was one of the teachers who believed that the curriculum and standards written for his CTE courses allowed him to engage his students without having to worry about sticking to a specific instructional timeline. He described how CTE curriculum is not assessed on the annual state accountability tests, so while CTE teachers still must cover their course's standards, they do not need to structure the course's scope and sequence to be aligned with a standardized test. CTE teachers, in his opinion, can modify their instruction to meet the needs of the students, rather than hit predetermined benchmarks in anticipation for the end-of-year exam:

Sometimes, we have the flexibility that, hey, everybody didn't get it or we're going to go a little deeper and we're going to move things around. So as long as the TEKS [curriculum accountability standards] are taught and you've covered the TEKS in the class, it gives you the flexibility of what you teach and when you teach.

Teacher Melon was not the only teacher that mentioned curriculum or the TEKS when

discussing the CTE programs. They echoed his belief that they had a greater ability to design and deliver engaging lesson because they did not feel the pressure to prepare their students for a state accountability test. Teacher Cranberry was a business teacher who did not teach a course that was included as part of the state's annual accountability test: "I didn't have the scrutiny of [the STAAR Test], oh you're not doing it the exact way that we want you to do it. I had more autonomy to I think, kind of be creative and be fun. So, I appreciated that." Teacher Cherry was the third participant who perceived that CTE teachers enjoyed more flexibility because their courses were not included in the state accountability tests. He posed the notion that CTE teachers were under less scrutiny because they did not have to prepare students for the test:

(T)he reality is that we (CTE teachers) are not... I mean, I got to speak honestly, we're not under the microscope like those other folks are, and for just reasons.

And I think that's what allows us to be able to have that flexibility.

Teachers Melon, Cranberry, and Cherry all believed that they had the greater flexibility in how they designed their course because they did not have to prepare their students for the STAAR test.

The fourth participant, Teacher Lime, perceived that he had flexibility, not because of the accountability tests, but because of the way his curriculum was designed. He believed that his engineering courses and their corresponding TEKS were written in such a way that encouraged an open-ended, project-based lesson design:

My senior class is probably the most open-ended course that I teach, and since we do a lot of little projects and one main big project, there's a lot of different things that I can do to modify that project so that my students are successful. For example, I can cut down the amount of tests that they have to perform, or I can have them refine or change their problem in some way, so that it can compensate

for ... They may pick something that's too complicated and then we can modify what they're actually trying to solve. As long as they're going through the design process, that's all I care about.

All four of these participants perceived that they enjoyed a greater degree of flexibility as CTE teachers than their peers in the other core departments.

Competition

Three of the twelve of the participants identified competition between teachers and CTE programs as a factor that indirectly enhanced student engagement. Given that the DWISD students had the ability to choose whether they wanted to participate in a CTE course, further they had their choice of courses from 13 unique career clusters, CTE teachers frequently found themselves in competition with one another. Administrator Apple, the DWISD CTE Curriculum coordinator, summarized this phenomenon by stating:

There is almost, from the teacher perspective, more pressure for course promotion because of that choice aspect. Algebra teachers don't really have to go out and promote algebra because kids have to have algebra. Whereas, our business marketing and finance teachers are going to have to really push it, and promote it, and ensure students know about (the program). So, I do feel like there is a difference between even teachers within CTE versus core. And I do feel like it all goes back to choice. I mean, the students are in there because they choose to be in there.

Teacher Orange agreed with Administrator Apple in that he believed that CTE teachers felt compelled to compete with other teachers when it came to recruiting students:

Some of it was the subject matter itself, but a lot of it has to do with the teacher, and how far they're willing to go to promote their course. I feel like CTE is

especially that way, it's kind of a dog-eat-dog world out there, it's either us or fine arts or athletics, or an elective in languages other than English.

Assistant Principal Banana argued that CTE teachers must be cognizant of recruiting and need to make their programs attractive to students. Furthermore, Assistant Principal Banana believed that once CTE teachers have recruited students into their programs they need to design relevant and engaging instruction to retain students from one year to the next:

(The CTE teachers) know that the number of courses they teach, or whether they're able to stay on, is going to be based on student numbers. And so they do have to go out there, and they have to compete, and they have to create these programs that really are designed to not just keep a student engaged, but that they're also showing those numbers of students that are coming out with certifications and things like that....they're (CTE teachers) solely responsible for the success of their program. It's one thing to go recruit the kids to go start taking the Principles class (the first course in a CTE-cluster), but to keep them highly engaged and progressing so that they're able to take the courses beyond that. They really have to put a lot of work into that, a lot of thought into how they're going to do that, because it's more than just recruiting. Then it's the actual delivery of instruction and making sure that they're delivering for those kids.

These three participants said that to maintain the enrollment need to sustain a viable program, CTE teachers not only need recruit well, but also need deliver engaging instruction to ensure that they retain the students they already have.

Increased Student Ownership

Four of the twelve of the CTE educators discussed how they have seen their students become invested in their respective CTE programs and how the students have

benefited from this commitment. One participant mentioned that students tend to become invested in CTE programs when they are given an opportunity to study something they find interesting or can relate to. The second participant mentioned that being a part of her program often becomes a part of the students' status or identity. Two other participants argued that when at-risk students are given a chance to participate and compete as part of a CTE organization they commit to being successful in all their classes to maintain their competition eligibility.

Administrator Apple, the district's CTE Curriculum Coordinator noted that while the district's CTE programs differed from one another, one thing that they all had in common was that once students found their niche, they frequently became invested in the program:

In terms of student participation, I feel like regardless of what cluster you're looking at, if that student is passionate about it, they're going to give you 110%. You have kids in the transportation cluster who are in auto tech, who live and breathe that auto tech shop. Just like the Ag kids. I mean, they are 100% committed to that program. So, I feel like the students, if they can find something that they can relate to or that they're interested in or see a future in, they're going to give you 110%.

Teacher Pear agreed and described how her students in the Child Guidance pre-school program developed a sense of pride in what they did and being part of the program became part of their identity:

It becomes their sport and their program, and that's who they are, and you know what I mean? It's like they're growing and learning and that becomes how they're attached, you know?...that gives them purpose and a reason and a drive."

These two participants noted that when students found a CTE program they enjoyed they

became invested in the program which gave the students a sense of purpose.

Teachers Orange and Mango believed that because their students needed to maintain passing grades in all their classes to participate in CTE competitions, they were influenced to be committed in all their classes. Teacher Orange said that being a part of his Robotics team not only provided the students a sense of belonging, but it incentivized the students to do well in all their courses, because the students were required to maintain passing grades in order to be an eligible member of the team:

But I tell you, the idea of failing, and not being able to be part of that team, was more incentive than anything else. I carried that over to robotics, if you failed, you could not be on the team, and you could not travel, and you could not come after school. So that alone would keep some of them at the desk a little longer, and working a little harder, to make sure they passed the test in English and science and history and everything, not just the engineering class.

Teacher Mango, the culinary teacher, also believed that being part of her program influenced students to put in additional effort to maintain passing grades. She said that just as athletes must pass their courses to compete, her culinary students had to meet the same expectation. The Culinary competition team, “is something that they look forward to and in order to maintain their status and be able to be part of culinary and to go to competitions or do whatnot, they also have to keep their grades up.”

Authentic Experiences

Eight of the twelve interview participants discussed how they believed CTE courses differed from other courses traditionally taught in a high school setting in that CTE programs are designed to expose students to authentic real-world experiences. Three of the participants discussed how they believed that the students in their CTE courses learned life lessons that would prepare them to be successful later in life. Four of

the participants described how their courses have been set up to teach students the career-specific skills necessary to be a successful employee in their field of study. Finally, two of the participants mentioned that these factors were particularly important and beneficial to socioeconomically disadvantaged, or otherwise at-risk students.

