An Analysis of Career and Technical Education's Influence on Graduation Rates in the Commonwealth of Virginia

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ABSTRACT

Every Student Succeeds Act of 2015 (ESSA), signed into law by President Obama on December 10, 2015, amended several K-12 accountability requirements. ESSA defined high school graduation rate for the first time in federal education law. In ESSA, the Four-Year Adjusted Cohort Graduation Rate (ACGR) was defined as the ratio of the number of students who graduated with a regular high school diploma over the course of four years divided by the number of students who made up an adjusted cohort. Under ESSA, high schools that graduate less than 67 percent of their students were labeled as low performing. The graduation rate differed significantly between high schools and was influenced by multiple factors. Among other factors, the difference in graduation rates might be attributed to increased dropout rates among groups, such as males, racial minorities, low socioeconomic (SES) families, and schools that were located in urban areas (Bower et al., 2013).

This study was modeled after the work of Blowe (2011) and White (2015). A quasi-experimental analysis of ex post facto data was conducted to determine if CTE completion affected students' standardized assessment scores and graduation rates. The purpose of this study was to determine if the completion of Career and Technical Education (CTE) sequences was associated with the graduation rates among Virginia students for the 2016-17, 2017-18, and 2018-19 cohort years. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. School graduation data from the 132 school divisions

were grouped according to The National Center for Education Statistics' designated locale classifications type to determine if CTE sequence completion and locale type were associated with graduation rates of each geographic region. The researcher used quasi-experimental, comparative analysis, t-test, and ANOVA to analyze the graduation data of each locale type.

The study determined that CTE finishers' graduation rates were significantly higher than students who have not completed CTE programs. In addition, regional classifications had a statistically significant influence on the overall graduation rates for all students.

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GENERAL AUDIENCE ABSTRACT

Every Student Succeeds Act of 2015 (ESSA), signed into law by President Barak Obama on December 10, 2015, amended several K-12 accountability requirements for K-12 education. Under ESSA, graduation rates were an essential measure of student outcomes, and high schools that graduated less than 67 percent of their students were labeled as low performing. Across the country, the graduation rate differed significantly between high schools and was influenced by a wide range of factors. Among other factors, the difference in graduation rates might be attributed to factors including increased dropout rates among groups, such as males, racial minorities, Hispanics, low socioeconomic (SES) families, and schools that were located in urban areas (Bower et al., 2013). The achievement of a diploma allowed students to choose their path - whether they wish to attend a two- or four-year college, a technical school, workforce training, or enter the military.

This study was modeled after the work of Blowe (2011) and White (2015) in using existing data to determine if CTE completion had an association with earning a diploma. The purpose of this study was to determine if the completion of Career and Technical Education (CTE) sequences was associated with the graduation rates of Virginia students for the 2016-17, 2017-18, and 2018-19 cohort years. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. That is, the study analyzed the graduation rates of Virginia's 132 school divisions in determining if completing a CTE course

sequence affected state graduation as well as regional graduation rates. Schools were grouped according to The National Center for Education Statistics' designated locale classifications type. The researcher used statistical analysis to compare the graduation data of each locale grouping, rural, town, suburban, and city, to the corresponding annual state average. The results of the study indicated that graduation rates for students who finished CTE sequences were significantly higher than their peers who did not finish a CTE sequence and that regional classifications influenced overall graduation rates.

Dedication

In honor of my loving mother, Velma Wynn Crenshaw, I dedicate this research study to her. My mother is one of my greatest supporters, and I am grateful for the support she has given me. Throughout my life, my mother has always believed in my abilities and supported me in overcoming challenges.

Acknowledgements

This educational journey would not have been possible without the love of my wife, Jessica. I would like to express my sincere gratitude to her for all the support, encouragement, and lessons she provided me with during this time. Together as partners we set out on this educational journey to both become doctors while motivating one another to never quit. I would also want to thank our children, Krystal and Hart, for giving up their time and allowing us to focus on hours of classwork. In memory of my father, Cecil Sr., for teaching me to overcome adversity fearlessly and for teaching me to be strong during times of adversity. I would like to take this opportunity to express my deepest gratitude to my aunt, Jocelyn Barnwell. She has served as a moral compass, an adviser, and a mentor at pivotal moments in my life. My journey has been made more meaningful by the fact that I am able to share it with you all. In my heart, I will always be grateful to you.

My sincere thanks extend to Dr. Ted Price, my committee chair, and my committee members, Dr. Jodie Brinkmann, Dr. Carol Cash, and Dr. David White. It has been an honor to receive your feedback and guidance throughout my doctoral journey.

In closing, let me take this opportunity to thank my sisters, Angela and Crystal, for their ongoing support and guidance. Their guidance and support have allowed me to develop as a person and improved the trajectory of my life in every way.

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Chapter One

Introduction

Students who completed a concentration of three or more CTE credits graduated at higher rates, on average, than non-CTE concentration peers (Dougherty, 2016; Kreisman & Stange, 2017). Graduating with a high school diploma increased student opportunities and affected several long-term outcomes (Campbell, 2015). According to Sum et al. (2009), on average, individuals who did not complete high school contributed less to the economy, were more likely to be incarcerated, and were less likely to be healthy than people who did complete high school. Dropout rates in the United States were disproportionately higher in low-income, rural, and minority communities (McMurrey, 2014). Based on a 2004 American Community survey, Strange (2011) found that rural dropout rates (11%) were higher than those in suburban areas (9%) but lower than those in cities (13%.). Further, Strange (2011) determined that the average freshman graduation rate in rural areas was 75%, which was higher than the average freshman graduation rate in cities (65%) but lower than the average freshman graduation rate in suburbs and towns (79% and 76%, respectively). According to Schott Foundation (2015), in the 2012-2013 academic year, there was a 59% graduation rate for African American males, a 65% graduation rate for Latino males, and 80% graduation rate for White males. Estes and McCain (2019) identified high-quality career and technical education (CTE) programs as being powerful tools that can close the achievement gap and increase students' opportunities for advancement. Students participating in a high-quality CTE program increased their probability of on-time high school graduation by 3 to 5% for higher-income students and 7% for their lower-income peers (Dougherty, 2018). In one study, career academy enrollment increased the likelihood of high school graduation and college enrollment for male students (Hemelt et al., 2019). Boys attending

CTE high schools were approximately 10% more likely to graduate from high school and had quarterly earnings of approximately 31% higher (Brunner et al., 2019). Therefore, this study used a quantitative research design to analyze the cohort graduation data of CTE and non-CTE completers from 2017, 2018, and 2019. The 132 Virginia school divisions are grouped into four categories according to their primary locale type (see Appendix A). As defined by the National Center for Education Statistics (NCES), the classification of U.S. territory is based on general geographical indicators that are grouped into four main categories: City, Suburban, Town, and Rural (NCES, 2018). Based on Blowe's (2011) and White's (2015) research, this study employed a quasi-experimental correlation evaluation of ex post facto data to determine the impact locale classification and CTE completion had on graduation rates in the Commonwealth of Virginia.

Overview of the Chapter

This chapter provided an in-depth understanding of the study by reviewing the history of vocational education, defining the problem, explaining its significance, and proposing research questions and hypotheses. A comprehensive description of this study's conceptual framework is presented. Throughout this chapter, key terms are defined to ensure that the reader understands how each term was used throughout the study. A detailed discussion of the study's limitations and delimitations are included. Finally, the chapter concludes with a description of how the study was organized and how it was conducted.

Historical Perspective

The Smith-Hughes Vocational Education Act of 1917 provided federal funds for vocational education in schools. The stipulations that guided the use of the federal funds to teach work-ready skills changed over time and eventually became the Elementary and Secondary Act (EASA) of 1965 which was designed to ensure that all children had equitable access to

vocational training. In time, vocational training changed and eventually turned into Career and Technical Education (CTE). However, the purpose of the designated funds to ensure that people had the skills needed to perform labor-intensive jobs remained the same. In 1984, the act was renamed the Carl D. Perkins Vocational Education Act which helped states fund vocational training and education for children and adults and limited gender stereotypes in the CTE courses (Perkins Collaborative Resource Network [PCRN], 1984). From 1984 to present, there have been four addendums that added standards to the Perkins Act, with each one providing more rigor and standards for CTE programs.

Vocational education has a deep legislative history in the American public education system, expanding over one hundred years (Hodge et al., 2020). In America, vocational education began with the Morrill Act, also known as the Land-Grant College Act of 1862. The Morrill Act of 1862 was the first legislation enacted to establish land-grant universities to create an agriculturally skilled and mechanically skilled population (Dougherty et al., 2019). Under the Morrill Act of 1862, the government provided each state with 30,000 acres of Federal land to establish colleges (Dougherty et al., 2019). The colleges specialized provided the foundation for training students in agriculture, home economics, and mechanical arts (Gordon, 2007). A primary goal of the Morrill Act was to improve access to a public college education for all citizens (Ingrassia, 2018).

Industrialization and the development of cities served as a driving force behind the continued development of vocational education legislation (Gordon & Schultz, 2020). The Smith-Hughes Act of 1917 introduced the federal government's role in Career and Technical Education by introducing vocational education into primary and secondary education (Jocson, 2015). In 1914, the Commission on Nation Aid to Vocation Education was established for the

purpose of ensuring that vocational education became an integral part of the curriculum of high school in the United States (Friedel, 2011). Specifically, programs in agriculture, trade, and industrial arts were designed for students who were male, while programs in home economics were designed for students who were female (Gordon, 2007). Recognized as the first vocational act, the Smith-Hughes Act required each state to have a Board of Vocational Education separate from the State Board of Education (Smith-Hughes Vocational Education Act, 1917).

The George-Reed Act of 1929 provided $1 million in annual funds over four years to hire economic and agriculture subject specialists (George-Reed Act, 1929). Unlike the Smith-Hughes Act, the George-Reed Act contained the following exceptions: farm population determined the basis allotted agricultural education funds and rural population determined the basis for home economics education funds (George-Reed Act, 1929). In the Smith-Hughes Act, the role of household education was separated as a separate division within vocational education, and the creation of Home Economics in public schools was made possible through federal funds (Moraru & Neilson, 2001).

During the 1960s, the federal government continued to increase funding for vocational education (Gordon & Schultz, 2020). The Area Redevelopment Act of 1961 provided $4.5 million annually to increase employment in weakened urban and rural areas. Vocational training and programs would receive a percentage of $4.5 million annually for four years (Gordon, 2007). The Vocational Education Act of 1963 eliminated federal control and gave states the right to determine the disbursement of funds for vocational education (Vocational Act, 1963). In 1963, Vocational Educational Amendments increased funds and expanded the usage to include research, residential-vocational schools, and curriculum development (Tanner & Tanner, 1980).

The Association for Career and Technical Education identified the Carl D. Perkins Acts as the historic legislative event that transformed vocational education into Career and Technical Education. The Act of 1984 created the first tech-prep program design and renamed the vocational legislation to Carl D. Perkins Vocational and Technical Education Act 1984 (Perkins I). Perkins I appropriated $950 million to support vocational initiatives for four years (Carl D. Perkins Vocational and Technical Education Act, 1984).

Significant changes occurred within the Perkins Act guidelines during the 1990s (Wonacott, 2003). First, the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 (Perkins II) required programs to have high standards to assist school systems in teaching competencies that prepared all for work in a technologically advanced society. Additionally, unlike previous legislation, the new version significantly changed the priority placed on all students gaining occupational and academic skills (H.R.7 - 101st Congress (1989-1990): Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990, n.d.). The act included revisions specifically aimed at exposing economically disadvantaged to contextual learning experiences.

The Perkins III Act, signed into law by President Clinton on October 31, 1998, set forth a detailed definition of vocational and technical education and increased accountability measures for states. Perkins III required states to provide data for four core performance indicators focusing on: (1) student attainment, (2) credential attainment, (3) placement and retention, and (4) participation in and completion of non-traditional programs. The focal points of Perkins III emphasized preparing students for postsecondary educational opportunities, future learning, and career development (Carl D. Perkins and Technical Education Act, 1998). With an annual budget

of over $1.3 billion, Perkins III funded local and state-level CTE programs in administration, curricular innovation, equipment purchases, and career guidance services (Lakes, 2007).

The Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) retired the label "vocational education" and replaced it with the federal definition of "career and technical education." Perkins IV provided $1.25 billion of annual support to career and technical education programs and established the standards for overall employability skills contrary to specific skills vocational education training (Carl D. Perkins Career and Technical Education Act, 2006). The Carl D. Perkins Act of 2006 additionally required a program of study. The program of study served as a bridge that links the academic and technical content of secondary courses in postsecondary education (National Education Foundation, 2008).

The Strengthening Career and Technical Education for the 21st Century Act (Perkins V) built on previous reauthorizations and significantly increased flexibility for states and local recipients (Gordon & Schultz, 2020). Signed on July 31, 2018, by Donald Trump, Perkins V increased funds for the first time in about 30 years, with a $75 million increase in calendar year 2018 and another $70 million increase in calendar year 2019. Under Perkins V, school districts had the authority to provide funds for career exploration to middle school students. In addition, the funds could be used for CTE and non-CTE students to receive comprehensive guidance and academic counseling in higher grades.

Hodge et al. (2020) considered the rebranding of vocational education to newly labeled Career and Technical Education as serving dual purposes. First, the Career and Technical Education brand enhanced vocational education with a modern technologically driven and service-based work curriculum with promising career clusters. Programs today are reflective of the developing world economy. Secondly, Career and Technical Education pathways represented

new manufacturing forms, differentiated health services, and information technology (Dougherty et al., 2019). Hodge et al. (2020) identified an evolution of CTE that stepped away from a history of discriminatory enrollment practices linked with vocational education. Tracking students based on race, class, and gender was negatively associated with vocational education's history (Giani, 2019). Vocational tracking segregated student populations by assigning student schedules based on racial, gender, and socioeconomic classifications (Hodge et al., 2020).

