

THE IMPACT OF CAREER AND TECHNICAL EDUCATION ON THE ACADEMIC
ACHIEVEMENT AND GRADUATION RATES OF STUDENTS IN THE
COMMONWEALTH OF VIRGINIA

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ABSTRACT

In 2002, the No Child Left Behind (NCLB) legislation (U.S. Department of Education, 2002) was signed into law to help children in the United States receive quality education and learn the basic skills needed to be successful (Chadd & Drage, 2006). The central focus of this legislation is the core academic subjects, which are identified in the legislation as English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history and geography. Career and technical education (CTE) is not specifically mentioned in the legislation, which suggests that NCLB and the high-stakes testing associated with the accountability benchmarks could impact the future of CTE. Even though the primary expectation of high-stakes testing is to increase academic achievement in specific areas, many worthwhile school programs could suffer from unintended consequences of this high-stakes testing initiative.

One of the strategies that many school districts are using to improve student performance in the core subject areas mentioned in the NCLB legislation is to devote more instructional time to the tested content subjects, such as reading, mathematics, social studies and science. Hence, the development of an unintended consequence of narrowing the curriculum offered to secondary students. As a result more CTE courses may be dropped from high school master schedules, which make the topic of specific concern for educational leaders (Gordon et al., 2007). School administrators and school leaders are concerned about school accreditation and student

performance on state mandated tests. Therefore, examining career and technical education student performance on Virginia's Standards of Learning assessments and the graduation rates of CTE students would help to determine the impact of CTE enrollment on student achievement. As such, the impact of CTE on high-stakes testing in the Commonwealth of Virginia was the impetus for this topic of study.

This purpose of this quantitative study was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates. This quantitative study used descriptive statistics, such as mean and standard deviation, to determine if their pass rates and graduation rates differ during the 2008, 2009 and 2010 school years. A *t*-test was used to determine if they differ significantly from each other. Findings indicate that statistically ($p < .05$), CTE completers had higher mathematics and Grade 11 English reading pass rates from those of non-CTE completers. The CTE completers in this study also demonstrated higher cohort graduation rates. It appears that a concentration of career and technical education makes a positive impact the pass rates of students on the Standards of Learning assessments and cohort graduation rates.

Dedication

I dedicate my dissertation to my loving and supportive family Shirley Jackson Hearst (my mother), Casey Victoria Blowe (my daughter) and in memory of Robert Lee Hearst (my father).

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"I do all things through Christ who strengthens me" Philippians 4:13. I give thanks to God for helping me through this journey to completing this dissertation. Without Him I would not have realized this accomplishment. During this journey, many family members, friends and co-workers offered me support and encouragement through this process. To all of you who asked about my progress in the program, I thank you. Your encouraging words and status checks helped to motivate me through the final stages of this degree program.

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Chapter One

Introduction

Public education in the United States, from the Civil War era to the No Child Left Behind (NCLB) legislation (U.S. Department of Education, 2002) evolved with the needs of public education and a changing nation (Martin, Fritzsche, & Ball, 2006). Our nation's schools are faced with the growing and evolving pressures of increasing the academic achievement of students. With the increasing pressures to improve educational programs, states have implemented standards and performance assessments (high-stakes tests) to measure student achievement, including increased graduation requirements. High-stakes testing systems generate scores with important consequences to schools and school personnel, which are also applied to students in the form of graduation requirements or remedial courses (Austin & Mahlman, 2002). Thus, the topic of high-stakes testing is important and timely because it has a direct and indirect impact on academic and elective programs offered in the high schools.

In 2002 President George W. Bush signed the No Child Left Behind (NCLB) legislation, which changed the face of the standards movement and the measure of student achievement. The purpose of the NCLB legislation was to ensure that all students have an opportunity to obtain a high-quality education and increase students' academic achievement (Gordon, Yocke, Maldonado, & Saddler, 2007). The central focus of No Child Left Behind was on core academic subjects, which are identified in the legislation as English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history and geography (Chadd & Drage, 2006). There are growing concerns with career and technical education leaders based on the fact that no program area of career and technical education (agriculture, business and computers, marketing, family and consumer sciences, health occupations, or technology-trade and industry education) is specifically mentioned in the NCLB legislation and there could

be a significant impact on career and technical education programs in the future (Martin, et al., 2006). Career and technical education (CTE) is not new to federal legislation; its programs in the United States exists as they are today because of federal legislation (Gordon, et al., 2007).