Administrator Apple, Teacher Cherry and Teacher Cranberry each spoke about how CTE courses gave students the opportunity to learn skills that would serve them as productive adults. Prior to becoming a teacher and administrator, Apple was hired as a member of the DWISD's Communications Department. One of her first assignments was to tour each of the district's high schools taking pictures and videos of students engaged in CTE course work, which would eventually be utilized as part of a CTE promotional video. This experience gave her a glimpse of how CTE courses emphasized kind of skills students would require to be successful in life after high school:

I went around to the CTE classes for this school district and that's really how I was able to see teaching is not just math and science and social studies. There are classes that are real world application, and you can teach kids the skills needed for life after high school.

Teacher Cherry taught business courses and discussed how it was important to him to show students how the concepts he covered in classes would be relevant once they graduate from high school:

I really, really try to focus and try to make the class flow in a way that gets them to understand what's actually waiting for them when they graduate high school or when they apply to college or move on to a career or possibly move into the military.

Teacher Cranberry also felt that the skills that he taught his students would prepare them for adulthood: "So like teaching Microsoft Office, teaching the kids how to use (the

functions) in Excel spreadsheets or teaching kids how to edit photos or teaching kids with (the course) *Dollars and Sense*, how to budget, manage money.”

Assistant Principal Banana was one the four participants who recognized that students seemed to draw connections between what they were learning in their high school CTE programs and what they wanted to pursue as a career:

So, our automotive students, for instance, they knew that when they graduated or while they were in high school, they were already working in an auto shop or a body shop somewhere while they're getting ... So, it just put two and two together, and it allowed these kids to start learning skills that they knew that they were going to use.

Assistant Principal Blackberry agreed. He believed that one aspect that set CTE courses apart from courses in other departments was that CTE courses often focused on a tangible project that allowed students to experience what it might be like to work in their prospective career:

The cool thing with CTE though, in most of those classes, unlike a general ed or the core curriculum, is the finished product looks much different. How fun is algebra or a research project in U.S. History as opposed to building an airplane or building a house somewhere or being in a digital graphics (class) and making your own game that took you a year to two? You're talking about a huge difference there. I think the end game for a kid is amazing as opposed to a general ed course.

Mr. Orange also believed that CTE courses were more authentic than core classes because of the way that CTE teachers approach the concept of failure. Failure, in his mind, was a critical part of innovation and something his students must understand if they wanted to become successful engineers:

Engineering, in particular, rewards failure because that's where innovation comes and also that's where you increase efficiency through learning what doesn't work. I feel like we come out of most of our core classes as, there is only one right answer. In CTE courses, there's never one right answer. It's true world situations, and I would feel like the students that come out of CTE will always have that as an advantage, in that they know there's more than one right answer. Failure is one of the right answers because you've learned from that failure, so that you can do it differently the next time and do it better the next time.

Other CTE teachers provided the students an opportunity to intern while still in high school. One such teacher was Teacher Mango, who along with her culinary students set up a successful catering business. She described how her students not only gained experience from working in that setting but were able to highlight the internship opportunity on their resumes:

Most of them would go get a job in the industry and I would help them with that, but they would put the school on their resume because we had a restaurant, and they would put working in the restaurant and all the catering and all of that on their resume. So that real-world experience was translating to the real world. When they went to get a job, they would actually get a foot in the door because of (their resumes), because of the fact that they were in culinary and they would hire them almost immediately.

Each of these participants believed that CTE students were given authentic, career-specific knowledge and skills that well prepare them for post-secondary employment.

While each of the nine participants spoke about how the authentic CTE curriculum, opportunities and experiences benefited students in general, two participants spoke about how they were especially significant for students who were at-risk of

dropping out of school. Assistant Principals Blackberry and Banana each spoke about how they would try to use CTE courses as an intervention or an incentive to reengage at-risk students. Assistant Principal Blackberry describe his thought process by saying:

If you can get a kid who's at-risk or struggling and push them into a program that they're interested in, that gets them to school every day, and then you're helping prepare that kid for their future, because the skills that they're building at their high school will obviously transfer into the real world when they leave and graduate.

Assistant Principal Banana mentioned that sometimes at-risk students want to give up and because they do not anticipate attending college, do not see the point of graduating from high school. He said that in these circumstances, he would try to convince the student that CTE courses are an alternative route towards a bright future:

Students might ask, 'Why should I even focus on graduating from school?' I think the CTE programs offer them an alternative route. 'Hey, look. This isn't just for you to go to college. There are other trades and careers that you can do where you just need the right certifications.' And so, to me, it's just about having access to those skills.

Assistant Principals Blackberry and Banana both felt that they could effectively use CTE coursework as an intervention for students who were at risk of dropping out of school because the students recognized that the skills they gained were relevant, and could help them get a job immediately after high school.

Opportunity to Build Positive Relationships

Each of the interview participants were asked if they had any experience working with students at risk of dropping out of school, and if so, what interventions they employ to prevent the students from dropping out of school. While the participants described

procedural interventions such as referring the student to a counselor or an administrator, the participants primarily spoke of their ability to foster and maintain positive relationships with their students. One of the campus administrators interviewed believed that because CTE teachers are frequently recruited from industry, they possess a certain credibility that helps them generate positive relationships with their students. Three of the eight teachers who were interviewed believed that as CTE teachers they had a greater capacity to develop stronger relationships with students than other teachers in their school. Two of the campus administrators were reluctant to say that CTE teachers were better at developing relationships with students than non-CTE teachers but did concede that CTE teachers had advantages when it came to relationship building.

Assistant Principal Banana spoke about how the hiring process differs when it comes to hiring CTE teachers. Whereas teachers in other departments are recruited from universities or from other public schools, CTE teachers are frequently hired from industry, and that industry experience gives them credibility, which changed students' perceptions of them:

A lot of them (CTE teachers) didn't get their training in the educational field.

They got their training in the actual field that they're teaching, so these are nurses that are coming into high schools and teaching these courses, or they're retired police officers, or people that have owned their own garages, professional chefs, things like that, and I think it's relational. I think kids don't necessarily see them as those traditional, maybe hard to reach teachers, where they're more like confidants, like role models, people they can look up to because they're in the same field that they want to be in.

He argued that this perceived credibility enables CTE teachers to develop strong and lasting relationships with their students.

Teachers Pear, Melon and Mango described their ability to generate positive relationships with their students as a powerful dropout intervention measure. These participants also believed that certain aspects of the CTE programs allow CTE teachers to spend more time with their students, thus providing them greater capacity to develop positive relationships with at-risk students. Teacher Pear described how since her CTE classes typically had smaller student-to-teacher ratios, she had more time to work with her students individually:

I can put them right beside me and be pulling them up the whole time that they're struggling. Whereas (another) teacher is going to have 30 kids in her class and she's going to have to not be able to be as present, as engaged, I guess, individually. I feel like I can really get in there and be engaged one-on-one with them.

Teacher Mango spoke about how many CTE courses are double blocked within the students' schedule. She explained that most of the courses in her high school lasted for one period, or 45 minutes. Double-blocked courses, however lasted for two periods within the school's bell schedule, which meant the class lasted for 90 minutes every day. Teacher Mango explained that teachers who teach double-blocked courses have literally twice as much time to spend with their students every day:

(A)s a CTE teacher you have the opportunity to work with them on a different level and build a little bit more trust with them. And your class is also a little bit longer, so you spend a little bit more time with them. And due to the fact that you're building trust working together, you have the opportunity to dig deep down and talk to them and try to find out their why's and have a better connection with them, than just a 45-minute class where you're teaching either math or science or whatnot, you don't have that same opportunity.

In addition to teaching double-blocked classes, Teacher Melon described how CTE teachers frequently teach the same students year after year. Teacher Melon, one of the few agriculture teachers at his school, taught multiple agriculture courses every year. He taught *Principles of Agriculture* to freshmen and sophomores, *Small Animal Management* and *Equine Science* to sophomores and juniors and *Practicum in Veterinary Technology* to seniors. As such, the students that chose to take multiple courses in the Agriculture Cluster were destined to spend a lot of time with Teacher Melon. Teacher Melon acknowledged that this was not unique to Agriculture Pathway but is probably true of all CTE clusters:

We're teaching CTE because we care about the kids. We care about our curriculum, but it's the kids first and foremost. And our classes are so that if you're in that pathway, you're going to see those kids over and over. I'll have the same four kids all four years in multiple classes, where some teachers don't have that luxury because if they teach English 1, they're going to have one year and then they're going to move on.