The Virginia Department of Education (2014) website compared the historical foundation of vocational education to the modern interpretation of vocational education. According to the Virginia Department of Education (2014), the new version of vocational education was more sophisticated and significantly valued the integration between core academics with career development. The traditional vocational class focused on preparation and association with low pay and low prestige career choices (Fletcher, 2012). Students classified as low achieving or non-college bound were scheduled disproportionately in Career and Technical Education courses (A Brief History of CTE, 2020). The placement in these courses forfeited college access and high-wage employment opportunities (Hodge et al., 2020). Career and Technical Education career clusters in pathways evolved from vocational education to becoming more rigorous and 21st century occupational based. Xing et al. (2019) explained that the current charge for Career and Technical Education was to empower students with the essential skills, abilities, and certifications required for multiple postsecondary opportunities.

Packard et al. (2012) stated that school reforms highlighted Career and Technical Education as a model for strengthening the educational relevance related to improving social mobility. Career and Technical Education career-focused instruction integrated coursework into work-based learning (WBL) experiences. Hodge et al. (2020) explained that Career and

Technical Education task competencies and curriculum frameworks are purposefully designed to deliver learning experiences that were rigorous and authentic. Students in Career and Technical Education programs experienced a cohesive course of study that included WBL coursework, and practical applications. Students were no longer separated into the categories of college-bound and work-bound. Schwartz (2016) stated that Career and Technical Education encompassed information technology, health care, and advanced manufacturing career pathways that provided students a viable route to upward mobility.

Statement of the Problem

Showalter et al. (2019) found that there were inconsistencies in the graduation rates of students across the United States based on factors that include regional contexts and economic status among other factors. In rural Virginia, especially those living in poverty, rural students had lower scores on standardized tests and graduation rates than their non-rural peers and rural students who were not living in poverty (Showalter et al., 2019). Previous studies by Blowe (2011) and White (2015) identified an association between the completion of CTE sequences with higher assessment score and graduation rates. However, there was no current information about if and to what extent the completion status of CTE courses was associated with the graduation rates of school divisions in different regions. Virginia's standard diploma required 22 credits for a student to graduate (Virginia Department of Education, 2022). These credits include one CTE course, economics and personal finance, one industry certification, five verified credits based on the Standards of Learning (SOL), two health and physical education credits, electives, and core classes (English, Social Studies, Science and Mathematics). An advanced diploma required 26 credits which include one CTE course, economics and personal finance, and nine verified SOL credits which included core and elective classes (Virginia Department of

Education, 2022). The requirements for students ensured that students had the basic skills necessary for work or higher education when they graduate in Virginia (Virginia Department of Education, 2022). While students were only required to have one CTE course, students had the option to pursue CTE career pathways based on individual preferences once they reached high school.

Blowe and Price's (2012) research identified that CTE completion had a statistically significant effect on the graduation rates of students. CTE completers graduated at a 6%-13% higher rate than students who did not complete a CTE sequence (Blowe & Price, 2012). Other studies suggested that CTE courses may motivate students to do better in high school because they are able to make a connection from CTE skills courses to standard academic courses since some of the same material was covered in both types of courses (Neild et al., 2015). CTE pathways claimed a reputation for being relevant, academic, and motivating to interested students entering high school (Michels & Liu, 2020). CTE programs provided opportunities for students to obtain professional licenses and industry-certifications while attending high school. The focus of CTE programs was to provide students with academic and career-oriented courses, and many of these programs provided students with the opportunity to gain work experience through internships, job shadowing, on-the-job training, and industry certifications (Smith, 2017). By taking advantage of CTE courses, students can acquire the skills they need to succeed in the workforce instead of having to attend a university or college (Schwartz, 2016). Gottfried and Plasman (2018) found that 12th grade students have a 1.6% higher probability on-time graduation for every CTE unit completed. Additionally, students who completed multiple CTE courses were more apt not to dropout and graduate with their cohort (Gottfried & Plasman, 2018).

Significance of the Study

By comparing the cohort graduation data from the Commonwealth of Virginia, this study analyzed quantitative data that determined if CTE sequence completion was associated with graduation rates and the impact on graduation rates based on the locale type. To receive a standard diploma from the Virginia Board of Education, students must obtain an industry certification before graduation. The industry certification signified mastery of a particular career-ready skill needed for working in the industry (Virginia Department of Education, 2018). This study focused on students who completed a CTE career pathway of two or more CTE classes. Estes and McCain (2019) identified CTE as an essential public education component, and therefore, it must maintain its position in educational initiatives by providing high-quality programs to students that prepare them for success after graduation.

Purpose of the Study

The purpose of this study was to determine the difference, if any, between the graduation rates of students who completed a CTE sequence from 132 school divisions in Virginia and those students who did not complete a CTE sequence. This quantitative study evaluated CTE's association with high school graduation rates across the Commonwealth. As a result, a determination can be made whether CTE was equally associated with supporting students across Virginia to graduate from high school. In addition, the study intended to advance previous studies conducted by White (2015) and Blowe (2011) in determining how completing a CTE course sequence uniquely affects the graduation rates of rural, town, suburban, and city school divisions for the 2016-17, 2017-18, and 2018-19 cohort years. By providing administrators with quantitative information, the better informed they will be able to make informed decisions

regarding the possibility of offering CTE courses to increase graduation rates and enhance the postsecondary opportunities available to students due to these courses (Blowe, 2011).

Justification of the Study

President Barak Obama replaced No Child Left Behind (NCLB) by signing Every Student Succeeds Act (ESSA) on December 10, 2015. ESSA pursued that all students without prejudice received a high standard education with high-quality 21st century skills. In addition, ESSA granted states the authority to coordinate services between post-secondary education and workforce development with CTE. Unlike previous legislation, ESSA defined CTE as integral to a well-rounded education.

This study adds to the limited variety of research conducted in the Commonwealth of Virginia regarding the impact of the completion of CTE courses on the graduation rate among students of different locale types. The study provides quantitative data on the cohort graduation data of CTE completers in Virginia's rural, town, suburban, and city school divisions. As evidenced by research, the work of supporting the significance of students completing CTE sequences affects how school policies are made, and how administrators strengthen local CTE programs.

Research Questions

The research questions guiding this study were as follow:

1) What difference, if any, is there between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

2) What difference, if any, is there between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

Hypotheses

H_o: Graduation rates in the Commonwealth of Virginia have no difference based on a student's completion of a CTE sequence.

H_1: Graduation rates in the Commonwealth of Virginia have differences based on a student's completion of a CTE sequence.

H_o: Graduation rates of rural, town, suburban, and city school divisions in the Commonwealth of Virginia have no statistically significant difference based on a student's completion of a CTE sequence.

H_2: Graduation rates of rural, town, suburban, and city school divisions in the Commonwealth of Virginia have statistically significant differences based on a student's completion of a CTE sequence.

Conceptual Framework

Research-based findings suggest that CTE engagement correlated positively with academic achievement in the form of more students graduating and better performance on tests (Michaels, 2020). Therefore, this study aimed to compare the graduation rates of students who have successfully finished a sequence of CTE courses with their peers who have not completed a CTE sequence. In addition, the study compared the total graduation rates of students according to locale classification and CTE finishers status.

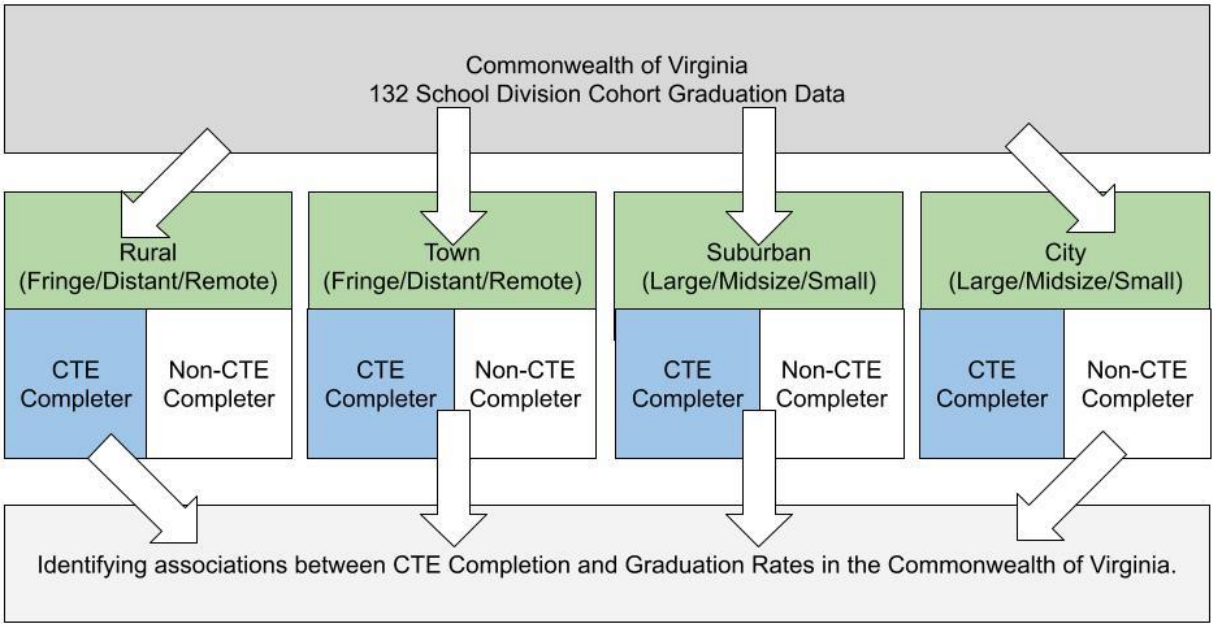
In the Commonwealth of Virginia, cohort graduation data can be analyzed by locale classification and CTE completion status in order to discover if there is a relationship between

completing a CTE sequence and earning a high school diploma in the Commonwealth of Virginia. In this conceptual framework, it is shown that there is a direct correlation between students graduating from high school, the school division classification, and the completion of CTE course sequences.

Figure 1 illustrates the conceptual framework used for this study.

Figure 1

Conceptual Framework



Definition of Terms

The terms listed below were vital to this study. Each of the terms were defined to ensure reader clarity as they relate to this study.

Career and Technical Education (CTE) **–** A broad term used to identify a curriculum encompassing a broad range of career-focused activities, from secondary to postsecondary

education. CTE encompassed a wide range of programs aimed at preparing students for successful lives and employment (Kosloski, 2013).

Cohort **–** a group of ninth-grade students who entered together with the expectation of graduating within four years (Virginia Department of Education, 2022).

CTE Completer **–** A student who fulfilled all the requirements of a CTE cluster including industry certification as part of their high school curriculum and diploma (Virginia Department of Education, 2022).

CTE Finisher **–** A student who has completed a minimum of two (two credits) state-approved CTE courses in a specific pathway and earned at least two standard credits for the courses (Virginia Department of Education, 2022).

Every Student Succeeds Act (ESSA) **–** Every Student Succeeds Act (ESSA), signed into law on December 10, 2015, by President Barack Obama, required that all students in America receive high academic standards to achieve college success. CTE was included in the law's definition of a well-rounded education, as well as requiring schools to coordinate ESSA and CTE plans, integrating academics with CTE coursework, and including a portion of the progress of students toward career and technical education proficiency in state assessments (U.S. Department of Education, 2017).

National Center for Education Statistics (NCES) Locale Classifications **–** NCES provided the framework and criteria that divided locales into four categorical types (city, suburban, town, and rural). Each locale contained three subtypes based on size of city and suburban locales and proximity in case of town and rural assignments (*Education Demographic and Geographic Estimates (EDGE) Program Locale Boundaries File Documentation*, n.d.).

No Child Left Behind (NCLB) – The No Child Left Behind Act of 2001 was a federal law passed under the George W. Bush administration. As the name implies, NCLB was a legislation aimed at achieving standards-based education reform (Lewis, 2014).

Limitations / Delimitations

The quantitative study was limited to analyzing variables collected by the Virginia Department of Education and made available on the Virginia Department of Education School Quality Profiles, the Virginia Department of Education High School Graduates and Completion Report, and the CTE Annual Performance Reports. There was a possibility that a portion of non-CTE completion rate students might have taken one or more CTE courses that were not aligned to a specific concentration sequence. Enrollment in limited or nonsequential CTE courses might have affected the student's academic performance and diploma attainment. According to Price and Murnan (2004), when contributing factors are not controlled by the study, the generalizability may be affected.

The researcher worked professionally in the CTE sector of education and has a strong connection in the field. This history included experience as an agricultural education teacher in a rural school district and served as a supervisor of CTE for both a rural school district and a city school district. Therefore, to mitigate this bias, the researcher chose a quantitative method of study that used ex post facto data provided by the Virginia Department of Education. The ex post facto data includes CTE finisher, non-CTE completer, and total student graduation rates of 132 school divisions across the Commonwealth of Virginia for the 2016-17, 2017-18, and 2018-19 academic years. The data might contain errors in reporting. The researcher acknowledged that additional factors such as gender, socioeconomic status, and ethnicity might influence the graduation rate data.

Delimitations can be defined as the choices a researcher makes regarding the boundaries within which the research will take place (Theofanidis & Fountouki, 2018). The study highlighted two delimitations. The first delimitation of this study was that it would be limited to the cohort graduation rates of CTE completers and those who failed to complete CTE during the 2016-17, 2017-18, and 2018-19 academic years. Second, the sample data of the study was representative of the total number of graduates in Virginia. Therefore, there was no guarantee that the CTE programs or graduation requirements offered in other states are comparable to those of the sample data population.

Organization of Study

This study consisted of five chapters. Chapter One contained the introduction, a history of CTE, statement of the problem, purpose of the study, research questions, significance of the study the definitions of key terminology, and the study's limitations and delimitation. Chapter Two included a literature review covering the history of vocational education to CTE and the relationship between CTE and student achievement along with the relationship between CTE and graduation rates. As part of the discussion, the lack of recent research as well as the limited research was discussed. Chapter Three presented the purpose of the study, research design, research questions, population, data collection and methodology. Chapter Four included a presentation of the study findings, analysis of the data, and a discussion of both. Chapter Five discussed major findings, implications of the study, recommendations for future research, and potential recommendations for local school division leaders.