Vocational programs, now called career and technical education, have been in existence for years. Some have traced the history of CTE to ancient times in 2000 BC with the organization of apprenticeships for scribes in Egypt. However, others more commonly trace the beginnings to apprenticeship programs in the 16th century. England organized a system for apprenticeships and training in 1601 through “The Poor Law”. Later this system was transferred to the American colonies (Lynch, 2000). The early programs took the form of apprenticeships, but in 1917 with the Smith-Hughes Act, work based skills were developed to prepare young men and women for work. Over time vocational and academic classes began to separate. Through this divide many reformers were concerned about the state of vocational programs. Currently, in an effort to strengthen career and technical education programs, the Carl D. Perkins Act of 2006 requires the integration of the academic content of math, science, and literacy to a real world context (Lynch, 2000).

Since career and technical education is not directly mentioned in the NCLB legislation, there is some cause for concern by educational leaders and CTE administrators. Due to the specific and straightforward points in NCLB , such as students meeting specific state identified proficiency levels in reading and mathematics , subgroups (students with disabilities, limited English proficient, gender ethnic minorities and low socioeconomic status) demonstrating adequate yearly progress, and improved graduation rates; CTE programs could begin to lose enrollment unless the programs demonstrate that they are directly contributing to schools reaching these federal benchmarks (Gordon, et al., 2007). As a former business teacher, high school guidance counselor, middle school administrator and current CTE administrator, the

researcher believes the increased pressure to test students is a force that could possibly not only change CTE courses, but also alter the structure of CTE programs.

In working with many of the high school principals in a school division in southeastern Virginia, the researcher has found that administrators are faced with decisions in reference to the master schedules in their schools and determining if additional remediation courses or sections should be added; or if creative scheduling should be used to provide students with more core instructional time to pass the state mandated tests. High school administrators are constantly faced with trying to meet the increased academic achievement benchmarks set by the No Child Left Behind legislation. School districts, fearful of the sanctions that accompany failing tests scores, have focused attention and resources almost exclusively on the core content area subjects (Meyer, 2003). With school administrators focusing their attention to the tested core academic subjects, the impact on elective courses could possibly be an unintended consequence of the federal legislation.

Due to the reallocation of resources, including instructional time, and the focus on the core academic courses, other programs such as CTE may be adversely affected (Chadd & Drage, 2006). In the daily work of assisting administrators in scheduling courses and allocating teachers, the researcher found that some administrators have the perception that since career and technical education is not directly mentioned in the NCLB legislation and is not tested by the Virginia Standards of Learning (SOL) tests, the CTE courses are expendable and are minimal in their impact of assisting students in being successful on the state mandated tests. In some cases, career and technical education is still viewed by high school administrators as the old vocational education or 'vo tech' program and not as a viable program that contributes to the successful academic achievement of students. In a discussion with a high school principal about dropping a section of business course, the high school principal's comment was, "I've got to get these scores

up!” He was referring to the strategy that many schools are using of dedicating more class time to reading/language arts, English and mathematics courses in hopes of increasing student achievement scores for their school. Remediation courses and double blocking of core content courses potentially could cause CTE courses to be “squeezed out” of high school master schedules (Chadd & Drage, 2006).

Public schools have revised curriculum offerings, reallocated resources of staff time and money, emphasized staff development and educational focus to strengthen their academic programs. Career and technical education courses are an integral part of most comprehensive high schools; thus, if these courses are reduced, many high school students will not have the opportunity for comprehensive high school experience or exposure to specialized training and work skills. Elective courses provide students with educational alternatives to reinforce reading, math and science skills that are highly valued in the state assessments. Students succeed in schools due to a number of factors, and a sound CTE program is one of them (Daggett, 2005). Career and technical education in the United States has undergone several transitions throughout the past few decades. These changes include a broad focus on career clusters and an additional focus on academic and technical skills in preparation for entry level jobs or postsecondary study. Further, with an emphasis on academic achievement in the Carl D. Perkins Act of 1998, as noted by the academic performance indicators and the further accentuation in the 2006 Carl D. Perkins Act, student achievement has become an area of focus for CTE.

Statement of the Problem

As career and technical education establishes and maintains itself as a viable component of the comprehensive school program, there is a need to determine how students that have completed a CTE concentration of sequenced courses perform on the state mandated high-stakes Virginia Standards of Learning tests. CTE courses will continue to lose enrollment and be