These participants posited that CTE teachers spend more time with their students, which gives them the ability build stronger relationships than the teachers in other departments, who only get to work with a new class of students every year.

While the CTE teachers generally perceived that they had a greater capacity to generate and maintain positive and effective relationships than teachers in other departments and content areas, two of the campus administrators were reluctant to go that far. They were more inclined to qualify their opinions by suggesting that master teachers, regardless of the department or discipline, shared the universal ability to connect and form powerful relationships with their students. Principal Avocado believed that one quality all master teachers share is their ability to relate with their students:

I think your highest-level teachers, in any course, are able to do that. And that's done through real, real, genuine relationships where they really know their students and know who they are, and what they're about, and what their struggles are, and what their successes are.

Assistant Principal Blackberry agreed and said, “anytime you have a rock star teacher in a core course, yes, kids would say, ‘that’s my favorite teacher.’ The reason would be the relationship and the caring along with the instruction that that teacher provides.”

The administrators conceded, however, that circumstances allowed CTE teachers unique opportunities, and advantages to develop positive relationships with their students. Principal Avocado compared CTE programs to other extracurricular activities known to engage at-risk students:

I think for CTE, or athletics, or fine arts it's inherently built in. The interest is more inherently built in and so that it's easier to... The content is easier to, I guess, to get the student engagement in so that you do have more time to work on the relationships.

Assistant Principal Blackberry agreed with the notion that that CTE teachers have a unique opportunity to build powerful relationships compared to teachers in other core departments:

...I think it's definitely fortunate for a CTE teacher. You have more opportunity to build (powerful relationships) because of the time that you're spending and again, finished products that they have and awards and places that you're going, field trips even overnight stays, a competition....

Administrators Avocado and Blackberry believed that while CTE teachers were not necessarily *better* at generating relationships with students than non-CTE teachers, there were factors that afforded CTE teachers more opportunities to build positive relationships

with their students.

Summary of Findings

This chapter provided an analysis of quantitative and qualitative research data collected to address the seven research questions. Five years of quantitative archival data were collected from a large sub-urban school district in south-east Texas. The archival data represented all students who had graduated, as well as all the students who attended, but dropped out of a DWISD high school between 2010 and 2016. The findings suggested that there existed significant relationships between the following: (a) ethnicity and graduation rates, (b) ethnicity and CTE course enrollment, (c) gender and graduation rates, and (d) gender and CTE enrollment. The findings also suggest that a relationship existed between the number of CTE courses DWISD students took and their probability of graduating from high school. Students who took between .5 and 2.5 credits of CTE coursework were more likely to graduate than those who did not take any CTE courses, but they were not as likely to graduate as those who took three or more CTE credit hours. Finally, the findings suggest that not all CTE course clusters had the same effect on graduation rates. Only eight of the thirteen DWISD CTE career clusters were found to be significant predictors for high school graduation.

Qualitative data were collected from twelve DWISD CTE teachers and administrators. The interview participants perceived that CTE programs were a vital component of their students' high school experience. Interview responses supported the quantitative analysis demonstrating that there exists a positive relationship in CTE enrollment and graduation rates. Upon the analysis of qualitative data, the research identified four emergent themes that illustrated the participants' perceptions of how enrollment in CTE programs positively affected the students. First, the participants perceived that CTE teachers are better equipped to design and deliver engaging lessons as

compared to teachers in other departments. The participants spoke about how CTE students often develop a sense of connection, pride, or ownership to their respective CTE programs. They perceived that DWISD students also benefited from being exposed to authentic experiences and scenarios that are inherently included as part of the CTE curriculum, and that CTE teachers are afforded more opportunities to build positive relationships with students than non-CTE teachers.

CHAPTER V: SUMMARY, IMPLICATIONS AND RECOMMENDATIONS

This chapter reports and evaluates the statistical data established from the research questions posed in previous chapters. First, there will be analysis of the relationships between gender, ethnicity, and the graduation rates in the Drowsy Willow Independent School District (DWISD) between 2010 and 2016. Next, the relationship between enrollment in DWISD Career and Technical Education (CTE) programs and the district's graduation rates will be defined and evaluated. The researcher will discuss this study's implications and contributions to existing research regarding the relationship between Career and Technical Education (CTE) and high school graduation rates. Finally, the researcher will recognize the limitations of this study and make recommendations for further research.

The purpose of this study was to determine if there exists a significant relationship between CTE coursework and the DWISD graduation rates from 2010 to 2016. The study was conducted in two parts. First, DWISD archival data from 2010-2016 were collected and analyzed. After obtaining the appropriate Internal Review Board (IRB) approval from DWISD and the University of Houston-Clear Lake, the researcher analyzed the transcript and demographic data for each of the 16,953 students who were enrolled in DWISD high schools from 2010 to 2016. Chi-square Tests of Independence and Logistic Regression were used to analyze these quantitative archival data. Additionally, 12 semi-structured interviews were conducted with educators who were employed DWISD as either teachers, or administrators between 2010 and 2016. Each of the interview participants were asked to speak to their experiences as either CTE teachers, or administrators over DWISD CTE programs. As the participants

reported their observations and perceptions the researcher used inductive thematic coding to track emergent themes, regarding dropout behavior.

Summary

Before seeking to evaluate the relationship between DWISD CTE enrollment and high school graduation rates, it is important to determine how the DWISD student demographics compare to national demographics found in CTE and dropout research. The first two research questions were posed to assess the relationship between ethnicity and DWISD graduation rates, and the relationship between students' ethnicity and their enrollment in CTE coursework.

Research question one, *What is the relationship, if any, between students' ethnicity and the graduation rates of DWISD students?*, was answered using a Chi-square Test of Independence comparing the frequency of dropouts by ethnicity. The results indicate that the DWISD dropout rate between 2010 and 2016 was lower than national averages. Of the 16,549 students who enrolled in DWISD high schools between 2010 and 2016, 404 or 2.4% dropped out of school. This number is lower than the 2017 national dropout rate of 5.4% (McFarland, Cui, Holmes & Wang, 2019).

Further, this study found sufficient empirical evidence to support that there is a relationship between ethnicity and DWISD graduation rates with Native Americans, African Americans and Hispanics showing dropout rates significantly higher than the 2.4% district average. The study found that 7.3% of Native American, 3.1% of African American and 3.8% of Hispanic/Latino students dropped out of DWISD during the course of this five-year study. These findings are consistent with national dropout research. Yates (2005) found that black students (17%) drop out more frequently than white students (10.2%), but Hispanic and Latino students (22.7%) experience the most pronounced dropout rates. McFarland, Cui, Holmes and Wang (2019) found that while

Native American 2017 dropout rates did not exceed the national average of 4.7%, Black (5.5%) and Hispanic/Latino (6.5%) demonstrated significantly higher event dropout rates. Bowers and Sprout (2012) wrote that the dropout rate in urban areas range from 20% to 50%. Each statistic is daunting, but worse when they are combined. Consider the African American or Latino boys, who have been diagnosed with emotional or behavioral disabilities, and live in urban areas; their probability of dropping out is compounded (Bowers & Sprout, 2012; McFarland, Cui, Holmes & Wang, 2019; Yates, 2005).

Research question two, *What is the relationship, if any, between students' ethnicity and CTE course enrollment?*, was answered using a Chi-square test of independence comparing students' ethnicity with the extent to which they enrolled in CTE coursework. The results of this Chi-square Test of Independence are notable. When comparing the data in *Table 5.1*, it is important to note that the largest ethnic subgroups have similar data. The *Asian, African American, White, Hispanic/Latino and Reported 2+* subgroups had proportionate numbers of *CTE Non-Participants* (10-13%), *CTE Participants* (29-35%) and *CTE Concentrators* (55-58%). The two smallest subgroups, *American Indian* and *Native Hawaiian/Pacific Islander*, reported higher percentages of *CTE Non-Participants* (20% and 21% respectively), and lesser percentages of *CTE Concentrators* (51% and 50% respectively).