Chapter Two

Literature Review

The purpose of this literature review was to explore the evolution of Career and Technical Education (CTE) and identify how CTE programs potentially influenced the graduation rates of rural, town, suburban, and city classified school divisions in the Commonwealth of Virginia. Multiple barriers impacted the levels of motivation and ability to learn for students (Berliner, 2009). CTE programs could be used as a tool to increase graduations by engaging students with a career focused curriculum. Hyslop and Imperatore (2013) credited current Career and Technical Education programs as the pioneer in linking classroom instruction to future career opportunities through authentic learning experiences. Hyslop and Imperatore (2013) adhered to the thought that pertinent educational programs in Career and Technical Education enhanced student engagement and prepared students for life beyond high school. Schwartz (2016) stated that Career and Technical Education participation positively influenced high school completion, initial enrollment in college, postsecondary employment, and wages after graduating high school.

Today's Career and Technical Education programs are comprised of rigorous educational standards, technical training, and authentic learning experiences through specific career clusters and pathways (Schwartz, 2016). Career and Technical Education evolved from vocational education to become a rewarding platform for all student populations (Hodge et al., 2020). Theobald et al. (2018) noted that existing research reflected that urban, minority, learning-disabled, and at-risk student populations enrolled in Career and Technical Education programs improved academically and influenced postsecondary outcomes.

Research Strategy

The literature reviewed was conducted primarily using the Virginia Polytechnic Institute and State University Online University Library and Databases. Search engine databases included ERIC Education Recourses Information, Proquest's Dissertations and Thesis, ESCO Host and Google Scholar. Key terms searched included *Career and Technical Education (CTE), vocational education, graduation rates, learning disabled student, urban instruction, and workforce development*. The literature search, which was initiated in October 2020 and concluded in December 2022, focused on the evolution of CTE programs and how they affected the graduation rates of students who complete CTE sequences. A review of 65 articles, five dissertations, and multiple Career and Technical Education professional organization websites was completed based on the theme, relevance, and peer-review status. Research additionally included CTE professional organization websites, states government websites, and websites that house documents produced by the United States Department of Education. Search engine databases included the Association for Career & Technical Education Virginia Department of Education and Library of Congress. The development of common groupings identified 60 relevant sources that suited the literature review criteria.

The History of Career and Technical Education in America

Vocational education had a complicated history in the American public education system and expanded over one hundred years (Hodge et al., 2020). In 1862, the Morrill Act established land-grant universities to develop an agriculturally and mechanically skilled population (Dougherty et al., 2019). Also identified as the Land Grant College Act, the Morrill Act of 1862 provided the foundation for training students in agriculture, home economics, and mechanical arts (Gordon, 2007).

The development of cities and industrialization, including a driving business demand for public education training for future workers, drove vocational education legislation (Gordon & Schultz, 2020). The Smith-Hughes Act of 1917 introduced the federal government's role in Career and Technical Education by introducing vocational education into primary and secondary education (Jocson, 2015). Additionally, recognized as the first vocational act, the Smith-Hughes Act required each state to have a Board of Vocational Education separate from the State Board of Education (Gordon & Schultz, 2020).

The George-Reed Act of 1929 provided $1 million in annual funds over four years to hire economic and agriculture subject specialists (Oklahoma Department of Career and Technology Education, 2006, 2020). Unlike the Smith-Hughes Act, the George-Reed Act contained the following exceptions: farm population determined the basis allotted agricultural education funds and rural population determined the basis for home economics education funds (Gordon & Schultz, 2020). A substantial increase in federal support for vocational education was made through the George-Reed Act, as well as a guarantee of future funding (A Brief History of CTE, 2020).

During the 1960s, the federal government continued to increase funding for vocational education (A Brief History of CTE, 2020). The Area Redevelopment Act of 1961 provided $4.5 million annually to increase employment in weakened urban and rural areas. Vocational training programs would receive a percentage of $4.5 million annually for four years (Gordon, 2007). The Vocational Education Act of 1963 eliminated federal control and gave states the right to determine the disbursement of funds for vocational education (Gordon & Schultz, 2020). In 1963, vocational educational amendments increased funds and expanded the usage to include research, residential-vocational schools, and curriculum development (Tanner & Tanner, 1980).

The association for Career and Technical Education identified the Carl D. Perkins Acts as the historic legislative event that transformed vocational education into Career and Technical Education (A Brief History of CTE, 2020). The Act of 1984 created the first tech-prep program design and renamed the vocational legislation to Carl D. Perkins Vocational and Technical Education Act 1984 (Perkins I). Perkins 1984 appropriated $950 million to support vocational initiatives for four years (Carl D. Perkins Vocational and Technical Education Act, 1984).

Three significant changes occurred within Perkins Act guidelines during the 1990s (Wonacott, 2003). First, the Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990 (Perkins II) required programs to have high standards. Secondly, funding increased by $600 million and reauthorized Perkins I for five years (Carl D. Perkins Vocational and Applied Technology Education Act, 1990). Finally, unlike previous legislation, the third significance of Perkins II changed the priority placed on all students to gain occupational and academic skills (Wonacott, 2003).

Preparing students for postsecondary educational opportunities, future learning, and careers were the primary focal points of the Carl D. Perkins Vocational and Technical Education Act of 1998 (Perkins III). The Perkins III Act additionally provided a detailed definition of vocational education. The Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) retired the label “vocational education” and replaced it with the federal definition of “Career and Technical Education”. Perkins IV provided $1.25 billion of annual support to career and technical education programs and established the standards for overall employability skills contrary to specific skills training (Carl D. Perkins Career and Technical Education Act, 2006). The Carl D. Perkins Act of 2006 additionally required a program of study. The program of study

served as a bridge that linked the academic and technical content of secondary courses in postsecondary education (National Education Foundation, 2008).

In 2018, The Strengthening Career and Technical Education for the 21st Century Act (Perkins V) built off prior amendments and made significant updates to afford states and local recipients more flexibility (A Brief History of CTE, 2020). In 2018, Congress also approved the Perkins Act increased funds for the first time in about 30 years, with a $75 million increase in calendar year 2018 and another $70 million increase in calendar year 2019 (A Brief History of CTE, 2020).

Hodge et al. (2020) considered the rebranding of vocational education to newly labeled Career and Technical Education as it served dual purposes. First, a reimagined Career and Technical Education brand enhanced vocational education with a modern technologically driven and service-based work curriculum with promising career clusters. Programs today were reflective of the developing world economy (Hodge, 2020). Second, Career and Technical Education pathways represented new manufacturing forms, differentiated health services, and information technology (Dougherty et al., 2019). Hodge et al. (2020) case brief identified an evolution of CTE that stepped away from a history of discriminatory enrollment practices linked with vocational education. Tracking students based on race, class, and gender was negatively associated with vocational education's history (Hodge et al., 2020). Vocational tracking segregated student populations by assigning student schedules based on racial, gender, and socioeconomic classifications (Hodge et al., 2020).

The Virginia Department of Education (2014) compared the historical foundation of vocational education to the modern interpretation of vocational education. According to the Virginia Department of Education (2014), the new version of vocational education was more

sophisticated and significantly valued the integration between core academics with career development. Traditional vocational education focused on preparation and association with low pay, low prestige career choices (Fletcher, 2012). Students classified as low achieving or non-college bound were scheduled disproportionately in Career and Technical Education courses (A Brief History of CTE, 2020). The placement in these courses forfeited college access and high-wage employment opportunities (Hodge et al., 2020). Career and Technical Education career clusters in pathways evolved from vocational education to become more rigorous and 21st century occupational based. Xing et al. (2019) explained that the current charge for Career and Technical Education was to empower students with the essential skills, abilities, and certifications required for multiple postsecondary opportunities.

Packard et al. (2012) stated that school reform~~s~~ highlighted Career and Technical Education as a model for strengthening the educational relevance related to improving social mobility. Career and Technical Education career-focused instruction integrated coursework into work-based learning (WBL) experiences. Hodge et al. (2020) explained that Career and Technical Education task competencies and curriculum frameworks were purposefully designed to deliver learning experiences that are rigorous and authentic. Students in Career and Technical Education programs experienced a cohesive course of study that included work-based learning, coursework, and practical applications. Students were no longer separated into the categories of college-bound and work-bound. Schwartz (2016) stated that Career and Technical Education encompassed information technology, health care, and advanced manufacturing career pathways that provided students a viable route to upward mobility.

Career and Technical Education in the Commonwealth of Virginia

In the Commonwealth of Virginia, Career and Technical Education programs educated more than 640,000 students annually from grades 6 through 12 (Virginia Department of Education, 2020). Students had the option to enroll in one or more Career and Technical Education courses simultaneously in a given year. The courses were part of specifically designed pathways and clusters designed to prepare students for productive postsecondary opportunities. Additionally, programs were aligned to meet Virginia's demands for a well-trained and industry-certified technical workforce (Virginia Department of Education, 2020).

Virginia recognized the significance of Career and Technical Education to the Commonwealth and students through diploma seals awarded by the Board of Education, industry credentialing diploma requirements, and required Academic and Career Plan (Virginia Department of Education, 2020). A provision in the Standards of Accreditation (SOA) for public schools in Virginia required each middle and high school student to have a personal learning plan. The personal learning plan included a course of study that aligned with the student's academic and career goals (Virginia Department of Education, 2020). Transitional plans were developed for each student and included academic and CTE course content in a coordinated, non-duplicative progression. Academic and career plans bridged the gap between secondary and postsecondary education (Virginia Department of Education, 2020). Each student's unique career goals determined each academic and career plan. The plans culminated with a recognized industry credential, certificate at the postsecondary level, an associate or bachelor's degree (Plasman, 2018).

Each student's course sequence was made up of selected Career and Technical Education courses, each of which aligns with a specific career cluster in which the student is interested. The

Commonwealth of Virginia adopted the 16 national career clusters and created a 17th Energy Cluster (Virginia Department of Education, 2020). The Virginia Department of Education defines a Career Cluster (2020) as a grouping of occupations and broad industries based on commonalities. Multiple career pathways within each career cluster represented a standard set of skills and knowledge, both academic and technical, necessary to pursue a full range of career opportunities within that pathway ranging from entry-level to management, including technical and professional career specialties (Virginia Department of Education, 2020).

The Virginia Department of Education (2022) listed 17 Career Clusters. The career clusters listed included Agriculture, Food & Natural Resources, Architecture & Construction, Arts, A/V Technology & Communications, Business Management & Administration, Education & Training, Energy, Finance, Government & Public Administration, Health Science, Hospitality & Tourism, Human Services, Information Technology, Law, Public Safety, Corrections & Security, Manufacturing, Marketing, Transportation, Distribution & Logistics, and (STEM) Science, Technology, Engineering & Mathematics (Virginia Department of Education, 2022). Clusters were divided into over 79 different career pathways. Career pathways were grouped according to the knowledge and skills required for occupations in identified career fields. Each pathway delivered a career-specific curriculum that was aligned with the student's postsecondary careers and educational pursuits.

Career and Technical Education and Postsecondary Opportunity

All student populations, including urban, rural, learning disabled, and low social-economic, benefited from enrolling in Career and Technical Education courses (Xing et al., 2019). According to Gottfried and Plasman (2018), researchers concluded that Career and Technical Education programs effectively reduced high school dropout rates and prepared

graduates for college-ready and career-ready futures. On-time graduation from high school, higher initial earnings, postsecondary employment, and two- or four-year college enrollment probabilities increased when students took an additional Career and Technical Education course in high school (Dougherty et al., 2019). Career and Technical Education courses required computational thinking and provided students with workplace skills such as teamwork and problem solving (Schescke, 2008). Schescke (2008) confirmed that "Career and Technical Education is the intersection between rigorous academic, technical, and employability skills, resulting in students who are capable, engaged, career-ready individuals" (p.1). Embedded in all Career and Technical Education course curriculums were workforce-practicum elements that connected secondary academics and postsecondary readiness (ACTE, 2016; Pearson, 2015).

Millions of youths from urban school districts lacked the skills necessary to achieve in college and the demanding 21st century labor market (Loera et al., 2013). Urban school divisions often failed to adequately prepare students with high-level skills requiring academic instruction and technical training. Unmotivated urban students who did not see the connections between their educational achievement and rewarding career opportunities often dropped out of school (Loera et al., 2013). Career and Technical Education programs embodied unique characteristics that could positively influence student motivation and academic engagement (Loera et al., 2013). The development of career academies as an alternative to traditional curricular programs had shown to reach disengaged students. Students enrolled in academies received personalized instruction that prepares them for career-ready skills (Jocson, 2015). The former United States Secretary of Education, Arne Duncan, made the following representative statement regarding President Barack Obama's plans for rebuilding a nation through Career and Technical Education (Duncan, 2012).

> A world-class education system that provides high-quality job-training opportunities will reduce skills shortages, spur business growth, encourage new investment and hiring, spark innovation, and promote continued economic growth. (p. II)

In the 21st century, science, technology, engineering, and mathematics (STEM) related careers were the fastest growing occupational segment (Jocson, 2015). Laird et al. (2006) research identified that an individual's socioeconomic background could influence educational pathways and career choices. A comparative study between peers of lower-income families and higher-income college-educated families revealed that students growing up in lower-income households were twice as likely to enroll in high school Career and Technical Education programs (Laird et al., 2006). The study further identified graduates of Career and Technical Education programs as exhibiting the following postsecondary behaviors; more likely to delay college by three times than preparatory students, leave college before graduation, enroll in trade school, and attend community college. Career and Technical Education graduates' postsecondary behaviors were problematic for gaining employment in any STEM-related career that required a 4-year degree. Packard and Babineau (2009) recognized that "Career and Technical Education graduates with interests in science or technology are more likely to become medical assistants or drafters rather than pharmacists or engineers" (p. 135).