removed from high school course offerings unless educational leaders can clearly demonstrate how these programs (1) contribute to the academic success of students as measured by state academic tests and (2) serve as motivation for students to stay in school and perform better in academic courses (Daggett, 2009). Countering negative or non-supportive perceptions of CTE is a challenge that if investigated could provide school administrators with data to support the need to maintain these courses in their master schedules and support student achievement. The four-year high school experience in Virginia incorporates numerous courses and other opportunities for students not assessed by state-mandated testing. Student participation in courses that are not included in state mandated testing could prove to be as valuable for future career plans as time spent preparing for the required tests (Daggett, 2005). All career and technical education courses in Virginia have been correlated to the core content area Standards of Learning (SOL); thus, the curriculum for these courses covers some of the same content as the core courses with a practical and contextual application. In 2000, the Virginia Department of Education's Career and Technical Education Department developed crosswalks (correlations) to the SOLs in the four content areas. These correlations provide contextual connections between CTE and the content areas. After development of the crosswalks, VDOE made this information available on the state's Career and Technical Education state website with the student competency task for each of the courses offered in Virginia (Virginia's CTE Resource Center, 2009). "With the demands of accountability testing intensifying, career and technical educators will face even more pressure to devote time and energy preparing their students for the high-stakes assessments, potentially threatening time formally devoted to the attainment of specific technical skills" (Thomas, 2004, p. 26-27). This brings attention to the potential need for the investigation of the impact of high-stakes testing on career and technical education instructional time in Virginia. Therefore, the performance of students in elective courses and their success on the SOLs in the

Commonwealth of Virginia is worthy of further investigation.

Theoretical and Conceptual Framework

As administrators and educational leaders continually look for avenues to increase student performance, programs that embrace career education and workplace skills of the 21st Century should not be overlooked (Daggett, 2009). The experiential and contextual learning environment in business, marketing, technology education and trade and industrial courses provide the best setting for some students to develop the academic skills needed for success on the state assessments (Thomas, 2004). Many schools are looking for the best methods to instruct students on the basic skills needed for NCLB's accountability assessments, CTE courses provide practical, hands-on experiences for students to receive relevant and purposeful instruction that are effective in strengthening basic skills (Glenn, 2005).

Contextual learning and teaching is a concept and theoretical base which links student learning to the context in which the learning will be used (Chadd & Drage, 2006). In the early 1980s, developments in research on learning and pedagogy emphasized the effectiveness of "teaching in context" (Hughes, Bailey, & Karp, 2002). The foundation of career and technical education courses is that students connect classroom learning to aspects of their daily lives. The skills and concepts that they learn in core content areas can be applied to real-life situations that will be useful to them beyond high school. Core content area teachers instruct and help students understand the importance of what they are learning. Contextual teaching and learning enables students to reinforce, expand and apply academic knowledge and skills in a variety of settings to solve simulated and real problems (Chadd & Drage, 2006).

Classroom teachers understand that students interest in math, science, and language arts improve when they see relevance in the learning or can connect it to their daily lives.

Researchers (Berns & Erickson, 2001) note that since most life situations are not limited to one

discipline, the contextual teaching and learning process must extend across disciplines for students to understand how knowledge and skills apply to real life situations. These experiences result in a deeper understanding of material which enables students to retain information longer and apply it to future situations. Even though CTE courses utilize contextual teaching and learning methods, these courses are typically electives and at times it may be difficult for educational leaders, teachers and other stakeholders to see how CTE courses contribute to achieving NCLB goals and school accreditation. However, research has shown that CTE improves student learning and achievement because of the contextual approach used in teaching those courses (Glenn, 2005).

Many educators now acknowledge that what students learn is impacted by how they learn. Students learn more when the school work is connected to their interests, to real world problems and the world of work and college (The Partnership for 21st Century Skills, 2011). CTE teaches 21st Century skills and many CTE educators believe that fostering 21st Century skills is a real strength of their programs. The framework for 21st Century teaching and learning combines a focus on skills needed for the 21st Century, workplace readiness and student outcomes (a blending of specific skills, content knowledge, expertise, and literacies) with a support system to help students master the abilities required for the future. The Partnership for 21st Century Skills identifies the following skills as valuable to students as they progress from secondary school to the world of work or to college:

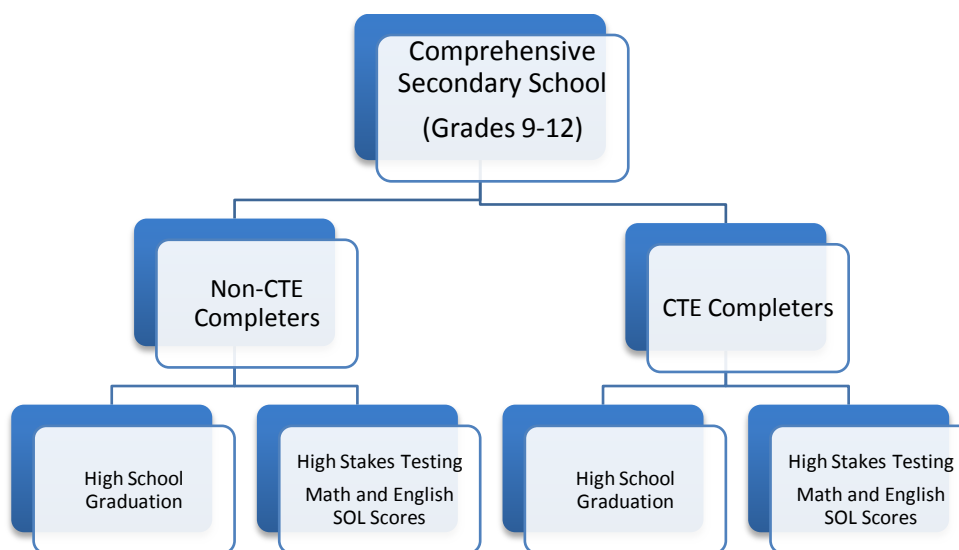
- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration
- Information Literacy