Table 5.1

Ethnicity and CTE Participation Crosstabulation

Ethnicity	CTE Non- Participants	CTE Participants	CTE Concentrators	Total
American Indian	8 (20%)	12 (29%)	21 (51%)	41 (100%)
Asian	208 (12%)	580 (29%)	949 (55%)	1737 (100%)
African American	157 (10%)	516 (34%)	835 (55%)	1508 (100%)
Nat. Hawaii/ Pac. Is.	6 (21%)	8 (29%)	14 (50%)	28 (100%)
White	1073 (12%)	3012 (32%)	5220 (56%)	9305 (100%)
Hispanic/Latino	352 (13%)	1340 (35%)	2180 (56%)	3872 (100%)
Reported 2+	56 (12%)	137 (30%)	269 (58%)	462 (100%)
Total	1860 (11%)	5605 (33%)	9488 (56%)	16953 (100%)

However, when one considers that the of 16,953 students enrolled in DWSID during this study, American Indians (41), and Native Hawaiian/Pacific Islanders (28) collectively account for 0.4% of the total student population. Overall, it is evident that the district had effectively and equitably promoted CTE programming and course enrollment to students of all ethnicities, which helps to account for the fact that the district enjoyed a lower dropout rate than the national average.

Just as research questions one and two were designed to analyze the relationships between ethnicity, CTE enrollment and DWISD dropout rates, questions three and four were designed to evaluate the relationships between gender, CTE enrollment and DWISD dropout rates. The researcher approached this study predicting that DWISD male students would experience decreased levels of CTE course enrollment and experience

higher dropout rates. The assumption was that male students would dropout at higher rates because they were not engaged in CTE as frequently as their female classmates. The findings to this study, however, refutes that assumption.

Research question three, *What is the relationship, if any, between students' gender and CTE enrollment?*, was answered using a Chi-square Test of Independence comparing students' gender with the extent to which they enrolled in CTE coursework. Quantitative analysis found that DWISD males participated in CTE courses at a greater rate than DWISD female students. To determine CTE participation the students were categorized into three groups upon review of their transcript data. Those students that did not take a CTE course while enrolled in high school were categorized as *CTE Non-Participants*. The study found no measurable difference between male and female students when looking at CTE participation. There were 16,953 participants in the study. Of the 8651 male students, 971 (11%) were found to be *CTE Non-Participants*. And of the 8302 female participants, 889 (11%) were *CTE Non-Participants*. Conversely, 89% percent of male and female participants enrolled in at least one CTE course while enrolled in high school.

Given that an equal percentage of male and female participants enrolled in CTE courses, the study found that male students enrolled in more CTE courses than females. The 15,093 participants that enrolled in at least one CTE course were categorized in two groups. Those participants who earned fewer than three CTE credits on their high school transcripts were defined as *CTE Participants*, while those participants who earned three or more CTE credits were defined as *CTE Concentrators*. This study found that 31% of the male participants and 34% of the female participants were *CTE-Participants*, while 57% of male participants and 55% of female participants were *CTE-Concentrators*. In short, the study found that while male and female students were just as likely to

participate in CTE courses. Further, the data demonstrate that male students participated in more CTE courses, because there was a higher percentage of male participants who earned three or more CTE credits on their transcript.

Research question four, *What is the relationship, if any, between students' gender and graduation rates?*, was answered using a Chi-square test of independence comparing students' gender with their graduation status. The results indicated that of the 404 students who dropped out of the DWISD high schools during the study, 59.2% were male, while 40.8% were female. These findings are significant and consistent with existing researching regarding gender and dropout rates (Bowers & Sprout, 2012; McFarland, Cui, Holmes & Wang, 2019; Yates, 2005).

Yates (2005) found that males (12.6%) drop out more frequently than females (10.6%), and that females who drop out have a lower earning potential in adulthood. McFarland, Cui, Holmes and Wang (2019) found that disparity between male and female dropout data is closer. They found that in most years there is no measurable difference in the event dropout rate for 15- to 24- year-old when comparing males to females. They reported that within the last 40 years there had only been four years (1978, 2000, 2001 and 2017) where the data indicated a measurable difference, however in each of those four years males exhibited a higher event dropout rate than females.

The results of research questions one through four provide baseline data and a general picture of the relationships regarding gender, ethnicity, CTE enrollment and graduation outcomes. The findings indicate that: a) African American, Hispanic/Latino and Native American students graduated from DWISD high schools at disproportionately lower rates, b) there was no measurable difference in CTE enrollment among most ethnic groups, c) that boys were more likely to drop out of school, yet d) boys on average enrolled in more CTE courses. Whilst research questions one through four were designed

to gather data from the large student population, question five was intended to determine how CTE enrollment was related to the 404 students who dropped out of DWISD between 2010 and 2016.

Research question five, *Do students enrolled in a coherent sequence of CTE courses have a greater probability of graduating than students enrolled in fewer than 3 credit hours of CTE coursework?*, was answered using a binary logistic regression comparing the extent to which students participated in CTE courses with their graduation status. The study found that students increased their probability of graduating by enrolling in CTE courses. Further, the data suggest that the more students enrolled in CTE courses, the more likely they were to graduate from high school. CTE Concentrators, those students who enrolled in three or more CTE credits, were the most likely to graduate. They were 40% more likely to graduate than the CTE Participants, those who earned between .5 and 2.5 CTE credits and 82 times more likely to graduate than the CTE Non-Participants, those students who did not earn any CTE credits at all.

These findings are supported by existing research finding schools that allow and encourage their students to take multiple CTE courses will see optimal benefits when it comes to dropout prevention (Plank et. al., 2008; Reese, 2005; Stone et.al., 2004). Plank et. al. (2008) found that a 5:4 ratio of academic to CTE courses, was the optimum enrollment ration for student dropout prevention. Reese (2005) and Stone and Alfred (2004) similarly found that optimal academic to CTE course ratios reduced high school dropout rates. This study, however, did not seek to determine if taking *too* many CTE courses had a detrimental effect on DWISD student graduation rates, thusly does not recommend an optimal academic to CTE course ratio.

While available research has established that enrollment in CTE courses can be used as a predictor for high school graduation (Bloomfield et al., 2013; Plank, DeLuca, &

Estacion, 2008; Reese, 2005; Ruiz-Gallardo, Verde, & Valdés, 2013; Schwartz, 2014; Stone & Alfeld, 2004), little research has been done to evaluate if enrollment in all CTE courses have the same effect on high school graduation rates. Research question six was formulated to address this gap in dropout research.

Research question six, *Do students enrolled in courses from each of the 13 CTE Career Clusters have the same probability of graduating from high school?*, was answered using direct logistic regression to determine if students' participation in CTE Course Clusters could predict the probability of the students completing high school. The results of the logistic regression found that each of the 13 CTE clusters produced an odds ratio greater than one, which indicates that by enrolling in any of the CTE clusters students increased their odds of graduating from high school. The findings, however, illustrate that not all 13 CTE clusters have the same effect on student graduation rates. Eight of the 13 CTE clusters produced P values $< .05$ which indicate they were significant predictors for high school graduation.

Though all CTE clusters produced an odds ratio > 1.0 , indicating that students who enrolled in these courses increased their odds of graduating high school, not all CTE clusters were found to have had a *significant* effect on high school graduation rates. Table 5.2 shows the Five CTE clusters that produced P values $> .05$, indicating they were not significant predictors for graduation.

Table 5.2

CTE Course Clusters that were not found to be significant predictors for High School graduation ($p > .05$).