In a qualitative research study, Packard et al. (2012) examined Career and Technical Education high school graduates' transition from school to work. The research specifically analyzed 40 graduates' adaptability to face background barriers that influenced one's career choice. The 22 men and 18 women from working-class families completed baseline surveys and phenomenological interviews one year after graduation. Packard et al. (2012) identified four primary themes; "job loss altered career plans, whereas relevant jobs propelled career

development; limited college access to college constrained options, whereas college experience expanded options; graduates experienced the loss of education-related support, and Career and Technical Education served as a backup plan" (p. 134).

The lack of support after graduation ranked significantly high during the transitional phase from school to work (Loera et al., 2013). Upon graduation, students removed from the daily school environment no longer received the network of support from teachers, school counselors, and family members. Without the social capital provided by a network of supportive individuals, post-graduate students found limited assistance during the school-to-work transition (Packard et al., 2012). During the transitional period between secondary school and the career world, Packard et al. (2012) suggested that graduates benefited from the support of high school staff members and college personnel.

The socioeconomic level of a student's family and other demographic characteristics influenced an individual's career choices. However, Packard et al. (2012) believed that students from low-income families were about twice as likely to participate in Career and Technical Education high school programs as students from higher-income families. Students of low economic status were often described as feeling limited in their career exploration options and often selected pathways based on survival. School and career counselors developed school-to-work transition plans for students based on a student's perceived abilities, needs, values, and interests (Packard et al., 2012). Enrollment in Career and Technical Education produced positive outcomes with learning disabled and non-learning-disabled students academically (Smith & Rayfield, 2019). Gottfried and Plasman (2018) described how dropout rates for students in school decreased, and the school-to-college pipeline, wages, and employment outcomes for post-

graduates increased due to the completion of CTE courses and the timing at which the CTE courses were completed.

Enrollment in Career and Technical Education courses could forecast employment success rates for students with learning disabilities post-graduation (Theobald et al., 2018). Moreover, Smith and Rayfield (2019) believed that matching student preferences with aligned Career and Technical Education pathways improved all students' academic achievement. The applied nature of CTE educators' content may enable them to be able utilize this feature and provide differentiated content which enables students to succeed academically (Smith & Rayfield, 2019).

Career-based vocational education was globally viewed as a primary method for developing skilled labor and a driver of economic progress in a competitive marketplace (Nurmalasari et al., 2019). Developing nations perceived the role of career-based vocational education as an educational institution for improving human capital. A close was identified between economic growth and well-implemented vocational education training (Nurmalasari et al., 2019). Career-based vocational education was multi-functional and benefited people through increased wage opportunities; benefited the industry through the development of free workforce training and benefited the nation through increased national productivity, incomes, and reduced unemployment (Nurmalasari et al., 2019).

Developing a STEM Workforce

Smith (2017) recognized that Career and Technical Education (CTE) served as the instructional leader in cultivating a knowledgeable STEM workforce. Hodge et al. (2020) highlighted the significance of how Career and Technical Education emerged from vocational education to become an ever-evolving educational curriculum centered on teaching career skills

to students. Jocson (2015) reported career interest scheduling, based on student interest, provided a pathway geared toward a specific career. Currently, there are 16 national career clusters and 79 related career pathways that divide Career and Technical Education. The 16 career clusters providing the CTE framework were based on high-demand career fields (Career Cluster, 2021).

Hyslop and Imperatore (2013) emphasized how Career and Technical Education connected students with rewarding career opportunities through relevant practical education pathways. They expounded on the concept that Career and Technical Education programs prepared students for various postsecondary opportunities through an integrated, applied, and connected curriculum (Hyslop & Imperatore, 2013). Career and Technical Education evolved from vocational education and currently included mechanical and hands-on labor, more scientifically technical-driven tracks, and service-based career pathways (Hodge et al., 2020). Career and Technical Education pathways were designed to prepare students for 2-year community college associate's degree (AS) programs, 4-year university bachelor's degree (BA) majors, and a range of direct employment career opportunities (Hodge et al., 2020). Based on the concept that all students need more than a high school diploma to gain employment in 21st century career fields, CTE career clusters and course pathways were specifically developed to fit that proposed need (Schwartz, 2016).

Career and Technical Education and Student Subgroups

Learning disabled students were disproportionately enrolled in Career and Technical Education courses (Wagner et al., 2016). A national public-school study sampled 9,000 students with learning disabilities and discovered that 96% of students took one or more Career and Technical Education courses (Wagner et al., 2016). Wagner et al. (2016) revealed that Career and Technical Education courses provided 19.7% (one-fifth) of learning-disabled students to

earn additional high school credits – compared to only 12.8% of the total student population earning additional high school credits. Students of all ability levels could develop postsecondary career skills in CTE courses (Deiterich & Smith, 2015). According to Bender (2007), a learning-disabled classification was not always an accurate indicator of an individual's academic ability. The learning-disabled classification helped classify students who required supplemental educational support differently from their peers.

Using longitudinal data from Washington State, Theobald et al., (2019) researched the relationships between Career and Technical Education enrollment, inclusion, and outcomes for learning disabled students. The study had a sample size of 5,122 students receiving special education services enrolled in Washington State public schools. The researcher calculated summary statistics for learning disabled students and students without disabilities to investigate the differences in outcomes. Theobald et al. (2019) found that 12th-grade students with learning disabilities enrolled in Career and Technical Education and inclusion showed a significant difference in on-time graduation rates compared to non-Career and Technical Education students. For example, 12th-grade students with learning disabilities enrolled in a Career and Technical Education course increased their year-end graduation percentage by three to four percentage points. In addition, the study discovered that "Career and Technical Education concentration and inclusion were associated with 2.8 to 4.2 percentage point increase in employment relative to a 5.3 percentage point gap, and inclusion was associated with 5.7 percentage point increase in college enrollment relative to a 19.3 percentage gap" (p. 117).

Graduation Rate Trends

The National Center for Education Statistics (NCES) (2018) reported a wide range of inconsistencies existed across the country regarding the graduation rates of students in public

high schools. According to the average cohort graduation rate (ACGR) report for 2018-19, the ACGR ranged from 69% in Washington, DC, to 92 percent in Iowa and Alabama. A total of forty states reported ACGRs that ranged from 80% to less than 90%. Students' graduation rates were affected by various factors, including household economic status, student engagement level, the region in which they live, and race/ethnicity. According to NCES (2018), the trend in graduation rates positively increased. However, it has been shown that some subgroups of students were experiencing disproportionately low graduation rates compared to their peers. White students' graduation rates increased from 86.7% to 94.8%, Black students increased their graduation rates from 73.9% to 93.8%, and Hispanic students' graduation rates increased from 58.6% to 88.3% (NCES, 2018).

The dropout rate for American Indian students was the highest compared to all other races and ethnicities, followed by Pacific Islander, Hispanic, and Black students. Additionally, it should be noted that there were other groups of students with high dropout rates, such as foster care students, students in special education programs, students with limited English proficiency, and homeless students (NCES, 2018). Among the characteristics associated with dropout, low socioeconomic status had the most substantial impact on the likelihood of a student quitting school. Dropout rates for 15- to 24-year-olds from families in the lowest income quarter were consistently the highest rates for dropping out of school (NCES, 2018).

McKee and Caldarella's study (2016) identified attendance as the fundamental indicator of student engagement with school. Disengaged students attended school less frequently than engaged students and earned lower grades. Despite the fact that many students fall off track for on-time graduation by the ninth grade, inadequate attendance patterns often started during middle school and increased as students progressed into their high school years (McKee &

Caldarella, 2016). McKee and Caldarella (2016) found that the association between poor attendance during secondary school and poor grades could often be traced back to low motivation on the part of the students. There was a direct correlation between students' grade point average (GPA) and the likelihood that they will succeed in earning a high school diploma (McKee & Caldarella, 2016). For example, students whose academic performance in their freshman year of high school was 2.0 or below (on a four-point scale) had a significantly lower graduation rate than those whose performance in their freshman year of high school was 2.5 or higher (on a four-point scale). In addition, it was essential to recognize that a student who failed one or more core classes or accumulated fewer credits than required to advance from the 10th grade were off the track for graduation at this point and were more likely to quit school consequently (McKee & Caldarella, 2016).

It has been shown that students who fall off track before the end of their first year of high school had minimal chances of ever earning their diploma (Neild, 2009). An analysis of the student's progressions through high school suggested that approximately one-third of the nation's recent high school dropouts never moved beyond 9th grade due to academic failures (Ritter, 2015). Educators and policymakers were faced with the challenge of continually increasing high school graduation rates, which meant closely examining which students were at risk of dropping out.

Summary of Research

The literature review examined the evolution of Career and Technical Education (CTE) and the effects Career and Technical Education programs had on student achievement and graduation rates. Comparative studies between Career and Technical Education and non-Career and Technical Education student populations identified Career and Technical Education

participation directly influenced academic achievement (Mobley et al., 2017). Career-focused instruction increased student engagement by combining relevant learning opportunities with hands-on activities (Theobald et al., 2018). The framework of career clusters and pathways were described in the literature as having direct alignment with emerging careers.

Student enrollment patterns in specific Career and Technical Education career clusters and pathways identified characteristic criteria aligned with gender, race, and ethnicity (Leu & Arbeit, 2020). The gender, race, and ethnicity differences were reflective of the uneven distribution held by many occupations. Leu and Arbeit (2020) found that occupational differences account for compensation gaps between men, women, and minorities. Schools purposely moved away from routing students into isolated general, academic, and vocational tracks (Hodge et al., 2020). However, currently, exploratory scheduling allowed students to complete a combination of courses in preparation for college and career opportunities post-graduation (Dougherty et al., 2019). Career and Technical Education courses provided students with authentic learning opportunities to explore traditional and non-traditional careers.

Finding relevant quantitative research that compared the graduation rates of rural, town, suburban, and city CTE completers and non-CTE completers was limited. Providing quantitative research that identified the influence CTE completion might have on improving graduation rates might justify continued growth and development of CTE programs. CTE courses showed an increase in student engagement through career-centered curricula that were designed according to the interests and needs of the students (Plasman, 2018). Therefore, additional research that compared and analyzed the impact CTE completion might have on graduation data could add beneficial information to the field.

Chapter Three

Methodology

Purpose of Study

The purpose of this study was to determine the difference, if any, between the graduation rates of students who completed a CTE sequence from 132 school divisions in Virginia and those students who did not complete a CTE sequence. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. That is, the study analyzed the graduation rates of rural, town, suburban, and city school divisions in determining if completing a CTE course sequence affected state graduation as well as regional graduation rates. The study aimed to advance previous studies by White (2015) and Blowe (2011) by determining how completing a CTE course sequence might uniquely affect the graduation rates of rural, town, suburban, and city school divisions for 2016-17, 2017-18, and 2018-19 cohort years.

Research Design and Methodology

The researcher utilized a quantitative study in which ex post facto data were used. The data included cohort graduation data from the Commonwealth's 132 school divisions. The graduation data focused on the 2017, 2018, and 2019 cohorts. A quantitative evaluation methodology was used to determine if CTE completion sequences impacted graduation rates and if the locale impacted CTE completers, non-CTE completers and total graduation rates of students in the Commonwealth of Virginia. The study was modeled after two previous studies, Blowe’s 2011 study and White’s 2015 study. This study used data published by the Virginia Department of Education.

A comparative analysis of locale graduation rates was conducted to determine the CTE finisher, non-CTE completer, and total graduation rate percentages for rural, town, suburban, and city school divisions in the Commonwealth of Virginia. CTE finisher graduation rates were determined by dividing the total number of CTE finishers by total number of CTE completers plus CTE finishers for each academic year. Non-CTE completer graduation rates were determined by dividing the total number of non-CTE completer graduates by the total number of non-CTE completers for each academic year. For each cohort year, the total number of CTE completers and non-CTE graduates were divided by the total number of cohort members in order to calculate the total graduation rate.

As a part of the research, the researchers analyzed graduation data for cohorts for each academic year, using a t-test in order to determine if completion of a CTE program had any impact on graduation rates. The researcher performed an Analysis of Variance (ANOVA) to determine if there was any statistically significant difference between the graduation rates of non-CTE completers, CTE finishers, and total graduation rates depending on where the student attended school in order to determine whether there was a regional impact on graduation rates. Furthermore, the researcher conducted a Tests Between Subjects Effect for each variable for each year to determine if there was a statistically significant regional effect on graduation rates for each variable. Statistical significance was attained when reaching a test significance level below 0.05. If significance was not attained, ANOVA indicated no statistical difference between graduation rates per region. However, when significance was attained, ANOVA indicated that a statistical difference existed between regional graduation rates. To determine where the difference existed, the researcher conducted a Post Hoc multiple comparison analysis using Tukey's test to determine where the difference lay.

The limitations of this research design were as follow:

1) During the process of submitting graduation data to the Virginia Department of Education, it is possible that a Local Educational Agency (LEA) could submit incorrect graduation data as a result of human error.
2) Since the researcher examined the relationship between locale type and total graduation rates, CTE-finisher graduation rates, and non-CTE completer graduation rates, the total student population within each locale might influence the possible relationships obtained through the Analysis of Variance.

Research Questions

1) What difference, if any, is there between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?
2) What difference, if any, is there between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

Hypotheses

H_o: Graduation rates in the Commonwealth of Virginia have no difference based on a student's completion of a CTE sequence.

H_1: Graduation rates in the Commonwealth of Virginia have differences based on a student's completion of a CTE sequence.

H_o: Graduation rates of rural, town, suburban, and city school divisions in the Commonwealth of Virginia have no statistically significant difference based on a student's completion of a CTE sequence.

H_2: Graduation rates of rural, town, suburban, and city school divisions in the Commonwealth of Virginia have statistically significant differences based on a student's completion of a CTE sequence.

Population

The study utilized graduation data of 132 school divisions in the Commonwealth of Virginia. This study focused on data related to the graduation rates of the 2016-17, 2017-18, and 2018-19 cohort years. The Virginia Department of Education state-reported data for each school division is made available on the Virginia Department of Education School Quality Profiles, the Virginia Department of Education High School Graduates and Completion Report, and the CTE Annual Performance Reports. The Virginia Department of Education's Department of Data, Research, and Technology provided detailed graduation data spreadsheets for each high school within the 132 school divisions. Spreadsheets contained the names and locale classification of every high school in the Commonwealth of Virginia and included the school's graduation data for CTE completers, CTE finishers, and non-CTE students for each cohort year.