- Media Literacy
- Life and Career Skills

These skills are needed to ensure college and career readiness for today's students. CTE employs these skills, which keep students in school, while teaching 21st Century skills for success. Tony Wagner (2008), author of *The Global Achievement Gap*, supports the 21st Century Skills framework and also adds that the use of academic content to teach the Survival Skills (21st Century Skills) will help to increase academic rigor for students.

Figure 1

Conceptual Framework



Source: Eleanor Hearst Blowe, 2011

The Partnership for 21st Century Skills conducted a national survey where 88% of the respondents believed that schools should incorporate 21st Century Skills, such as problem solving, computer technology, communication, and self-direction skills into the curriculum to better prepare students for the future. Sixty-six percent of the respondents believed that students needed more than reading, writing and arithmetic in school. The Association for Career and Technical Education (ACTE) has joined the Partnership for 21st Century Skills because both

organizations share the common goal of preparing students to be college and career ready. The organizations have complementary approaches to 21st Century learning, which are exemplified by the integration of academics and 21st Century Skills for economic, workforce and civic relevance. Providing students with 21st Century Skills and contextual learning helps to make education relevant to students and serves as a critical part of closing both the achievement gap and the global competition gap (The Partnership for 21st Century Skills, 2011).

Significance of the Study

Researchers note there is a paucity of research on the impact of high-stakes testing and NCLB on career and technical education (Gordon, Yocke, Maldonado & Saddler, 2007). Federal legislation has regulated career and technical education since its inception and continues to mandate the operation of the programs. Thus, there is documentation available in reference to the specifics of the Carl Perkins legislation and the requirements of the grant that funds secondary and postsecondary CTE programs. However, few state studies have been conducted to evaluate the impact of the requirements of federal mandated testing of NCLB on career and technical education programs (Gordon, et al., 2007).

On a national level, “the National Center for Education Statistics (NCES) is the primary entity for collecting, analyzing, and reporting data related to education in the United States and other nations” (Levesque, Laird, Hensley, Choy, Cataldi & Hudson, 2008, p.iii). The NCES produces a publication every five years that describes the condition of career and technical education in the nation. The latest volume of the report seeks to describe the full range of career and technical education from 1990 to 2005, through data from 11 National Center for Education Statistics surveys. The Levesque et al. (2008) report states that no measurable changes were detected to have taken place in student participation in career and technical education courses on a national level between 1990 and 2005. Public high school graduates were reported by NCES

to have earned 4.19 CTE credits in 1990, 4.2 credits in 2000, and 4.01 in 2005. Some course taking shifts were detected among program areas, but changes in course taking patterns and enrollment were found to not be statistically significant (Levesque, et al., 2008). The national data were last evaluated in 2005, approximately four years after the NCLB legislation. Thus, the impact of the sanctions and increased accountability standards did not have an opportunity to significantly impact national career and technical education enrollment. NCES cautions readers that it is important to remember that the report is descriptive in nature and the reader should not make “unwarranted casual inferences from simple cross tabulations” (Levesque, et al., 2008, p. iv).

In the Commonwealth of Virginia, the Virginia Department of Education (VDOE) website reports CTE enrollment numbers and upon initial review shows a 10,139 increase in the number of program concentrators. The change in enrollment numbers represents an increase from 24,885 program concentrators in 2001-2002 to 35,024 concentrators in 2008-2009 in the Commonwealth of Virginia; however, this figure is not disaggregated to account for other factors such as the size of the school divisions, proportion of CTE students in relation to the total increase of student enrollment in Virginia schools or the attitudes of the principals in the various divisions in regards to CTE programs. The Virginia Department of Education also reports that the 2008-09 CTE completers’ pass rate on the Standards of Learning assessments were 98.08% in English and 98.23% in mathematics. Nationally, the NCES reports that the 2005 graduates, the majority of both occupational concentrators and their non-concentrating classmates were English proficient as of grade 12 (96–98%), and had taken mid-level mathematics in grade 9 (63–67 %). Smaller percentages of occupational concentrators than non-concentrators took geometry or higher-level mathematics in grade 9 (19% vs. 26%) and attended the largest schools (enrolling 2,000 or more students) (Levesque et al., 2008).