CTE Cluster	N	Odds Ratio	p
Architecture & Construction	885	1.04	.868
Human Services	3452	1.11	.437
Information Technology	259	2.16	.189
Manufacturing	190	1.57	.438
Transportation & Logistics	409	1.12	.736

One might assume that career clusters designed as college preparatory programs, such as the engineering program within the STEM CTE Cluster, would be significant predictors for high school graduation, while the clusters designed to prepare students for blue-collar careers would not. In general, that assumption proved to be true. All five of CTE Clusters that did not prove to be significant predictors for high school graduation, were clusters designed around careers that do not require employees to earn a bachelor's degree. Though professions in construction, human services, information technology, manufacturing and automotive technology frequently require employees to obtain industry certifications or an associate degree, few require employees to obtain a bachelor's degree. The Human Services Cluster, illustrated in Table 5.3, is an example of a cluster designed to prepare students transitioning into the workforce immediately after their high school graduation.

Table 5.3

Courses Offered as Part of the Human Services Cluster and course descriptions per the DWISD Course Selection Handbook.

Course Name	Course Description
Dollars and Sense	"...covers basic financial skills and problem-solving techniques needed as students take their roles as consumers in American Society."
Lifetime Nutrition and Wellness	"... concentrates on nutrition, food choices, and food management skills that may be applied to individual life and/or careers related to hospitality and tourism, education and training, human services and health sciences."
Child Development	"... is designed to study human growth and development from newborns through school-age children."
Child Guidance I	"This on-site laboratory includes hands-on experiences in a preschool classroom.... Students prepare by analyzing the developing theories of young children and exhibit principles of effective teaching."
Child Guidance II	"designed for the student who demonstrated success in Child Guidance I."
Interpersonal Studies	"This course prepares the student for life in the real world. Students will examine how relationships between individuals and family will affect quality of life."
Introduction to Cosmetology	"The introductory course consists of orientation to cosmetology, fundamentals of cosmetology, chemical reformation and related theory of artistry of hair, and manicures."
Cosmetology I	"... designed to provide job-specific training for employment in cosmetology careers."
Cosmetology II	"The students practice advanced haircutting and related theory, learn about salon development, and prepare for the Texas Department of Licensing Regulation (TDLR) exam."
Principles of Cosmetology Design & Theory	"The cosmetology program is a two-year sequence of courses designed to provide job specific training that will prepare the student to become a licensed cosmetologist."

Some of the courses in the Human Services Cluster were designed not necessarily with a career focus in mind, but rather to prepare the students to be successful and productive citizens in American society. *Dollars and Sense*, *Lifetime Nutrition and Wellness*, and *Interpersonal Studies* are three such courses. *Dollars and Sense*, for instance, is meant to teach students the knowledge and skills they will require to become financially independent post high school, regardless of the students' career interests. Some of the courses in the Human Services Cluster, such as the cosmetology courses, are designed to prepare students for employment immediately after high school. The students who enrolled in the cosmetology course were prepared to sit for the Cosmetology State Exam from the Texas Department of Licensing Regulation (TDLR). Those who successfully preformed on the exam earned their Cosmetology Certification and could immediately start their careers in the Cosmetology industry.

Some of the courses in the Human Services Cluster appeal to both college-bound and non-college bound students. The *Child Development* and the *Child Guidance* courses are three such examples. Teacher Pear, who teaches all three *Child Development* and *Child Guidance* courses, explained how her program benefited those students who wanted to attend a four-year university and pursue a career as a public-school teacher. However, she also had students who took *Child Development* and *Child Guidance* intending on working as day-care instructors, a profession that requires certification, but not a bachelor's degree.

Conversely, when analyzing the CTE Clusters that were found to be significant predictors for high school graduation, one found that most were designed to offer college preparatory programs intended for college-bound students (Table 5.4). The course curriculum in the following CTE Clusters were intended to prepare students for careers that require a college diploma: a) Audio/Visual Technology, b) Education Training, c)

Health Science, d) Marketing, e) Science, Technology, Engineering and Mathematics (STEM), and f) Business.

Table 5.4

CTE Course Clusters that were found to be significant predictors of High School graduation ($p < .05$).

CTE Cluster	N	Odds Ratio	<i>p</i>
Agriculture, Food & Natural Resources	5839	1.56	.000
Audio/Visual Technology	8256	1.92	.000
Education Training	3983	1.60	.001
Hospitality & Tourism	3097	4.32	.000
Health Science	8708	2.27	.000
Marketing	1945	1.73	.006
Stem	5656	5.8	.000
Business (Constant)	9507	39.60	.000

The Health Science and STEM CTE Clusters were the strongest predictors for high school graduation. The Health Science Cluster produced an odds ratio of 2.27 and a *P* value of .000. The STEM Cluster produced an odds ratio of 5.8 and a *P* value of .000. A quick review of the courses offered in each of these clusters (found in APPENDIX A) suggests that these programs offer an academically rigorous slate of courses. Students who enrolled in the Health Science Cluster took courses in *Medical Terminology, Anatomy and Physiology, Pathophysiology, and Principles in Biomedical Science*. Students who enrolled in the STEM program were able to take courses such as *Robotics, Civil Engineering and Architecture, Aerospace Engineering, and*

Biotechnology. Logic dictates that the students who chose to enroll in these courses would have been academically driven and had aspired to pursue a post-secondary degree.

These findings are in line with the perceptions of two of the interview participants. Teacher Orange and Teacher Lime both taught engineering courses within the STEM Cluster. When asked to compare the students that enrolled in their courses to students that enrolled in other CTE Clusters, they both claimed that they noticed a difference. Teacher Orange claimed that the students who enrolled in his engineering courses were typically from well-educated families, they had an interest in the subject matter, and were highly motivated to succeed. He said that many of his students understood what engineering was and that a career in the engineering field offered high earning potential. Teacher Lime said that many of his students understood what they were getting into because they had a family member who was an engineer or someone who helped guide them toward the STEM pathway.

Both Teacher Orange and Teacher Line mentioned that because many of the courses within the STEM pathway were designated as honors courses, the top students were frequently drawn to them. 11 of the 15 courses within the STEM Cluster were designated as Advanced Academic (AA), Pre-advanced Placement (PreAP), or Advanced Placement (AP) courses (APPENDIX A). These courses were deemed to be more academically rigorous, and as such were weighted heavier in the district's Grade Point Average (GPA) Scale (see APPENDIX B). Teacher Lime said that the students that took his courses were typically better behaved, they were interested in getting good grades, maintaining a high GPA, and getting into a good college. He did not perceive that the students in other CTE clusters felt the same way.

It is important to note, however, that not all CTE Clusters found to be significant predictors for high school graduation were geared towards careers requiring a bachelor's

degree. The *Agriculture, Food and Natural Resources* Cluster and the *Hospitality and Tourism* Cluster each produced odds ratios greater than 1.0 and *P* values less than 0.05, indicating that they were significant predictors for high school graduation. The Agriculture Cluster offers a wide variety of courses (APPENDIX A). Courses such as *Small Animal Management*, *Advanced Animal Science*, *Wildlife, Fisheries and Ecology Management*, and *Veterinary Medical Applications* are courses intended to prepare college-bound students for careers in conservation, and veterinary medicine. The cluster also offers several courses that prepare students for a career immediately after high school. Courses such as *Floral Design*, *Food Technology and Safety*, and *Agriculture Mechanics and Metal Technologies* prepare high school students to take and obtain industry credentials with which they can seek immediate employment after high school.

There are only four courses offered as part of the Hospitality and Tourism Cluster: a) *Food Science*, b) *Culinary Arts*, c) *Advanced Culinary Arts*, and d) *Practicum in Culinary Arts*. These courses are intended to prepare students for careers in the restaurant industry, and while most aspiring chefs attend a Culinary Institute before becoming the Head Chef in the industry, the career does not require a four-year degree from a college or university. Yet the Hospitality and Tourism Cluster produced odds ratio of 4.32 and a *P* value of 0.00. These data indicate that of the 13 CTE Clusters, the Hospitality Cluster was the third most significant predictor for high school graduation.