Data Collection

The data utilized were public domain data and were not covered by any intellectual property laws, such as copyright, trademarks, or patents. The researcher obtained the study data from the School Quality Profiles for Virginia available through the Virginia Department of Education (Virginia Department of Education, 2020). These reports are published yearly by the Virginia Department of Education and included data on school graduation rates and completion

rates. The researcher utilized the School Graduates and Completion Report available through the Virginia Department of Education which provided data regarding outcomes for students who enter ninth grade for the first time and their possible graduation four years later. In addition, on-Time Graduation Rates at Virginia high schools and for school divisions were included in cohort reports. A Virginia On-Time Graduation Rate was an indicator to define how many students from a particular cohort entered high school for the first time and earned a Virginia Board of Education-approved diploma within four years of starting high school (Virginia Department of Education, 2020). Local leaders of CTE programs collected and submitted annual CTE performance data to the Virginia Department of Education. The Virginia Department of Education collected CTE data from every division in the Commonwealth and presented the information as CTE Annual Performance Reports. CTE Annual Performance Reports included the number of CTE completers, industry certification earned, and nontraditional enrollment data.

Data Gathering Procedures

Permission for this research study was obtained from the Virginia Polytechnic Institute's Institutional Review Board (IRB) (see Appendix B). The researcher obtained the 2016-17, 2017-18, and 2018-19 cohort graduation data from the Virginia Department of Education through utilizing School Quality Profiles, the Virginia Department of Education High School Graduates and Completion Reports, and the CTE Annual Performance Reports. A detailed graduation data spreadsheet was provided by Virginia's Department of Data, Research, and Technology for every high school within each of the 132 school divisions within the state.

Data needed to address each research quested were presented below:

Question 1 *What difference, if any, is there between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?*

Graduation rates are compared to CTE completer percentages and collected from the CTE Annual Performance Report and the Virginia Department of Education Graduation and Completion Report. Microsoft Excel was used to organize the data, which then were plugged into the Statistical Package for the Social Services (SPSS) to perform statistical functions. The researcher was able to determine if there was a statistically significant difference in graduation rates between students who finished CTE and those who did not finish CTE by using a t-test.

Question 2 *What difference, if any, is there between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?*

The researcher aimed to address if there existed a regional impact of total graduation rates, CTE finisher graduation rates, and non-CTE completer graduation rates. A comparison of regional graduation rates for non-CTE completers with regional graduation rates for CTE completers is made using information from the CTE Annual Performance Report as well as the Virginia Department of Education Graduation and Completion Report as a source of data. Microsoft Excel spreadsheets was used to organize data, which were then uploaded to the Statistical Package for the Social Services (SPSS) for statistical analysis.

To determine whether regional effects on graduation rates existed, the researcher performed an Analysis of Variance (ANOVA) to determine if there were any statistically significant differences between non-completers, CTE finishers, and total graduations. When significance was not attained, ANOVA showed no statistical difference between graduation rates

at a 0.05 significance level. Only when significance was attained the researcher conducted a Post Hoc analysis to identify the source.

Data Treatment and Management

The data used in this study were stored and processed on the researcher's computer, protected by a secure network equipped with intrusion detection, a firewall, and a personal computer password to ensure the data is safe and secure. Data were collected ex post facto from the Virginia Department of Education for the 2016-17, 2017-18, and 2018-19 cohort years. These data included the graduation rates of CTE and non-CTE completers, total graduation rates and locale classification for 132 school divisions in the Commonwealth of Virginia. The data did not contain personally identifying student information and were publicly available. No manipulation of data occurred during the collection of the data. Per the requirement of the Virginia Tech Graduate School, the researcher completed the required Collaborative Institutional Training Initiative (CITI) certificate in Social and Behavioral Research in January of 2022 (see Appendix C).

Data Analysis Techniques

The researcher organized the data using Microsoft Excel and utilized SPSS to conduct the statistical analysis. For each locale in Virginia, the analysis generated statistics showing CTE completers' graduation rates. As part of the study, longitudinal data was compared from cohort graduation years 2017, 2018, and 2019 to determine whether CTE completion made a difference in the graduation rates throughout the Commonwealth of Virginia. According to McMillan and Wergin (2010), the purpose of comparative research was to accurately describe how two or more groups differ by looking at some phenomenon or set of phenomena. The researcher conducted a t-test analysis through SPSS to determine if statistical significance existed between the means of

CTE and non-CTE completers' state graduation rates at a 95% confidence level. The researcher compared the regional CTE and non-CTE sequence completers graduation rates for the 2016-17, 2017-18, and 2018-19 academic years. This researcher utilized an ANOVA through SPSS to establish possible influences the locale might have on graduation rates. In order to determine the statistical significance of an experiment in which sample results are compared with a known and specified value, a t-test was used (Skaik, 2015). For this study, a comparative analysis was performed with the use of analysis of variance (ANOVA) in order to determine statistical significance as there were more than two levels for the independent variable (McMillan & Wergin, 2010). The comparison of locale-specific state graduation rates could determine if CTE sequence completion had statistically different associations with rural, town, suburban, and city school divisions' graduation rates. The analysis could identify the statistical difference in the graduation rates of each locale in the Commonwealth of Virginia.

Chapter Summary

This study compared the influence of locale on graduation rates and the graduation rates of CTE completers and non-CTE completers in the Commonwealth of Virginia. The purpose of this study was to determine the difference, if any, between the graduation rates of students who completed a CTE sequence from 132 school divisions in Virginia and those students who did not complete a CTE sequence. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. That is, the study analyzed the graduation rates of rural, town, suburban, and city school divisions in determining if completing a CTE course sequence affected state graduation as well as regional graduation rates. The data was analyzed using the mean, frequency, standard deviation, and t-test alpha level of 0.05. Data

were analyzed using Microsoft Excel and SPSS. Detailed results and findings are included in Chapter Four.

Chapter Four

Results

Analysis of Data

School divisions throughout the Commonwealth of Virginia continually work to improve student graduation rates (Virginia Department of Education, 2021). The purpose of this study was to determine the difference, if any, between the graduation rates of students who completed a CTE sequence from 132 school divisions in Virginia and those students who did not complete a CTE sequence. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. That is, the study analyzed the graduation rates of rural, town, suburban, and city school divisions in determining if completing a CTE course sequence affected state graduation as well as regional graduation rates. As part of this research, the researcher collected ex post facto information available on the Virginia Department of Education website. The Virginia Department of Education's Department of Data, Research, and Technology additionally supplied detailed graduation data spreadsheets for each high school within the 132 school divisions. Spreadsheets included the graduation data for CTE completers, CTE finishers, and non-CTE students for each cohort year.

This chapter highlighted the study's findings as they relate to the study's research questions. The research questions were:

1. What difference, if any, is there between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

2. What difference, if any, is there between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

Data Collection

As part of this research, the researcher collected ex post facto data available on the Virginia Department of Education website. The Virginia Department of Education's Department of Data, Research, and Technology additionally supplied detailed graduation data spreadsheets for each high school within the 132 school divisions. Spreadsheets included the graduation data for CTE completers, CTE finishers, and non-CTE students for each cohort year.

A comparison of cohort graduation data from 132 school divisions in the Commonwealth of Virginia, which were collected for the years 2016-17, 2017-18, and 2018-19, was presented in this chapter. For each cohort year, graduation data incorporated CTE finishers and non-CTE student populations graduation rates. A CTE finisher was defined as a student who passed two sequential CTE electives in an identified CTE pathway. To be classified as a CTE completer the student must be a finisher who has graduated. For cohort years 2016-17, 2017-18, and 2018-2019 more the 115,000 students finished a CTE pathway and graduated from high school.

Data Analysis Methodology

The researcher conducted a comparative analysis to determine if completion of a CTE sequence influenced student graduation rates. The comparative analysis methods were modeled after two previous studies conducted by Blowe (2011) and White (2015). Blowe (2011) addressed the Impact of Career and Technical Education on the Academic Achievement and Graduation Rates of Students in the Commonwealth of Virginia, and White (2015) addressed the Impact of Career and Technical Education (CTE) on Student Academic Achievement and

Graduation Rates in the Commonwealth of Virginia. Blowe (2011) examined school year data from 2008-09 through 2009-10. White (2013) analyzed the cohort graduation rates from school years 2010-11 through 2012-13. According to the two previous studies, CTE completers graduated with their cohort at higher average graduation rates than non-CTE classmates who did not complete a CTE sequence during their time in high school.

This study employs multiple methods to determine the difference, if any, between the graduation rates of students who completed a CTE sequence from those students who did not complete a CTE sequence within the same cohort. The researcher analyzed cohort graduation data of each year using a t-test to determine if the completion of a CTE sequences impacted graduation rates. The t-test determined if there were statistically significant differences between CTE finishers and non-CTE students.

To address if there was a regional impact on graduation rates, the researcher conducted an Analysis of Variance (ANOVA) to determine if the graduation rates of non-completers, CTE finishers, and total graduation were statistically different based on the region where a student attends school. The researcher conducted a Tests Between Subjects Effect for each variable per year to determine if there was a statistically significant regional impact on graduation rate. Statistical significance was attained when reaching a test significance level below 0.05. If significance was not attained; ANOVA indicated that there was no statistical difference between graduation rates per region. However, when significance was attained; ANOVA indicated that a statistical difference existed between regional graduation rates. To determine where the difference existed, the researcher conducted a Post Hoc multiple comparison analysis using Tukey’s test.

Presentation of Data

Impact of CTE Sequence Completion on Graduation Rates

The graduation rates for students in each academic year were gathered from the Virginia Department of Education, entered into a spreadsheet, and organized by cohort for 2016-17, 2017-18, and 2018-19. Each academic year provides a summary of the graduation rates for students in different school years. Table 1 contains descriptive statistics pertaining to the graduation rate, including the number of reporting schools, mean graduation rate, and standard deviation for CTE finishers and non-CTE completers. For the 2016-17 school year, 320 schools were included in the analysis. Similarly, 322 schools were included for the 2017-18 school year, and 321 schools were included for the 2018-19 school year. In the 2016-17 school year, the graduation rate for CTE finishing students was 96.35 percent, while the graduation rate for non-CTE completers was 83.61 percent. As of the 2017-18 academic year, the mean graduation rate for CTE finishers was 96.97 percent, compared to the mean graduation rate for non-completers, which was 84.69 percent. And in the 2018-2019 school year, the graduation rate for CTE finishers was 97.13 percent and for non-CTE completers was 85.45 percent. This study's calculated three-year average graduation rate equals 12.33 percentage points higher for CTE finishers compared with the graduation rates of non-CTE completers in the same cohort. The mean difference was 12.74 percent in 2016-17, 12.28 percent in 2017-18, and 11.68 percent in 2018-19.

The results of the t-test indicate that completion of a CTE program sequence resulted in a higher graduation rate than that of non-CTE students.

Table 1

Mean Standard Deviation for Cohort Graduation Rates for Included High Schools (N)

	Standard Mean	Standard Deviation	N
CTE Finisher Graduation Rate 16-17	96.35	9.98	320
Non-CTE Completer Grad Rate 16-17	83.61	14.57	320
CTE Finisher Graduation Rate 17-18	96.97	8.36	322
Non-CTE Completer Grad Rate 17-18	84.69	15.76	322
CTE Finisher Graduation Rate 18-19	97.13	7.87	321
Non-CTE Completer Grad Rate 18-19	85.45	13.9	321

A paired t-test was conducted on the cohort graduation rates for 2016-17, 2017-18, and 2018-19. The results of the paired t-test are presented in Table 2. The t-test was used to measure the significance of the mean difference between students who obtained CTE finisher status in high school and those who did not, as shown by the results of the cohort graduation rate of each school division. A *p*-value equal to <.001 for each of the three years studied indicated that a statistically significant difference existed between CTE finishers and non-CTE completers graduation rates at a significance 0.05 level.

CTE finishers had a mean graduation rate of 96.35 percent, compared with non-completers who had a mean graduation rate of 83.61 percent for the school year 2016-17; $t(319) = 15.713$, $p = <.001$. The *t*-value with 319 degrees of freedom was 15.713 and with a calculated *p*-value <0.001. Since the calculated *p*-value < 0.001 < 0.05, significance was attained. Thus, the researcher rejected the null hypothesis and concluded that there was a statistical significance between the means of non-CTE completer graduation rates and CTE finisher graduation rates.

Based on the 2017-18 school year data, $t(322) = 15.45$, $p = .001$, the CTE finishers had a mean graduation rate of 96.97 percent, and the non-CTE completers had a mean graduation rate of 84.69 percent, respectively, for the school year 2017-18. The *t*-value with 321 degrees of freedom was 15.450 and with a calculated *p*-value <0.001. Since the calculated *p*-value < 0.001

< 0.05, significance was attained. Thus, the researcher rejected the null hypothesis and concluded that there was a statistical significance between the means of non-CTE completer graduation rates and CTE finisher graduation rates.

During the school year 2018-19, t(320) = 17.882, p=<.001, CTE finishers had a mean graduation rate of 97.13, and non-CTE completers had a mean graduation rate of 85.45 percent. The t-value with 320 degrees of freedom was 17.882 and with a calculated *p*-value <0.001. Since the calculated *p*-value < 0.001 < 0.05, significance was attained. Thus, the researcher rejected the null hypothesis and concluded that there was a statistical significance between the means of non-CTE completer graduation rates and CTE finisher graduation rates.