Purpose of the Study

Since 2001 and the passage of No Child Left Behind, schools and school divisions have worked to meet the accountability demands outlined in the legislation. Anecdotal accounts indicate that there is a narrowing of CTE programs due to the marginalization of elective programs by educational leaders (Thomas, 2004). Therefore, the purpose of this study is to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates. Through an evaluation of career and technical education students' performance on Virginia's Standards of Learning assessments in English, mathematics as well as graduation rates educational leaders would gain information about the performance of CTE students as it relates to academic performance on the state mandated SOL tests. This investigation includes students who have taken two years of an outlined sequence of CTE courses and obtained at least 80% or more of the competencies in a particular program. Additionally, this study examines CTE enrollment and school completion for students who have taken two years of the outlined sequence of courses. Thus, in this time of school accountability, a study on the impact of CTE on academic achievement in the Commonwealth of Virginia is due to be investigated.

Research Questions

As noted, a potential unintended consequence of high-stakes testing is the marginalization of career and technical education programs due to the need for additional instructional time for the core content areas. Thus, it becomes imperative for CTE programs to provide information regarding their impact on helping students meet the benchmarks of NCLB and state mandated tests, which in most cases is directly linked to graduation requirements. The overarching question for this study is: What is the difference in academic achievement and

graduation rates of high school students with regards to secondary career and technical education enrollment, as measured by the Math and English/Reading Standards of Learning (SOL) assessments and graduation rates? To accomplish this endeavor, the following research questions were developed for this study:

1. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured by SOL Math pass rates of the highest level of Math completed (Algebra I, Algebra II, and/or Geometry)?
2. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured Grade 11 English reading, literature, and research SOL pass rates?
3. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. non-CTE completer) and the graduation rates of students?

Definition of Terms

In reading this research study, it is necessary that terms used are defined. The terms used in this study are:

1. ***Career and Technical Education:*** Formally known as vocational education, is a coherent sequence of instruction and educational activities that provide individuals with the academic and technical knowledge and skills that the individuals need to prepare for further education and for careers in current and emerging career pathways. The program includes competency-based applied learning that contributes to the academic knowledge, higher order reasoning and problem solving skills, work

- attitudes, general employability skills, technical skills and occupational-specific skills (Elliot, et al, 2005).
2. ***Career Cluster:*** The U. S. Department of Education Office of Vocation and Adult Education (OVAE) identified 16 career clusters that represent career opportunities for the 21st Century economy. These clusters frame student opportunities as they pursue secondary and post-secondary education and a wide range of career opportunities (States' Career Clusters, 2011).
 3. ***Career Pathway:*** A Career Pathway is a series of connected education and training programs and support services that enable individuals to secure employment with a specific occupational sector and to advance over time to successively higher levels of education or employment in that sector.. Career Pathways focus on easing and facilitating student transition from high school to community college; high school to four year universities; from pre-college courses to credit postsecondary programs; and from community college to university or employment (Virginia Community College System, 2011).
 4. ***Carl D. Perkins Career and Technical Education Improvement Act of 2006:*** The 109th Congress passed new career/technical legislation, the Carl D. Perkins Career and Technical Education Improvement Act of 2006, known as Perkins IV. Perkins IV provides more than \$1.2 billion in federal support for career/technical education programs. The legislation is aimed at helping today's students gain the academic and technical skills and knowledge necessary for high demand, high-wage jobs. The legislation requires states to outline a logical sequence of high school and college courses leading to industry certification, while maintaining a strong academic focus

that promotes instruction and accountability consistent with No Child Left Behind (NCLB) (SREB, 2007).

5. **Concentration Sequences:** A concentration is a coherent sequence of courses as identified in the course listings within the Virginia Department of Education- Career and Technical Education Administrative Planning Guide (VDOE, 2010).
6. **CTE Completer:** A career and technical education completer is a student who has met the requirements for a career and technical education concentration and all requirements for high school graduation, or an approved alternative education program. Completers have passed at least 80% of the program competencies in an approved CTE concentration sequence. Students may take additional career and technical education courses that will enhance their career pathway goals (VDOE, 2010).
7. **Graduation rate:** – Virginia calculates three graduation “rates” for accountability purposes. For the purpose of this study, the following graduation rate indicator will be used:

The Federal Graduation Indicator is the percentage of students who graduate with a Standard or Advance Studies Diploma. It is used in calculating AYP ratings of high schools, school divisions and the commonwealth (VDOE, 2011).
8. **High-Stakes Test:** Tests from which results are used to make significant educational decisions about schools, teachers, administrators, and students. (Amrein & Berliner, 2002). These tests are also used to determine who would be eligible for a high school diploma (Elliot et al., 2005).
9. **Non-CTE Completer:** A non-CTE completer is a student who did not complete a concentration sequence.