Research question seven, *What are the perceptions of CTE educators concerning the impact of Career and Technical Education courses on graduation rates?*, was answered by utilizing an inductive thematic coding process to analyze 12 semi-structured interviews of DWISD teachers and administrators. The qualitative analysis of this study found four emergent themes: student engagement, increased student ownership, authentic experiences, and CTE teachers' capacity to build positive relationships and rapport.

The interview participants perceived that there were three contributing factors to CTE teachers' increased capacity to deliver highly engaging lessons: *student choice*, *flexibility*, and *competition*. The first theme that participants spoke of had to do with *student choice*. There exists a relationship between student choice or autonomy and high levels of student engagement (Gentry et al., 2007; Stone, 2017). Given that virtually all the CTE courses in this study were electives, students were not required to take them to graduate from high school. The participants mentioned that in most cases students enrolled in CTE courses because they had some interest in the content. Whereas students had to take an Algebra course whether they liked math or not. The participants maintained that students enrolled in their courses because they were curious in the content area. As such, it was easier for them to engage the students and draw relevant connections between the course content and the students' interests.

Four of the twelve participants in this study perceived that they enjoyed greater flexibility as CTE teachers than their peers in other departments. They claimed that this increased sense of flexibility enabled them to design more dynamic and engaging lessons. Two of the participants, Teachers Melon and Cherry, described how CTE teachers benefited from not having to prepare their students for a state accountability test. There exists research suggesting that standardized tests used for school accountability led to increased dropout rates (Bost & Riccomini, 2006). Further, enrollment in CTE courses leads to decreased dropout rates (Bloomfield et al., 2013; Fletcher, Lasonen, & Hernandez, 2014; Plank et al., 2008; Reese, 2005; Ruiz-Gallardo et al., 2013; Stone & Alfeld, 2004). Few researchers, however, have suggested that CTE students experience lower dropout rates because CTE curriculum is not included in state accountability tests. Teachers Melon and Cherry argued that the state's curriculum and content standards in many of the core classes were prescriptive, often too structured, and inhibited teacher

creativity. Their argument was that while core teachers are often preoccupied with preparing their students to succeed on the state accountability tests, CTE teachers could pace their course's scope and sequence according to what they believed was best for their students. They had the flexibility to introduce and explore new concepts and ideas with their students, while core teachers were behold to a rigorous timeline in anticipation of the annual accountability test.

One of the participants defined flexibility in another way. Teacher Lime spoke about how his courses' CTE curriculum allowed him to utilize a project-based lesson design. He felt that his counterparts in the core departments were over-reliant on lecture-based instruction and multiple-choice tests. He enjoyed the fact that he was encouraged to incorporate project-based lessons that allowed his students to problem-solve and work with their hands. He believed that this approach was far more effective and engaging to his students.

The participants identified *competition* as the third factor that contributes to student engagement. The participants knew that students were limited to the number of courses they could take every year. After accounting for the courses required for graduation, most students were limited to one or two elective courses each year. As such, CTE teachers found that they had to promote their courses to recruit students. Teachers feared that when students did not see the value in taking a specific elective course, they would simply choose another. If a CTE teacher could not recruit enough students to justify offering the course, then the course would not have the requisite number of students and the teacher would be asked to teach another course outside of his area of interest or expertise. So, the CTE teachers found themselves in direct competition with one another which incentivized them to create and deliver highly engaging lessons.

Teachers Orange, Lime and Pear spoke about how important it was to develop a positive reputation among the student body. They perceived that if students heard through word of mouth that their courses were dry or boring, their programs would suffer. They endeavored to offer highly engaging lessons in the hopes that their students would tell their friends how much they enjoyed the class. Presumably, if the friends learned how fun and engaging the courses were, they would enroll the following year, and the CTE teachers would preserve the strength and viability of their programs.

The administrators similarly recognized that CTE teachers competed against each other and stressed how important it was for the CTE teachers to promote their courses. Principal Avocado and Assistant Principal Banana described how a school will only function if the administrators can create a complex master schedule that meets the needs of students and teachers. The master schedule must be designed to ensure that each student is scheduled into the courses they need to graduate, as well the elective courses that they wish to take. The student/teacher ratios for each class must be monitored to ensure that no class has too many or too few students. The schedule must also be designed around the teachers. They must be given a conference period and a 30-minute duty free lunch every day. Further, they may only be assigned courses for which they are certified to teach. The administrators explained that there are so many factors that go into a master schedule, they cannot accommodate all requests. Therefore, there are times when administrators must discontinue a course due to lack of student interest. The CTE teachers who participated in this study were aware of this reality and found themselves in direct competition with each other, as well as with elective teachers from other departments. Mr. Orange may have put it best when he said, "... it's kind of a dog-eat-dog world out there, it's either us or fine arts or athletics, or an elective in languages other than English." Existing research has found that a school can reduce its dropout rate by

changing its infrastructure or master schedule (McCallum & Sparapani, 2010), but little research has been done establishing how competition between CTE teachers or programs influences master schedule decisions or overall dropout rates. This study has found that competition between CTE teachers is a contributing factor to high levels of engagement in the CTE classes and a decreased dropout rate among those students enrolled in CTE courses.

The next emergent theme from the participant interviews was that of *increased student ownership*. The interview participants spoke of the perks and privileges their programs afforded to students. Many of the Career and Technical Education Student Organizations (CTSO's) offered the students chances to travel, compete in competitions and participate in state or national conferences. Student participation in CTSO's increases academic achievement, career-self-efficacy, college aspiration and employability skills (Alfeld et al., 2007; Aragon, et al., 2013; McNally & Harvey, 2001). The participants in this study described how CTSO's worked in DWISD. Just as a school's athletes can represent the school and community in athletic contests, the DWISD CTE students were able to compete similarly in variety of career, skills-based competitions in areas such as culinary, agriculture, and robotics. The students knew, however, that their ability to compete and represent the school was a privilege, not a right. They had to maintain passing grades, good attendance, and positive discipline records to be eligible to compete and participate as an active member of the team. The interview participants perceived that the students felt pride and ownership when they were given the opportunity to represent the school, and because they had to maintain their eligibility, they were incentivized to work hard in all classes, which in turn led to higher levels of student engagement and decreased dropout rates.

The participants who were campus administrators acknowledged that this sense of student/program ownership could be used as a powerful dropout prevention tool for at-risk students. They believed that if they could help at-risk students find a class or a program that was of interest to them, the teachers would then engage the students and offer them opportunities and privileges that were previously unavailable. The administrators believed that when students develop a passion, or at least a passing interest, in one of the CTE programs the students become connected to the school, they see value in attending every day, and are far less likely to drop out.

Another theme that emerged from the participant interviews had to do with the *authentic experiences* that students are exposed to in CTE courses. CTE courses provide students the opportunity to engage in authentic work-based learning (Stone, 2017; Fletcher Jr. et al., 2018). Each interview participant talked about how CTE courses were unique in that they exposed students to authentic, real-world experiences in ways that are not normally done in other traditionally academic classrooms. Whereas a geometry teacher might teach a mathematical formula and speak theoretically about how the formula might be used in the real world, the students in a construction class had to learn the same formula, measure the angles, cut the wood, and assemble the door frame. The interview participants argued that the skills-based, project-lesson design used in CTE courses allow students to better understand intellectual concepts and immediately see relevance when they are asked to apply the concept in a real and concrete way.

The CTE teachers offered several examples of how this was done in their classrooms. Teacher Pear taught her students concepts and theories regarding early child development, then supervised her high school students as they taught and cared for four-year-old children in a daycare setting. Teacher Melon taught his students what they need to know to be successful, certified Veterinary Technicians, which allowed them to be

placed in Veterinary Clinic internships. Teacher Lime and Teacher Orange asked their students to apply what they learned in their engineering courses to identify a problem in the world; then research, design and construct the solution to the identified problem. Each example showcased how CTE students were asked not only to demonstrate that they understood a concept but apply what they learned in an authentic real-world scenario.