Table 2

Paired Sample t-test for Cohort Graduation Rates for 2016-17, 2017-18, and 2018-19 Academic Year

	Mean Difference	Standard Deviation	t-score	*p*-value
CTE Finisher Grad Rate – non-CTE completer Grad Rate 16/17	12.744	14.508	15.713	<.001
CTE Finisher Grad Rate – non-CTE completer Grad Rate 17/18	12.276	14.259	15.450	<.001
CTE Finisher Grad Rate – non-CTE completer Grad Rate 18/19	11.682	11.732	17.822	<.001

Table 3 displays a summary of the graduation percentages of CTE finishers, non-CTE completers, and total cohort graduation rates for the 2016-17, 2017-18, and 2018-2019 school years. CTE finisher graduation percentages were calculated by dividing the population of CTE completers by the total number of CTE finishers in a given cohort year. Non-CTE completer graduation percentages were calculated by dividing the total number of non-CTE finisher graduates by the total number of students who did not complete a CTE sequence in a given cohort year. By taking the total graduation student population, which includes both those who

have completed CTE as well as those who have not completed CTE, and then dividing it by the number of students who graduated during the same school year, we can determine the total graduation rate. During the three cohort years of this study, the average graduation rates for the total cohort were 93%, the average graduation rate for CTE finishers was 98%, and the average graduation rate for non-CTE students was 88%.

Table 3

State Cohort Graduation Data for 2016-17, 2017-18, and 2018-19 Academic Years

Year	CTE Finisher Graduation Rate	Non-CTE Graduation Rate	Total Cohort Graduation Rate
2016-17	97.5%	87.5%	92.6%
2017-18	97.8%	88.3%	93.9%
2018-19	97.8%	88%	93%

Table 4, Table 5, and Table 6 displayed rural, town, suburban, and city school divisions' summary of the graduation rate of CTE finishers, non-CTE completers, and total cohort graduation rates for the 2016-17, 2017-18, and 2018-2019 school years. Regional CTE finisher graduation percentages were calculated by dividing the population of regional CTE completers by the total number of regional CTE finishers in a given cohort year. Regional non-CTE completer graduation percentages were calculated by dividing the number of regional non-CTE completers who graduated during a given cohort year by the total number of regional students who did not complete a CTE sequence during that cohort year. A total graduation rate was determined by dividing the total regional graduation student population, -which included students who have completed CTE and students who have not finished a CTE sequence and dividing the sum by all students in the region that graduated during the same year.

Table 4

Regional Graduation Data for 2016-17 Academic Year

Locale	CTE Finisher Graduation Rate	Non-CTE Graduation Rate	Total Cohort Graduation Rate
Rural	98.8%	87%	93.5%
Town	97.3%	85.5%	92.7%
Suburban	97.6%	88.5%	93.5%
City	97.1%	83.5%	90.1%

Table 5

Regional Graduation Data for 2017-18 Academic Year

Locale	CTE Finisher Graduation Rate	Non-CTE Graduation Rate	Total Cohort Graduation Rate
Rural	97.9%	88.1%	93.9%
Town	97.1%	83.6%	92.4%
Suburban	97.9%	90.1%	93.5%
City	97.6%	84.7%	90.8%

Table 6

Regional Graduation Data for 2018-19 Academic Year

Locale	CTE Finisher Graduation Rate	Non-CTE Graduation Rate	Total Cohort Graduation Rate
Rural	97.8%	87.9%	94.2%
Town	97.4%	85.4%	92.9%
Suburban	98%	89.6%	93.3%
City	97.3%	84.2%	90.4%

Regional Impact on Graduation Rates

An Analysis of Variance (ANOVA) test was conducted to determine the mean graduation rates of CTE finishers, non-CTE, and total graduation rates of students in the Commonwealth of Virginia were statistically different based on the locality (rural, town, suburban, and city). The National Center for Education Statistics NCES designated the grouping and locale classifications of the 132 school divisions. This type of geographical indicator served as a general summary of

the area where a particular school was located. As stated by NCES (2018), all areas in the United States were classified into four types: rural, town, suburban, and city. Regional classifications were based on the density of the population or the distance from populated areas. The ANOVA results are shown in Tables 7 through 12.

Table 7

ANOVA Regional Analysis of CTE Finisher Graduation Rates for 2016-17Academic Year

Source	Type III Sum of Squares	Degree of Freedom	Mean Square	F Ratio	*p*-value
Location	.110	3	.037	3.786	.011
Error	3.066	316	.010		
Corrected Total	3.177	319			

The ANOVA showed significant differences in CTE finisher graduation rates with a *p*-value of $0.011 < 0.05$. Therefore, the researcher rejected the null hypothesis that the means between locations for CTE finisher graduation rates are equal. Based on the statistical evidence, it is evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 8 highlighted a Tukey's HSD test to conduct a multiple comparison between mean graduation rates for CTE finishers amongst four regional types: town, city, rural, and suburban.

Table 8

Tukey's Multiple Comparisons Post Hoc Analysis for 2016-17 Finisher Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	-.0262	-.0879	.0356	.693
	Rural	-.0623	-.1185	-.0060	.023
	Suburban	-.0475	-.1053	.0103	.148
City	Town	.0262	-.0356	.0879	.693
	Rural	-.0361	-.0759	.0037	.091
	Suburban	-.0213	-.0633	.0207	.556
Rural	Town	.0623	.0060	.1185	.023
	City	.0361	-.0037	.0759	.091
	Suburban	.0147	-.0187	.0482	.665
Suburban	Town	.0475	-.0103	.1053	.148
	City	.0213	-.0207	.0633	.556
	Rural	-.0147	-.0482	.0187	.665

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD only indicated a statistically significant difference between CTE finisher graduation rates for town and rural regions (p-value = .023). The cohort graduation Table 4 reflects that the CTE finisher graduation rate for Town students is 97.3%, and the CTE finisher rate for Rural students is 98.8%. Based on this, individuals who finish a CTE program in Rural schools have a 98.8% chance of graduating, compared with those in Town schools who had a 97.3% chance of graduating. As reflected in Table 8, CTE finisher graduation rates were statistically different between town and rural regions. Thus, CTE finisher

students who attended rural schools had higher graduation rates than similar students attending town schools.

Table 9

ANOVA Regional Analysis of non-CTE Completer Graduation Rates for 2016-2017 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.279	3	.093	4.544	.004
Error	6.559	320	.020		
Corrected Total	6.839	323			

The ANOVA showed significant differences in non-CTE completer graduation rates with a *p*-value of $0.004 < 0.05$. Therefore, the researcher rejected the null hypothesis that the means between locations for non-CTE completer graduation rates are equal. Based on the statistical evidence, it is evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 10 highlighted a Tukey's HSD test to conduct a multiple comparison between mean graduation rates for non-CTE completers amongst four regional types: town, city, rural, and suburban.

Table 10

Tukey's Multiple Comparisons Post Hoc Analysis for 2016-17 non-CTE Completer Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0235	-.0662	.1132	.906
	Rural	.0194	-.0623	.1011	.928
	Suburban	-.0438	-.1276	.0401	.534
City	Town	-.0235	-.1132	.0662	.906
	Rural	-.0041	-.0618	.0536	.998
	Suburban	-.0672	-.1280	-.0064	.024
Rural	Town	.0194	-.1011	.0623	.928
	City	.0041	-.0536	.0618	.998
	Suburban	-.0631	-.1113	-.0150	.004
Suburban	Town	.0438	-.0401	.1276	.534
	City	.0672	.0064	.1280	.024
	Rural	.0631	.0150	.1113	.004

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant differences were between city and suburban regions (p-value = .24) and between suburban and rural locations (p-value = .004). The 2017 cohort graduation Table 4 reflects that the non-CTE completer graduation rate for City students is 83.5%, and the non-CTE completer graduation rate for Suburban students is 89.5%. Thus, Suburban students enrolled in non-CTE completer programs have an 89.5% chance to graduate compared to an 83.5% chance to graduate if they were in City schools. Additionally, the non-CTE completer graduation rate for Rural students is

87%, and the non-CTE completer graduation rate for Suburban students is 89.5%. Thus, Suburban students enrolled in non-CTE completer graduation programs have an 89.5% chance to graduate compared to an 87% chance to graduate if they were in Rural schools.

Table 11

ANOVA Regional Analysis of Total graduation Rates for 2016-2017 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.093	3	.031	4.511	.004
Error	2.205	320	.007		
Corrected Total	2.298	323			

The ANOVA showed significant differences in total graduation rates with a *p*-value of $0.004 < 0.05$. Therefore, the researcher rejected the null hypothesis that the means between locations for CTE total graduation rates are equal. Based on the statistical evidence, it was evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 12 highlighted a Tukey's HSD test to compare total graduation rate means among four regional types: town, city, rural, and suburban.

Table 12

Tukey's Multiple Comparisons Post Hoc Analysis for 2016-17 Total Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0424	-.0096	.0945	.153
	Rural	-.0048	-.0521	.0426	.994
	Suburban	.0067	-.0419	.0553	.985
City	Town	-.0424	-.0945	.0096	.153
	Rural	-.0472	-.0807	-.0137	.002
	Suburban	-.0357	-.0710	-.0005	.046
Rural	Town	.0048	-.0426	.0521	.994
	City	.0472	.0137	.0807	.002
	Suburban	.0115	-.0164	.0394	.714
Suburban	Town	-.0067	-.0553	.0419	.985
	City	.0357	.0005	.0710	.046
	Rural	-.0115	-.0394	.0164	.714

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant differences were between city and rural regions (p-value = .002) and between suburban and city locations (p-value = .046). The 2017 cohort graduation Table 4 reflects that the total graduation rate for City students is a 90.1% chance of earning a diploma from high school, compared to a 93.5% chance of graduating from high school if they were attending a school in a Rural region. Additionally, students living in Suburban areas had a 93.5% chance of graduating from high school compared to a 90.1% chance of graduating from high school if they attended schools located in the city.

Table 13

ANOVA Regional Analysis of CTE Finisher Graduation Rates for 2017-18 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.053	3	.018	2.554	.055
Error	2.192	318	.007		
Corrected Total	2.245	321			

The ANOVA reflected a *p*-value of 0.055 > 0.05. Thus, there were not any statistically significant differences with the CTE finisher graduation rates. Therefore, the researcher failed to reject the null hypothesis that the means between locations for CTE finisher graduation rates are equal. Based on the statistical evidence, it is not evident that a significant difference exists between the means of the four regions as compared to each other for the 2017-2018 school year. Since there were no statistically significant differences within the regional CTE finisher graduation rates for the 2017-18 academic year, a post hoc analysis was unnecessary.

Table 14

ANOVA Regional Analysis of non-CTE Completer Graduation Rates for 2017-2018 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.301	3	.100	4.173	.006
Error	7.769	323	.024		
Corrected Total	8.070	326			

The ANOVA showed significant differences in non-CTE completer graduation rates with a *p*-value of 0.006 < 0.05. Therefore, the researcher rejected the null hypothesis that the means between locations for non-CTE completer graduation rates are equal. Based on the statistical evidence, it was evident that there existed, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the

regional graduation rates, a Post Hoc analysis was needed. Table 15 highlighted a Tukey's HSD test to conduct a multiple comparison between mean graduation rates for non-CTE completers amongst four regional types: town, city, rural, and suburban.

Table 15

Tukey's Multiple Comparisons Post Hoc Analysis for 2017-18 non-CTE completer Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0005	-.0987	.0977	1.000
	Rural	.0007	-.0877	.0892	1.000
	Suburban	-.0644	-.1550	.0262	.259
City	Town	.0005	-.0977	.0967	1.000
	Rural	.0003	-.0623	.0623	1.000
	Suburban	-.0649	-.1304	.0007	.053
Rural	Town	-.0007	-.0892	.0877	1.000
	City	-.0003	-.0628	.0623	1.000
	Suburban	-.0651	-.1168	-.0134	.007
Suburban	Town	.0644	-.0262	.1550	.259
	City	.0649	-.0007	.1304	.053
	Rural	.0651	.0134	.1168	.007

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant difference is between rural and suburban regions (p-value = .007). The 2018 cohort graduation Table 5 reflects that the non-CTE completer graduation rate for Rural students is 88.1%, and the non-

CTE completer graduation rate for Suburban students is 90.1%. Thus, Suburban students enrolled in non-CTE completer programs have a 90.1% chance to graduate compared to an 88.1% chance to graduate if they were in City schools.

Table 16

ANOVA Regional Analysis of Total Graduation Rates for 2017-2018 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.088	3	.029	4.058	.007
Error	2.333	323	.007		
Corrected Total	2.421	326			

The ANOVA showed significant differences in total graduation rates with a *p*-value of $0.007 < 0.05$. Therefore, the researcher rejected the null hypothesis that the means between locations for CTE total graduation rates are equal. Based on the statistical evidence, it is evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 12 highlighted a Tukey's HSD test to compare total graduation rate means among four regional types: town, city, rural, and suburban.

Table 17

Tukey's Multiple Comparisons Post Hoc Analysis for 2017-18 Total Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0378	-.0155	.0911	.260
	Rural	-.0080	-.0564	.0405	.974
	Suburban	.0004	-.0492	.0501	1.000
City	Town	-.0378	-.0911	.0155	.260
	Rural	-.0458	-.0800	-.0115	.004
	Suburban	-.0374	-.0733	-.0015	.038
Rural	Town	.0080	-.0405	.0564	.974
	City	.0458	.0115	.0800	.004
	Suburban	.0084	-.0200	.0367	.871
Suburban	Town	-.0004	-.0501	.0492	1.00
	City	.0374	.0015	.0733	.038
	Rural	-.0084	-.0367	.0200	.871

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant differences were between city and rural regions (p-value = .004) and between suburban and city locations (p-value = .038). The 2018 cohort graduation Table 5 reflects that the total graduation rate for City students is a 90.8% chance of earning a diploma from high school, compared to a 93.9% chance of graduating from high school if they were attending a school in a Rural region. Additionally, students living in Suburban areas had a 93.5% chance of graduating from high school compared to a 90.8% chance of graduating from high school if they attended schools located in the city.

Table 18

ANOVA Regional Analysis of CTE Finisher Graduation Rates for 2018-19 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.038	3	.013	2.041	.108
Error	1.946	317	.006		
Corrected Total	1.983	320			

The ANOVA reflected a *p*-value of 0.108 > 0.05. Thus, there were not any significant differences with the regional CTE finisher graduation rates for the 2018-19 academic year. Since there were no statistically significant differences within the regional CTE finisher graduation rates for the 2018-19 academic year, a post hoc analysis was unnecessary.