Table 1
Sample CTE Completer/Concentration Sequences, Career Clusters, and Career Pathways

Program Area	Example Concentration Sequences	Career Cluster	Career Pathway
Business	Computer Information Systems Design, Multimedia and Web Technologies	Information Technology	Information Support
Business	Finance Personal Finance and Economics	Finance	Business Finance
Health and Medical Services	Biomedical Innovation Human Body Systems	Health Sciences	Biotechnology Research
Marketing	Global Marketing and Commerce Financial Services Marketing	Marketing	Marketing Communication
Technology Education	Engineering Design and Development Computer Integrated Manufacturing	Science, Technology, Engineering and Mathematics (STEM)	Engineering and Technology

Source: Virginia Department of Education, Career and Technical Education Administrative Planning Guide, 2011.

10. Secondary school: A secondary school is defined as a public school with any grades 9 through 12 (VDOE, Standards of Accreditation, 2011).

11. Standards of Learning-SOL tests: State mandated high-stakes assessments that measure student achievement in English, mathematics, science and history/social science. Students are assessed in English and mathematics in grades 3-8 and at the conclusion of certain high school-level courses. (VDOE, 2010)

12. Two Sequential Electives: Students who are pursuing a Standard or Modified Standard Diploma must complete two sequential electives. Two sequential electives

comprise a concentration of courses from a variety of options, including Career and Technical Education. Completing any CTE concentration, including prerequisites if applicable, will meet the requirement (VDOE, 2010).

Limitations and Delimitations of the Study

As this study attempts to identify the impact of CTE concentration on student performance on SOL assessments in English and mathematics, there are several factors that may contribute positively or negatively to students' performance on the SOLs. Thus, with the acknowledgement of this assumption, the following limitations are identified:

Limitations.

1. The researcher has no control over the course selections of the students or the CTE concentration sequences. Differential course taking pattern of high school students are not controlled by the researcher. Nor is there information on the CTE completers regarding their particular concentration sequence. Information regarding the performance of one concentration as opposed to another was not regarded in this study.
2. Some of the subjects in the non-CTE completer sample may have taken one year of a CTE course, which could have impacted their student performance. Students having one CTE course versus completing a CTE concentration of courses were not considered in this study.
3. The researcher cannot account for the varying academic proficiency levels of the subjects in the study. The subjects in the CTE completer and non-CTE completer groups enter high school having varying levels of academic proficiency, which could be a factor in their academic achievement on the SOL assessments.

4. Student academic achievement success on the Math and English SOLs could be attributed to other factors that are not included in this study. However, these variables will not be the focus of the study. Course taking patterns were not analyzed to determine if the students in the CTE completer group were enrolled in honors, dual enrollment, Advanced Placement or upper level mathematics or English courses.
5. Poor student achievement on the standardized SOL assessments could be affected by factors such as ethnicity, socio-economic status, gender, parent education, and learning styles,. These factors will not be the focus of this study.
6. The researcher's past experiences as a business teacher and CTE administrator are prevalent, thus the interest in this topic. In an effort to control for this bias, the researcher has purposefully selected a quantitative method of study using ex post facto data.
7. The data used for analysis do not take into account the practices of various school divisions regarding student course selection and students enrolled in Career and Technical Education Regional Centers.
8. Using ex post facto data, the researcher understands that there may be internal validity issues that are characterized by the selection threat. The result of the inability of the researcher to control the selection of the comparison groups may not be initially equivalent on critical variables other than the type of curriculum taken or not taken.
9. The researcher understands that the graduation rate data is reflective of CTE completers who have taken two sequential electives during their junior and senior years, thus placing them closer to graduation and reducing the number of students included in the completer graduation rate who may have left school prior to graduation.

Delimitations.

1. The Standards of Learning assessments are only utilized in the Commonwealth of Virginia, thus the results of this study may not be generalizable to other states that utilize state specific high-stakes tests.
2. Only three years of cohort graduation rate data were available on the Virginia Department of Education website. As a result of NCLB, these are data that the Commonwealth of Virginia has only recently begun to capture. Thus, the graduation rates of CTE completers versus non-CTE completers are limited to the past three years.

Organization of the Study

A five chapter format was used to organize this study. Chapter 1 of this study provides a context for the research. In addition, this chapter includes the statement of the problem, the purpose of the study, its significance, and the research questions that guide the research. Chapter 2 contains a review of literature that pertains to this topic. It includes a historical perspective of career and technical education, the value of career and technical education, high-stakes testing, narrowing of secondary high school curriculum and CTE student academic performance and graduation rates. Chapter 3 proposes a methodology for this investigation, including population, data collection, proposed research design and possible data analysis methods. Chapter 4 reports the results of the study by research question, including data tables and statistical analysis of the data. In conclusion, Chapter 5 offers the findings of the study, implications for practice and recommendations for further research.