Finally, six of the interview participants spoke of how CTE teachers enjoy a greater capacity to establish and maintain positive relationships with their students. This is particularly significant considering that Jarjoura (1993) found that students who developed strong social bonds within the school setting successfully acclimated to school, while those who could not develop positive social bonds were more likely to drop out. Teacher Pear mentioned that her child development and child guidance courses are relatively small compared to other classes. Given the relatively low student to teacher ratio, Teacher Pear believed that she could devote more time getting to know each of her students. Teacher Melon discussed how he was one of only 4 agriculture teachers on his campus, which meant that he frequently had students that he had taught in previous years. Being able to teach the same students three or four years in a row allowed him to build deeper relationships with them. There is abundant research that suggests that students' relationships with their teachers, or the lack thereof, can be a significant factor in whether they are successful in school (Äärelä et al., 2015). Further, CTE programs are designed around technical profiles that allow teachers and students to personalize learning which enables students and teachers to form more powerful relationships (Bloomfield et al., 2013). What has not been discussed in these studies, however, is Mr. Melon's assertion that CTE teachers can build better relationships because they are afforded more time to connect with their students. Teacher Mango also spoke about how much time she got to

spend with her culinary students as they ran a catering enterprise after school. She described how her program felt very much like a family because of the amount of time she spent with her students. In each case, the participants valued the circumstances that allowed them to develop lasting relationships with their students. They perceived that students were more successful in school if they found a safe place where they could learn and have fun with others who shared similar interests and experiences, which in turn would motivate the students to do well and graduate from high school.

Implications

This study has found that there exists a relationship between CTE enrollment and the Drowsy Willow Independent School District's (DWISD) high school graduation rates. The study produced numerous data points for which the district and the DWISD community should be proud. The district maintains a 2.4% dropout rate, which well below the national averages (McFarland, Cui, Holmes & Wang, 2019). The district also developed an impressive array of Career and Technical Education programs and course offerings, giving students the ability to explore their interests and prepare for future occupations. This comprehensive CTE program has proven to be an asset to the DWISD students and community at large.

DWISD is a highly functional school district, but good organizations can always be made better. DWISD administrators should analyze the data presented in this study and consider the following. First, as previously mentioned the district maintained a 2.4% dropout rate from schoolyears 2010 to 2015. This is a relative low dropout rate, but disproportional rates were found when factoring for ethnicity and gender. Boys dropped out of DWISD schools at a higher rate than girls. Similarly, African American, Native American, and Hispanic and Latino students dropped out of school at disproportionately higher rates. School officials should review their internal dropout prevention practices to

ensure they include a procedure that would enable school personnel to analyze the factors that influence students dropping out of school. Beyond CTE enrollment, the focus of this study, there are likely a multitude of factors that influence dropout behavior. These factors could range from substance abuse, to teen-pregnancy, domestic violence, etc. Given that there were only 404 students who dropped out of the DWISD high schools between 2010 and 2016, these data could be compiled with relative ease. Once the data are compiled district officials should determine emergent patterns and intervene accordingly.

When evaluating the relationship between CTE course enrollment and the DWISD graduation rates, this researcher found: (a) that 89% of DWISD students enrolled in at least one CTE course; (b) those students who enrolled in CTE courses graduated at higher rates; and (c) enrollment in each of the 13 CTE clusters increased the students' likelihood of graduating from high school. Given these findings, DWISD administrators should determine why 11% of DWISD students never enrolled in any CTE courses at all. Presumably, some DWISD students choose to participate in other elective programs in fine arts or athletics. But is that true for all of them? DWISD administrators should conduct a transcript audit of those students who drop out of school and determine the extent to which they participated in elective coursework. This study found that participation in CTE coursework had positive outcomes on dropout prevention. It is plausible that studies on participation in DWISD athletics and fine arts programs would likely produce similar results. School officials need to determine why students choose not to take CTE courses. They may find that a large percentage of advanced students choose not to take CTE courses because the CTE Clusters do not offer many courses that receive a weighted Grade Point Average (GPA). Thus, these students might perceive that taking CTE courses reduces their chances of being accepted to prestigious universities. If

that is the case, administrators need not worry about at-risk students not given the opportunity to benefit from the CTE programs, though they may consider expanding the number of advanced CTE courses that receive weighted GPA points within the GPA scale.

The transcript audit could identify internal practices that prevent at-risk populations from participating in CTE courses. Suppose that a high school student fails *Algebra I*, *Biology* and *World Geography* in his freshman year, but passes *Physical Education*, *Spanish*, *English Language Arts* and *Art*. This hypothetical student has failed three of his seven courses and has yet to take a course he is remotely interested in. His guidance counselor must consider credit recovery strategies to ensure that the student will graduate on time, but also needs to consider that the student has been unsuccessful in, and dispassionate about, the courses he has taken so far. School officials need to carefully consider how they advise at-risk students. One option would be to recommend that the student retake, in his sophomore year, the courses he failed as a freshman along with the sophomore slate of core classes. This recommendation is a bit of a gamble in that if the student passes all courses in his sophomore year, he is back on track for graduation. However, if he continues to struggle and fail, he could enter a cyclical pattern of defeat and frustration, which could eventually lead him towards dropping out of school. School officials need to consider ways to utilize CTE and other elective programs to reengage their students, especially those who are most at-risk of dropping out.

Finally, DWISD administrators should consider the factors that contribute to the CTE programs' success regarding dropout prevention. Interview participants perceived that at-risk students benefited from being in their CTE classes because the teachers were able to create environments in which all students felt welcome and successful. The CTE teachers believed that when compared to teachers in traditional core departments, they

were better prepared to engage at-risk students and intervene when necessary. They cited numerous factors to support their claim. They posited that students find CTE courses more engaging than core classes because of the following: (a) students find CTE course curriculum interesting and relevant; (b) CTE instructors have more flexibility to modify their curriculum to meet their students' needs and interests, and (c) CTE teachers are incentivized to design and deliver highly engaging lesson design. The interview participants also believed that they had increased capacity to develop and maintain positive relationships with their students, which in turn was particularly beneficial for at-risk students. DWISD administrators should identify the best practices CTE teachers use to create engaging lessons and build relationships. Once identified, the administrators should determine if those practices are being employed in other departments, and if not, what could be done to ensure all teachers have the advantages the CTE participants described.

Conclusion and Recommendations for Future Research

This study has found that there exists a positive relationship between Career and Technical Education enrollment and high school dropout out rates, and many of the results herein match previously established CTE and dropout research (Bloomfield et al., 2013; Plank, 2001; Plank, DeLuca, & Estacion, 2008; Reese, 2005; Ruiz-Gallardo, Verde, & Valdés, 2013; Schwartz, 2014; Stone & Alfeld, 2004). While it has been established that there exists a relationship between CTE enrollment and graduation rates. This study sought to explain the relationship from CTE educators' perspectives. This research should be expanded to include the students' voices. It would be important to document and consider the perceptions of those students who were greatly at-risk of dropping out of school but were able to persevere and graduate. Those students should be asked to recount their stories and expound on the factors that put them at risk of

dropping out, as well as the interventions that allowed them to continue in school. Research should also be done to include the voices of those who eventually dropped out of school. The researchers should identify the factors that influenced the dropout behavior. Those influences could be categorized as internal school factors (i.e. CTE enrollment, engaging instruction, bullying, etc.) and external factors such as domestic violence at home, substance abuse, and teen-age pregnancy. Once those factors have been identified and categorized, school administrators will be able to interpret the data, discerns patterns and implement interventions to mitigate dropout influencers.

This study sought to analyze CTE teachers' perceptions of dropout prevention, and in many cases the CTE educators contrasted themselves with non-CTE teachers. CTE teachers perceived that they were better equipped to work with at-risk students and intervene when needed. Further research should be done to consider if non-CTE teachers share the same perception. It is entirely plausible that math or teachers disagree with the CTE teachers' perception that students find CTE coursework more engaging and relevant. Similarly, it would be interesting to compare the ways CTE and non-CTE teachers intervene when they recognize potential dropout behavior.