Table 19

ANOVA Regional Analysis of non-CTE Completer Graduation Rates for 2018-2019 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.179	3	.060	2.808	.040
Error	6.867	324	.021		
Corrected Total	7.045	327			

The ANOVA showed significant differences in non-CTE completer graduation rates with a *p*-value of 0.040 < 0.05. Therefore, the researcher rejected the null hypothesis that the means between locations for non-CTE completer graduation rates are equal. Based on the statistical evidence, it is evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 20 highlighted a Tukey's HSD test to conduct a multiple comparison between mean graduation rates for non-CTE completers amongst four regional types: town, city, rural, and suburban.

Table 20

Tukey's Multiple Comparisons Post Hoc Analysis for 2018-19 non-CTE Completer Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0444	-.0467	.1354	.590
	Rural	.0013	-.0817	.0844	1.000
	Suburban	-.0244	-.1094	.0607	.881
City	Town	-.0444	-.1354	.0467	.590
	Rural	-.0430	-.1014	.0153	.228
	Suburban	-.0687	-.1299	-.0076	.021
Rural	Town	-.0013	-.0844	.0817	1.000
	City	.0430	-.0153	.1014	.228
	Suburban	-.0257	-.0742	.0228	.520
Suburban	Town	.0244	-.0607	.1094	.881
	City	.0687	.0076	.1299	.021
	Rural	.0257	-.0228	.0742	.520

Post hoc analysis using Tukey HSD test (p-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant difference was between suburban and city regions (p-value = .021). The 2019 cohort graduation Table 6 reflects that the non-CTE completer graduation rate for City students is 84.2%, and the non-CTE completer graduation rate for Suburban students is 89.6%. Thus, Suburban students enrolled in non-CTE completer programs have an 89.6% chance to graduate compared to an 84.2% chance to graduate if they were in City schools.

Table 21

ANOVA Regional Analysis of Total Graduation Rates for 2018-2019 Academic Year

Source	Type III Sum of Squares	Df	Mean Square	F Ratio	*p*-value
Location	.194	3	.065	6.395	<.001
Error	3.275	324	.010		
Corrected Total	3.468	327			

The ANOVA showed significant differences in total graduation rates with a *p*-value of $0.001 < 0.05$. Therefore, the researcher rejected the null hypothesis that the means between locations for CTE total graduation rates are equal. Based on the statistical evidence, it is evident that there exists, in fact, a significant difference between the means of the four regions as compared to each other. Since there was statistical significance within the regional graduation rates, a Post Hoc analysis was needed.

Table 12 highlighted a Tukey's HSD test to compare total graduation rate means among four regional types: town, city, rural, and suburban.

Table 22

Tukey's Multiple Comparisons Post Hoc Analysis for 2018-19 Total Graduation Rates

(I) Location	(J) Location	Mean Difference (I-J)	Lower Bound	Upper Bound	*p*-value
Town	City	.0654	.0026	.1283	.038
	Rural	-.0015	-.0589	.0559	1.000
	Suburban	.0197	-.0390	.0785	.822
City	Town	-.0654	-.1283	-.0026	.038
	Rural	-.0669	-.1072	-.0266	<.001
	Suburban	-.0457	-.0880	-.0035	.028
Rural	Town	.0015	-.0559	.0589	1.000
	City	.0669	.0266	.1072	<.001
	Suburban	.0212	-.0123	.0547	.361
Suburban	Town	-.0197	-.0785	.0390	.822
	City	.0457	.028	.0880	.028
	Rural	-.0212	-.0547	.0123	.361

Post hoc analysis using Tukey HSD test (*p*-value < .05) was conducted to compare all possible pairs of groups of means. The Tukey HSD indicated that the only significant differences were between city and rural regions (*p*-value = <.001) and between suburban and city locations (*p*-value = .028). The 2019 cohort graduation Table 6 reflects that the total graduation rate for City students is a 90.1% chance of earning a diploma from high school, compared to a 93.5% chance of graduating from high school if they were attending a school in a Rural region. Additionally, students living in Suburban areas had a 93.5% chance of graduating from high school compared to a 90.1% chance of graduating from high school if they attended schools located in the city.

Data Summary

After analyzing the study data, the researchers determined that completing a CTE program sequence results in a higher graduation rate than non-CTE students over the 2016-17, 2017-18, and 2018-19 academic years. For each cohort, a *t*-test at a 0.05 significance level was used to determine a statistically significant difference between the means of non-CTE completer graduation rates and CTE finisher graduation rates. The calculated *p*-value for each academic year equaled <.001. Therefore, significance was attained for academic years 2016-17, 2017-18, and 2018-19.

When analyzing the impact that school regions may have on CTE finishers, non-CTE completers, and total graduation rates, ANOVA results varied. For the 2016-17 academic year, the overall ANOVA is significant for all dependent variables: CTE finisher, non-CTE completer, and total graduation rates. However, in the 2017-18 and 2018-19 academic years, the means between locations for CTE finisher graduation rates were not statistically different. In the 2017-18 academic year, the *p*-value is 0.055 > 0.05, and in the 2018-19 academic year, the *p*-value is 0.108 > 0.05.

Conclusion

The study aimed to address if a difference existed between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer). The researcher determined that, for the 2016-17, 2017-18, and 2018-19 academic years, the completion of a CTE program sequence resulted in higher student graduation rates compared to students who were non-CTE finishers. In addition, the study indicated that there existed a statistically significant difference between CTE finisher and non-CTE completer graduation rates.

Further, the study aimed to determine if there was a difference between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer. For the 2016-17 academic year, the researcher determined that there was a statistical difference between regional CTE finisher graduation rates and determined that a significant difference in CTE finisher graduation rates existed between town and rural regions. For non-CTE completers, a significant difference existed between the city and suburban regions as well as the rural and suburban regions. As for total graduation rates, a significant difference existed between city and rural regions as well as city and suburban regions. Additionally, for the 2017-18 academic year, the researcher determined that there was no statistical difference between regional CTE finisher graduation rates. For non-CTE completers, a significant difference existed between the suburban and rural regions. As for total graduation rates, a significant difference existed between city and rural regions as well as city and suburban regions. Furthermore, for the 2018-19 academic year, the researcher determined that there was no statistical difference between regional CTE finisher graduation rates. For non-CTE completers, a significant difference existed between the suburban and city regions. As for total graduation rates, a significant difference existed between city and rural regions as well as city and suburban regions.

Chapter Five provides a summary and discussion of the findings, presents the implications of the findings, highlights conclusions, and presents recommendations and suggestions for future studies.

Chapter Five

Findings, Implications, and Future Research

The findings and implications of this study are presented in this chapter, along with recommendations for future research for those who might be able to use the conclusions and findings of the study to develop policies to improve the graduation rates of high school students by strategically integrating career and technical education (CTE) programs into the curriculum. The purpose of this study was to determine whether there was a statistically significant difference in the graduation rates of students who finished a CTE sequence in 132 school divisions in the Commonwealth of Virginia and those students who did not complete a CTE sequence during the 2016-17, 2017-18, and 2018-19 academic years. In addition, the study examined whether there were statistically significant differences in graduation rates among CTE finishers, non-CTE finishers, and total students when regional classifications were considered. That is, the study analyzed the graduation rates of rural, town, suburban, and city school divisions in determining if completing a CTE course sequence affected state graduation as well as regional graduation rates.

In the study, the researcher included the graduation rates of all high schools in the Commonwealth of Virginia in the sample. The study utilized data provided by the Virginia Department of Education's Department of Data, Research, and Technology. Furthermore, this study furthered the work of White (2015) and Blowe (2011). This study aimed to determine whether the graduation rates for CTE finisher graduates, non-CTE completer graduates, and the total graduation rate varied according to the region within a school division, either rural, town, suburban, or city. This research was modeled after both White's (2015) study, entitled *The Impact of Career and Technical Education (CTE) on Student Academic Achievement and*

Graduation Rates in the Commonwealth of Virginia, and Blowe's (2011) study, entitled *The Impact of Career and Technical Education on Student Academic Achievement and Graduation Rates of Students in the Commonwealth of Virginia;* however, the study focused on the longitudinal examination of subsequent academic years. This study used two primary statistical tests to determine if students in the Commonwealth of Virginia's graduation rates were significantly different based on their completion of a CTE course sequence. The researcher utilized a t-test to determine if there was a statistically significant difference in CTE finisher and non-CTE student graduation rates. Further, the researcher conducted an Analysis of Variance (ANOVA) test to examine if there was a statistically significant difference among rural, town, suburban, and city students' graduation rates because of completing CTE courses in their respective localities. The research questions for the study were:

1) What difference, if any, is there between the graduation rates of students in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?
2) What difference, if any, is there between the regional graduation rates of students (rural, town, suburban, and city) in the Commonwealth of Virginia based on their completion of a CTE sequence (CTE completer vs. non-CTE completer)?

A primary purpose of this research was to provide policymakers and school administrators with quantitative data regarding the differences in graduation rates that existed between students who completed CTE programs and those who did not complete CTE programs in the same divisions. Thus, following this study, educational leaders might have an opportunity to make well-informed decisions in regard to how to strategically incorporate CTE courses into the school curriculum in order to increase the rate of total school graduation.

Summary of Findings

After conducting a comparative analysis, a t-test, and an ANOVA analysis, the primary study findings and implications were identified as well as recommendations for future research. The researcher identified statistically significance relationships. These findings, supported by study data and analysis as well as related and supporting research, follow.

Finding 1

The graduation rates for the students who had finished CTE programs were higher than those of their peers who had not completed a CTE sequence during the 2016-17, 2017-18, and 2018-19 academic years.

Graduation rates over 2015-16, 2016-17, and 2018-19 academic years were consistently higher for CTE finishers compared to non-CTE completer students. For the 2016-17 academic year, the standard mean for CTE finisher graduation rates was 96.35% compared to an 83.61% for non-CTE completers. For the 2017-18 academic year, the standard mean for CTE finisher graduation rate was 96.97% compared to an 84.69% for non-CTE completers. For the 2018-19 academic year, the standard mean for CTE finisher graduation rate was 97.13% compared to an 85.45% for non-CTE completers. The t-test analysis of the graduation rate for the three years of the study showed that the graduation rate for the cohort of students who completed a CTE sequence was higher than the graduation rate for the cohort of non-CTE completers. For the academic year 2016-17, the t-value with 319 degrees of freedom was 15.713, with a calculated p-value < 0.001. Since the calculated p-value $< 0.001 < 0.05$, significance was attained. Therefore, the researcher rejected the null hypothesis and concluded that there was a statistical difference between the means of the two groups.

For the academic year 2017-18, the t-value with 321 degrees of freedom was 15.450, with a calculated p-value < 0.001. Since the calculated p-value < 0.001 < 0.05, significance was attained. Therefore, the researcher rejected the null hypothesis and concluded that there was a statistical difference between the means of the two groups.

For the academic year 2018-19, the t-value with 320 degrees of freedom was 17.882, with a calculated p-value < 0.001. Since the calculated p-value < 0.001 < 0.05, significance was attained. Therefore, the researcher rejected the null hypothesis and concluded that there was a statistical difference between the means of the two groups. For a summary of SPSS output, refer to Table 1 and Table 2.

As previously identified by Gottfried and Plasman (2018), CTE courses have the potential to increase high school students' graduation rates through a curriculum that intentionally develops skills in critical thinking, collaboration, and reasoning in students. Those skills can later be applied to other non-CTE courses to make students more successful in CTE and non-CTE courses (Gottfried & Plasman, 2018). In addition, CTE programs of study, as described by Castello et al. (2012), provide students with a path that is designed to prepare them for successful entry into a specific profession by incorporating academic preparation, career preparation, and workplace readiness skills. In addition, the kind of curricula that integrate various career experiences into the teaching process is also known to give students a sense of purpose and become an intervention, especially when it comes to disengaged students (Hyslop & Imperatore, 2013).

Finding 2

Regional classifications had an impact on total graduation rates. The study determined that differences existed when comparing the total graduation rates of rural,

town, suburban, and city school divisions during the 2016-17, 2017-18, and 2018-19 academic years.

The study determined that the difference between the means of the four regions total graduation rates were statistically significant for the 2016-17, 2017-18, and 2018-19 academic years. Thus, the researcher rejected the null hypothesis that stated the total graduation rates means between locations were equal. For the 2016-17 academic year, the ANOVA revealed a p-value of 0.004 < 0.05. Post hoc analysis using the Tukey HSD showed a significance of 0.002 < 0.05 between rural and city regions and 0.046 < 0.05 between city and suburban regions. During the 2016-17 academic year, students who finished a CTE sequence in city regions had a 90.1% chance to graduate compared to a 93.5% chance of graduating from either a rural or suburban high school.

For the 2017-18 academic year, the ANOVA revealed a p-value of 0.006 < 0.05. Students who finished a CTE sequence in city regions had a 90.8% chance of graduating compared to a 93.9% chance of graduating from a high school if they were attending a school in a rural region or 93.5% chance of earning a diploma living in suburban regions. Post hoc analysis using the Tukey HSD showed a significance of 0.004 < 0.05 between rural and city regions and 0.038 < 0.05 between city and suburban regions. During the 2017-18 academic year, students who finished a CTE sequence in city regions had a 90.8% chance to graduate compared to a 93.9% chance of graduating from either a rural high school or 93.5% chance of graduating from a suburban high school.

For the 2018-19 academic year, the ANOVA revealed a p-value of 0.040 < 0.05. Post hoc analysis using the Tukey HSD showed a significance of <0.001 < 0.05 between city and rural regions, 0.028 < 0.05 between city and suburban regions, and 0.038 < 0.05 between city and

town regions. Students who finished a CTE sequence in city regions had a 90.4% chance of graduating compared to a 92.9% chance in town regions, a 93.3% chance to graduate in suburban regions, and a 94.2% chance to graduate rural regions.