Chapter Two

Review of Literature

This chapter examines the literature as it relates to career and technical education concentration on graduation rates and student achievement. To gather the background information necessary for this synthesis of literature, several computerized databases were used including Iliad, ERIC, EBSCO Host and Dissertation Abstracts International. Key terms used to conduct this research included, but were not limited to career and technical education, student achievement, student performance, narrowing curriculum, standardized testing, high-stakes testing, graduation rates and No Child Left Behind. As a result of the information gained from that research, this chapter is divided into five areas: historical perspective of career and technical education and its value, standardized and high-stakes testing, narrowing of the secondary high school curriculum and CTE student academic performance and graduation rates. The review illustrates how historical and social forces have impacted the development of career and technical education programs and how the emergence of high-stakes testing and accountability systems has impacted elective courses.

Historical Perspective and Value of Career and Technical Education

From the beginnings of vocational education, there has been one factor that has been a major influence in the establishment and sustainability of vocational education programs, which is the federal funding sources that have been earmarked specifically for vocational education programs. As the educational system evolved in this country, the need for vocational education also arose. Informal vocational education programs emerged providing the skills needed as the country industrialized. However, in 1917 the landmark legislation of the Smith-Hughes Act appropriated \$1.7 million in 1917-1918, which increased to \$7.2 million by 1925-1926. These funds were designated for the education of students fourteen years of age not attending college

and preparing to enter a specific vocational field (Barlow, 1976, Thomas, 2004). This funding established vocational and agricultural programs in the secondary schools. The Smith- Hughes Act, a landmark report released in 1917, also provided matching funds to pay vocational teacher salaries and later amendments paid for teacher training and education.

The Commission on the Reorganization of Secondary Education was established to address to the needs of the increasing number of students attending schools (Thomas, 2004). Due to more students attending school and a greater proportion remaining in school for a longer period of time, the Commission sought to force school curricula to help students cope with the changing world by providing curriculum that met the needs of students with different interests and ability levels. The Commission developed seven areas of life for secondary education to address: health, command of fundamental processes, worthy home membership, vocational preparation, citizenship, worthy use of leisure time, and development of ethical character (Raubinger, Rowe, Piper, 1969). The inclusion of vocational education in this report as well as the passing of the 1917 Smith-Hughes Act, vocational education made a significant step in becoming a legitimate part of secondary education as well as becoming a formal part of high schools. Several other subsequent events helped to contribute to the establishment of career and technical education as it is today.

By 1926 enrollment in vocational education programs rose to almost 900,000 and the George Reed Act of 1929 helped to expand the growth (Keller, 1976). This Act authorized \$1 million dollar annual increases in vocational education funding from 1930-1934 to expand the areas of agriculture and home economics (Keller, 1976). Vocational education continued to see funding increases as the nation realized that the practical skills taught in these areas helped the country to flourish. Even many notable educators such as John Dewey saw the value in high school students receiving practical skills and education. In Dewey's book *Democracy and*

Education (1916), he referred to this as “the theory of experience and knowledge”. From the 1929 George Reed Act, several other forms of legislation were put in place to increase the funding and support the growth of vocational education in the United States. In the 1940’s funding was established for WWII vets as well as high school students to train in the areas of trade and industrial, home economics, practical nursing and fishery.

In addition to the release of national reports, the nation began to recognize the need to meet the diverse educational needs of students. Educational reformers began to understand that the traditional academic curriculum was not designed to address the societal and industrial needs of the country. Though vocational programs were included in the structure of secondary schools, there was a practice of separating students enrolled in the career specific programs from the academic courses. This is a perception that many educators still hold today (Chadd & Drage, 2006).

In 1963, President Kennedy ordered a review of vocational education that resulted in the *Education for a Changing World of Work* report. The report recommended the expansion and improvement of vocational programs to offer students additional opportunities. The outcome of this report was the Vocational Education Act of 1963. The emphasis of this legislation was upon the people who needed the skills rather than upon occupations in which needed skilled people (Thomas, 2004). One of the most prominent advocates and sponsors for this legislation was Kentucky Representative Carl D. Perkins. He was one of the most influential advocates for vocational education in Congress and thus, the Vocational Education Act would later be renamed the Carl D. Perkins Act. Funding for the Perkins Act continued to increase with the expansion of vocational programs. Vocational education programs saw tremendous recognition during this time. Since 1963, the Carl D. Perkins legislation has seen many amendments and revisions. The most recent reauthorization in 2006, known as Perkins IV, now offers states the “unprecedented

latitude to align CTE with a broader set of high school redesign, programs, and funding” (Harris & Wakelyn, 2007, p. 4). Perkins IV provides for:

- Increased focus on academic performance of career and technical education students
- Improved instruction of CTE teachers and assistance in working with academic teachers to integrate their curricula
- Strengthened connections between secondary and postsecondary education
- Improved state and local accountability (Harris & Wakelyn, 2007, United States Department of Education, 2011)

One of the focal points of the legislation is the increased concentration on the academic performance of CTE students. “Past research on the impact of CTE upon academic performance was not encouraging” (Harris & Wakelyn, 2007, p. 4). Therefore, it was not surprising that the legislation required states to be more accountable for high school graduation rates and proficiency toward earning a diploma in effect staying in line with the No Child Left Behind Act. The heart of Perkins IV is to provide students with academic and career/technical skills that will propel them to success in secondary and postsecondary studies as well as into high wage, high demand jobs (SREB, 2007).