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APPENDIX A:
CAREER AND TECHNICAL EDUCATION (CTE) CLUSTERS

CTE Career Cluster	Course #	CTE Course Title	Credits
Agriculture, Food & Natural Resources	7000	Principles of Agriculture, Food & Natural Resources	1.0
	7010	Small Animal Management	0.5
	7015	Professional Standards in Agribusiness	0.5
	7017	Wildlife Fisheries & Ecology Management	1.0
	7018	Livestock Production	1.0
	7019	Food Technology & Safety	1.0

	7020	Veterinary Medical Applications	1.0
	7021	Advanced Animal Science	1.0
	7030	Floral Design	1.0
	7033	Horticulture Science	1.0
	7070	Agriculture Mechanics & Metal Technologies	1.0
	7072	Agriculture Structures Design & Fabrication	1.0
	7072L	Agriculture Lab & Field Experience	1.0
	7090	Practicum in Agriculture, Food and Natural Resources	2.0
	7095	Practicum in Veterinary Medicine	2.0
Architecture & Construction			
	7100	Interior Design	1.0
	7145	Principles of Construction	1.0
	7146	Construction Technology	2.0
		I	
	7147	Construction Technology	2.0
		II	
	7148	Practicum in Construction Technology	2.0

Arts, A/V Technology
&
Communication

7200	Professional Communication	0.5
7225	Audio/Visual Production I	1.0
7226	Audio/Visual Production II/ AV Production Lab	2.0
7227	Practicum in Audio/Video Production	2.0
7227L	Practicum in Audio/Video Production/ Extended Practicum in AV Production	3.0
7231	Animation I	1.0
7233	Animation II	1.0
7240	Fashion Design I	1.0
7241	Graphic Design & Illustration I	1.0
7243	Graphic Design & Illustration II	1.0
7245	Fashion Design II	1.0
7250	Video Game Design	1.0

Business Management/
Administration
& Finance

Education & Training	7300	Principles of Business, Marketing & Finance	1.0
	7330	Business Law	1.0
	7320	Touch Systems Data Entry (Keyboarding)	0.5
	7321	Business Information Management I	1.0
	7331	Practicum in Small Business Management I	2.0
	7332	Practicum in Small Business Management II	2.0
	7391	Career Preparation I	2.0
	7391L	Career Preparation I/ Extended Career Preparation I	3.0
	7392	Career Preparation II	2.0
	7392L	Career Preparation II/ Extended Career Preparation	3.0
	7499	Independent Study Mentorship Project Based Research (AA)	1.0
	7341	Accounting I	1.0
	7342	Accounting II	1.0
	7709	Principles of Education & Training	1.0

Health Services	7711	Teacher Education Training I	2.0
	7712	Teacher Education Training II	2.0
	7501	Principles of Health Science	1.0
	7503	Certified Nursing Assistant- Practicum in Health Science	2.0
	7504	Pharmacy Technician- Practicum in Health Science	2.0
	7505	Health Science Theory/Health Science Clinical	2.0
	7511	Medical Terminology	1.0
	7530	Pathophysiology	1.0
	7550	Anatomy & Physiology	1.0
	7550H	Anatomy & Physiology (AA)	1.0
	7560	Dentistry-Practicum in Health Science	2.0
	7570	Principles in Biomedical Science (AA)	1.0
	7571	Human Body Systems (AA)	1.0

	7572	Medical Interventions	1.0
		(AA)	
	7573	Biomedical Innovation	1.0
		(AA)	
Hospitality & Tourism			
	7620	Food Science	1.0
	7621	Culinary Arts	2.0
	7622	Advanced Culinary Arts	2.0
	7690	Practicum in Culinary	2.0
		Arts	
Human Services			
	7340	Dollars & Sense	0.5
	7500	Lifetime Nutrition and	0.5
		Wellness	
	7713	Child Development	1.0
	7721	Child Guidance I	2.0
	7722	Child Guidance II	2.0
	7750	Interpersonal Studies	0.5
	7763	Introduction to	1.0
		Cosmetology	
	7763L	Cosmetology I	2.0
	7765	Cosmetology II	2.0
	7765L	Principles of Cosmetology	1.0
		Design & Color Theory	

Information

Technology

2820	AP Computer Science Principles (PreAP/GT)	1.0
2821	Computer Science (AP/GT)	1.0
2890	Independent Study Mentorship Computer Science (AA)	1.0
7201	Digital Media	1.0
7410	Computer Maintenance	1.0
7410L	Computer Maintenance/Computer Maintenance Lab	2.0
7420	Computer Technician Practicum	2.0
7450	Computer Science/Programming	1.0
7450Q	Computer Science/Programming (PreAP/GT)	1.0

Manufacturing

7160	Manufacturing Engineering Technology	1.0
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Marketing	7161	Metal Manufacturing & Machining	2.0
	7162	Metal Manufacturing & Machining II	2.0
	7350	Social Media Marketing	0.5
	7370	Fashion Marketing	0.5
	7375	Sports & Entertainment Marketing	0.5
	7380	Entrepreneurship	1.0
Science, Technology, Engineering & Mathematics (STEM)	7900	Introduction to Engineering Design (AA)	1.0
	7910	Engineering Science (AA)	1.0
	7911	Digital Electronics (AA)	1.0
	7920	Civil Engineering & Architecture (AA)	1.0
	7921	Aerospace Engineering (AA)	1.0
	7940	Engineering Design & Development (AA)	1.0
	7951	Forensic Science	1.0

	7964	Biotechnology I (AA)	1.0
	7965	Biotechnology II (AA)	1.0
	7972/7972L	Broadband	2.0
		Communications I & II	
	7972	Broadband	1.0
		Communications I	
	7975	Robotics I (AA)	1.0
	7976	Practicum in Robotics	2.0
		(AA)	
	7990	Practicum in	2.0
		Biotechnology	
	7991	Biotechnology	1.0
		Independent Study Mentorship	
		Project Based Research (AA)	
Transportation			
	7811	Automotive Technology I	2.0
	7812	Automotive Technology II	2.0
	7890	Practicum in	2.0
		Transportation Systems	

Advanced Academics (AA), Pre-advanced Placement (PreAP), Advanced Placement (AP) and Gifted and Talented (GT) courses are designated as Level 1 Courses and carry a higher weight in the district's Grade Point Average (GPA) Scale (see APPENDIX B).

APPENDIX B:

DROWSY WILLOW INDEPENDENT SCHOOL DISTRICT (DWISD) GRADE
POINT AVERAGE (GPA) SCALE

Actual Grade	Grade Points		
	Level 1	Level 2	Level 3
100	6.0	5.0	4.0
99	5.9	4.9	3.9
98	5.8	4.8	3.8
97	5.7	4.7	3.7
96	5.6	4.6	3.6
95	5.5	4.5	3.5
94	5.4	4.4	3.4
93	5.3	4.3	3.3
92	5.2	4.2	3.2
91	5.1	4.1	3.1
90	5.0	4.0	3.0
89	4.9	3.9	2.9
88	4.8	3.8	2.8
87	4.7	3.7	2.7
86	4.6	3.6	2.6
85	4.5	3.5	2.5
84	4.4	3.4	2.4
83	4.3	3.3	2.3
82	4.2	3.2	2.2
81	4.1	3.1	2.1

80	4.0	3.0	2.0
79	3.9	2.9	1.9
78	3.8	2.8	1.8
77	3.7	2.7	1.7
76	3.6	2.6	1.6
75	3.5	2.5	1.5
74	3.4	2.4	1.4
73	3.3	2.3	1.3
72	3.2	2.2	1.2
71	3.1	2.1	1.1
70	3.0	2.0	1.0
Below 70	0	0	0

The DWISD Course Selection Handbook defines Level 1 Courses as follows: Advanced Academics (AA), Pre-advanced Placement (PreAP), Advanced Placement (AP) and Gifted and Talented (GT). Level 2 Courses include all general education courses. Level 3 Courses include courses wherein the content and curricula have been modified by a Special Education Annual/Determination/Review (ARD Committee).