Finding 3

Regional classification had an impact on non-CTE completer graduation rates. The study determined that differences existed when comparing non-CTE completer graduation rates of rural, town, suburban, and city school divisions during the 2016-17, 2017-18, and 2018-19 academic years.

The study determined that the difference between the means of the four regions non-CTE completer graduation rates were statistically significant for 2016-17, 2017-18, and 2018-19 academic years. Thus, the researcher rejected the null hypothesis that stated the means between locations for non-CTE completer graduation rates were equal. In the concluding Post hoc analysis using the Tukey HSD, the researcher determined where the differences occurred as a result of the initial ANOVA, determining statistically significant differences existed.

For the 2016-17 academic year, the ANOVA revealed a p-value of $0.004 < 0.05$. Thus, the difference between the non-CTE completer graduation rates for the four regions was statistically significant. Post hoc analysis using the Tukey HSD showed a significance of $0.004 < 0.05$ between suburban and rural regions and a significance of $0.024 < 0.05$ between suburban and city regions. The study determined that non-CTE completer graduation rate for city students were 83.5% compared to an 89.5% non-CTE completer graduation rate for suburban students.

For the 2017-18 academic year, the ANOVA revealed a p-value of $0.006 < 0.05$. Thus, the difference between the means of the four regions was statistically significant. Post hoc analysis using the Tukey HSD showed a significance of $0.007 < 0.05$ between rural and suburban

regions. The study determined that there was a statistically significant difference between the 88.1% rural non-CTE completer graduation rate and the 90.1% suburban non-CTE completer graduation rate.

For the 2018-19 academic year, the ANOVA revealed a p-value of 0.040 < 0.05. Thus, the difference between the means of the four regions was statistically significant. Post hoc analysis using the Tukey HSD showed a significance of 0.021 < 0.05 between suburban and city regions. The study determined that there was a statistically significant difference between the 84.2% city non-CTE completer graduation rate and the 89.2% suburban non-CTE completer graduation rate.

Finding 4

Regional classification had a statistically significant impact on CTE finisher graduation rates. The study determined that statistically significant differences existed when comparing the graduation rate of rural, town, suburban, and city school divisions CTE finisher during the academic years of 2016-17.

The study determined that the differences between the means of the four regions for CTE finisher graduation rates were statistically significant for academic year 2016-17. Thus, the researcher rejected the null hypothesis that stated the means between locations for CTE finisher graduation rates are equal. For the 2016-17 academic year, the ANOVA revealed a p-value of 0.011 < 0.05. The post hoc analysis using the Tukey HSD showed a significance of 0.023 < 0.05 between rural and town regions. The study determined that there was a statistically significant difference between the 97.3% town CTE finisher graduation rate and the 98.8% rural CTE finisher graduation rate.

Page (2012) found that there was an 11% increase in the earnings of male students who attended career academies compared to those who did not. However, graduation rates did not change. In contrast, Hemelt, Lenard, and Paeplow (2019) examined the students of a single career academy with randomized admissions in North Carolina and reported significant improvements in graduation rates. In addition, Dougherty (2018), in a study he conducted of three Vocational and Technical High Schools in Massachusetts, found that on-time graduation rates increased from 7% to 10% as a result of the program.

Implications for Practice

The study determined that the completion of career and education course sequences significantly influenced graduation cohort rates in rural, town, suburban, and city school divisions in the Commonwealth of Virginia for the 2016-17, 2017-18, and 2018-19 academic years. In addition, the study indicated a significant difference in the 2016-17 academic year when comparing the regional graduation means of CTE finisher students. There was, however, no significant difference in graduation rates between the localities of the school divisions of CTE finishers in the school years 2017-18 and 2018-19 for those completing CTE programs in both years.

Based on the study data analysis and associated findings, several implications for school and district leaders were identified. These implications identified actions and recommendations for school and district leaders, provided an explanation, and were related to corresponding findings. These implications are included below.

Implication 1

School and district leaders could incorporate career and technical education programs into a blueprint that helps students earn a diploma while gaining college and

career-ready skills. Based on the 2016-17, 2017-18, and 2018-19 evaluation of cohort graduation data, educational leaders should integrate CTE programs strategically into the curriculum for all students in order to increase cohort graduation rates in schools and school divisions. The study determined that the CTE finisher graduation rates were statistically higher than non-CTE completer graduation rates. This implication was associated with Finding 1 and Finding 2.

Implication 2

School divisions could provide school counselors professional development training on how to create appropriate career academic plans for students, which combine the completion of CTE pathways, work-based learning, and postsecondary training (apprenticeship programs, community colleges). The session should invite counselors from multiple regions to discuss best practices. In the academic years 2016-17, 2017-18, and 2018-19, the results of the graduation data indicated that, across all four regions in the Commonwealth of Virginia; rural, town, suburban, and city, the graduation rates of CTE students were statistically higher from the graduation rates of non-CTE completers.

School divisions can use this study to create professional development seminars for school counselors and leadership teams. School counselors, instructional leaders, and teachers across the country face challenging times in preparing students for life after high school due to emerging technology, workforce demands, and global competition (ACTE, 2015). Traditional education models of previous generations must adapt to keep up with global competition and a changing workforce (ACTE, 2015). This implication was associated with Finding 1 and Finding 2.

Implication 3

School divisions should consider expanding CTE facilities designed to serve interested students. Additionally, school divisions should consider remodeling existing facilities to attract uninterested students. Newly constructed facilities and lab spaces should contain unique real-world learning environments to engage all students while satisfying local industries' human resource needs. Through advisory partnerships, school division leaders can strategically select CTE programs, remodel current facilities, and create future learning spaces based on the insight of local industry leaders and city managers. This implication was associated with Finding 1, Finding 2, Finding 3, Finding 4, and Finding 5.

Implication 4

To provide students with an opportunity to complete specialty CTE programs and CTE academies that are not currently available in the zoned school district, school divisions should consider establishing student exchange partnerships with a neighboring school district. Partnering school districts can specialize in a targeted career cluster and offer an agreed enrollment count to participating school districts. Career academies aim to prepare students for real-world employment opportunities. The academy serves as a bridge between secondary instruction and local post-secondary partnerships. Local partners for each academy may include community college educators, business leaders, and civic officials (Hackmann et al., 2018). The group works collectively to identify workforce needs within the region and design meaningful curricula that prepare students for life beyond high school. This implication was associated with Finding 1, Finding 2, Finding 3, and Finding 4.

Implication 5

School divisions should consider expanding their current CTE course catalog to include multiple career clusters and complete pathway sequences. School divisions can incorporate multiple CTE pathways and career clusters into their curriculum to improve cohort graduation rates. Based upon the findings in the current study regarding higher graduation rates for CTE completers compared to their non-CTE peers, divisions should increase CTE pathway opportunities for students that include modern CTE programs. The additional programs merged with industry certifications and professional licenses to engage students and improve graduation rates. This implication was associated with Finding 1, Finding 2, Finding 3, and Finding 4.

Recommendations for Further Study

This study focused on a qualitative analysis between total graduation rates, CTE finisher graduation rates, and non-CTE completer graduation rates as well as a regional comparison with each rate. Future studies should consider a qualitative analysis that incorporates the interviews of high school graduates who completed a sequence of CTE courses while in high school. The responses from the students who have completed CTE courses could enable future researchers to gain insight from the students about the importance CTE courses had on their journey to attaining a high school diploma, as well as the impact that CTE courses had on their lives.

This study was limited to the Commonwealth of Virginia. Future studies should consider duplicating this study in multiple states. By expanding the scope of the research, a national perspective can be gained regarding the overall influence CTE courses may have on student graduation rates across the nation.

This study utilized data from the 2016-17, 2017-18, and 2018-19 academic years without differentiating between district economic strength. Future studies should expand this longitudinal

study to compare the graduation rates of students completing CTE programs with non-CTE students attending schools in high-poverty and low-poverty districts in order to gain a deeper understanding of the benefits of CTE to a specific subgroup of youths.

To further this study, future studies should incorporate a qualitative study that gathers the perspectives of CTE teachers on the most effective instructional practices for teaching CTE curriculums in the context of an actual classroom would be a valuable contribution to the current literature on contextual learning and CTE in general.

Reflections

During the research process, the researcher developed a deeper understanding of why school divisions have grown to consider CTE programs to be an integral part of the success of students in their academic studies. Furthermore, the researcher learned the importance of having quantifiable data that measures CTE completer and non-CTE finisher graduation rates over multiple cohorts. By utilizing a statistical data analysis, the researcher was able to eliminate biases and provide both state and local policymakers with statistically significant findings regarding the graduation success rates of CTE students.

It is relevant to note that the researcher began his educational career as a teacher in rural school divisions teaching agricultural education. In years to come, the researcher would later continue on to work as a site coordinator and a central office administrator for a large city school district. Through numerous professional exchanges with multiple district administrators, the researcher has always worked to promote practices and strategies that have proven effective in rural districts. According to this study, statistical data was produced that can be examined by each of the four regions in the Commonwealth of Virginia as well as other regions throughout the nation. During the study, the researcher gained a more thorough appreciation of the total

number of high schools in the Commonwealth and the total number of students served by each region. In addition, it was discovered that rural school divisions consistently had higher graduation rates when compared to town, suburban, and city regions. During the analysis of the data, it was extremely satisfying to be able to provide policymakers and school division leaders with evidence that could contribute to the continued advancement of CTE programs in schools

School administrators, with the support of school division staff, should establish practices that identify students at risk of dropping out in order to provide intervention plans that include student selected CTE course offerings. A robust CTE program offers students the opportunity to learn through hands-on activities, gain experience in the real world, receive industry certifications, and earn professional licenses as a result of engaging curriculums.

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Appendix A

Locale Definitions

National Center for Education Statistics (NCES) Locale Classifications and Criteria

NCES Locale Code	NCES Locale	Definition
City		
11	Large	Territory inside an urbanized area and inside a principal city with population of 250,000 or more
12	Midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000
13	Small	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000
Suburban		
21	Large	Territory outside a Principal City and inside an Urbanized Area with population of 250,000 or more.
22	Midsize	Territory outside a Principal City and inside an Urbanized Area with population less than 250,000 and greater than or equal to 100,000.
23	Small	Territory outside a Principal City and inside an Urbanized Area with population less than 100,000.
Town		
31	Fringe	Territory inside an Urban Cluster that is less than or equal to 10 miles from an Urbanized Area.
32	Distant	Territory inside an Urban Cluster that is more than 10 miles and less than or equal to 35 miles from an Urbanized Area.
33	Remote	Territory inside an Urban Cluster that is more than 35 miles from an Urbanized Area.
Rural		
41	Fringe	Census-defined rural territory that is less than or equal to 5 miles from an Urbanized Area, as well as rural territory that is less than or equal to 2.5 miles from an Urban Cluster.
42	Distant	Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an Urbanized Area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an Urban Cluster.
43	Remote	Census-defined rural territory that is more than 25 miles from an Urbanized Area and also more than 10 miles from an Urban Cluster.

SOURCE: *NCES locale classifications and Criteria*. Retrieved February 25, 2022, from https://nces.ed.gov/programs/edge/docs/LOCALE_CLASSIFICATIONS.pdf

For additional information, including the history of NCES locale design and development, see the Locale Boundaries User's Manual.

The NCES locale framework is composed of four basic types (City, Suburban, Town, and Rural) that each contains three subtypes. It relies on standard urban and rural definitions developed by the U.S. Census Bureau, and each type of locale is either urban or rural in its entirety. The NCES locales can be fully collapsed into a basic urban–rural dichotomy or expanded into a more detailed collection of 12 distinct categories. These subtypes are differentiated by size (in the case of City and Suburban assignments) and proximity (in the case of Town and Rural assignments). The NCES classifications and corresponding two-digit locale codes are as follows.

https://nces.ed.gov/surveys/annualreports/topical-studies/locale/definitions

Appendix B

Institutional Review Board Determination Letter

VIRGINIA TECH

Division of Scholarly Integrity and Research Compliance
Institutional Review Board
North End Center, Suite 4120 (MC 0497)
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-3732
irb@vt.edu
http://www.research.vt.edu/sirc/hrpp

MEMORANDUM

DATE: October 26, 2022

TO: Ted S Price

FROM: Virginia Tech Institutional Review Board (FWA00000572)

PROTOCOL TITLE: An Analysis of Career and Technical Education's (CTE) Influence on Graduation Rates in the Commonwealth of Virginia

IRB NUMBER: **22-985**

Based on the submitted project description and items listed in the Special Instructions section found on Page 2, the Virginia Tech Human Research Protection Program (HRPP) has determined that the proposed activity is not research involving human subjects as defined by HHS and FDA regulations.

Further review and approval by the Virginia Tech Human Research Protection Program (HRPP) is not required because this is not human research. This determination applies only to the activities described in the submitted project description and does not apply should any changes be made. If changes are made you must immediately submit an Amendment to the HRPP for a new determination. Your amendment must include a description of the changes and you must upload all revised documents. At that time, the HRPP will review the submission activities to confirm the original "Not Human Subjects Research" decision or to advise if a new application must be made.

If there are additional undisclosed components that you feel merit a change in this initial determination, please contact our office for a consultation.

Please be aware that receiving a "Not Human Subjects Research" Determination is not the same as IRB review and approval of the activity. You are NOT to use IRB consent forms or templates for these activities. If you have any questions, please contact the Virginia Tech HRPP office at 540-231-3732 or irb@vt.edu.

PROTOCOL INFORMATION:

Determined As:	**Not Human Subjects Research**
Protocol Determination Date:	**October 26, 2022**

ASSOCIATED FUNDING:

The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

Appendix C

Virginia Tech CITI Training Certificate

CITI PROGRAM

Completion Date 23-Jan-2022
Expiration Date 22-Jan-2025
Record ID 46816771

This is to certify that:

Cecil Avery

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Social & Behavioral Research
(Curriculum Group)
Social & Behavioral Research
(Course LearnerGroup)
1 - Basic Course
(Stage)

Under requirements set by:

Virginia Polytechnic Institute & State University (Virginia Tech)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w9c1f27b2-92af-4a91-acd6-c1a9ee99cbb4-46816771