With the increased accountability of Perkins IV for states and schools to report test scores, graduation rates, and academic targets, it would be beneficial for educators to know the impact of CTE enrollment on these indicators. As students continue to take CTE courses and the academic educational accountability benchmarks increase, most recently in the form of high-stakes tests, educators must review CTE’s impact. As President Obama’s administration seeks to graduate students that are college and career ready, educators are beginning to go beyond identifying subject matter courses that students need to succeed (Sparks, 2010). In 2010 the

President's budget outlined level funding for the Carl D. Perkins Career and Technical Education Act. The President has a national focus on increasing and strengthening the middle class and CTE can help to support that end (ACTE, 2009).

In the Commonwealth of Virginia, the Virginia Department of Education (VDOE) is the recipient of the grant funds for Carl D. Perkins. Approximately 85% of the funds are used for secondary schools, with the remaining 15% used by the Virginia Community College System to help increase the linkages among secondary, postsecondary and employment. The grant award period is from July through June; however, the funds are distributed to the state and school divisions in two allocations. Thirty-two percent is made available on July 1 of each year. The remaining 68 % of the grant funds are available on October 1. There is no provision for Perkins funds to be carried over from one school year to the next school year, which means that all funds must be expended by the state and school divisions before June 30 (VDOE, 2009).

Perkins IV now requires that states distribute secondary funds under Section 131(a)(2) of the Act based on the Bureau of the Census estimate of the number of individuals aged 5 through 17, inclusive, who reside in the school district served by such local education agency and are from families below the poverty level for the preceding fiscal year, as determined on the basis of the most recent satisfactory data used under Section 1124(c)(1)(A) of the Elementary and Secondary Education Act (ESEA) of 1965, compared to the total number of individuals who reside in the school districts served by all the local educational agencies in the state for such preceding fiscal year (VDOE, 2009). Therefore, Virginia school divisions receive varying amounts of funding from the Perkins grant depending upon the number of students reported in poverty and the total number of students enrolled in the school division. For example during the 2008-09 school year, Amelia County reported having 242 students age 5-17 in poverty, with a total school division enrollment of 5,206; which provided them with \$29, 973 in Perkins

funding. Whereas a larger school division such as Fairfax County, with 9,929 students reported in poverty, and a total school division enrollment of 165,722, received \$1,611,045 in Perkins funding for that same academic year.

Standardized High-Stakes Testing

In 1983 the Commission on Education released *A Nation at Risk*, which argued that schools in the United States were performing poorly in comparison to the other industrialized nations, and the United States was in jeopardy of losing its global superiority (Amrein & Berliner, 2002). One of the results of this report was the concept of high-stakes testing. Although high-stakes tests existed before the release of this report, an emphasis on minimum competency testing called for a movement that would help to increase the academic achievement of the United States. The high-stakes tests which existed prior to *A Nation at Risk* were used to assess intelligence, to quantify merit, and to diagnoses deficiencies and strengths. The tests did not have a great effect on schools. *A Nation at Risk* called for standards and tests to improve the academic performance of students in schools. The Commission recommended that states implement higher academic standards and administer assessments to make sure schools were meeting those educational standards. As a result, states developed high-stakes state assessments to hold school accountable for student success (Amrein & Berliner, 2002; Elliot et al., 2005) *A Nation at Risk* sparked much debate and began a movement in education that focused on achievement testing and a rigorous standards based reform. The information included in that report coupled with the decline in student performance lead the way for even further reform in education.

The Elementary and Secondary Education Act (ESEA) of 1965 also played a role in mandated standardized testing. The ESEA required schools that were receiving Title I funds to test their students in order to receive funding. Even though this testing was not required of all

students, it contributed to the influx of commercially prepared standardized testing programs. The use of these tests increased in the sixties and seventies, but they had virtually no impact on the students' performance. The scores from these assessments did not have any sanctions on the schools or teachers, thus the tests were considered to be "low-stakes" (Thomas, 2004).

In an effort to continue the reforms in education that were prompted by *A Nation at Risk*, President George W. Bush assembled a National Education Summit for state governors to discuss the issues in education. This group established six broad educational objectives that were eventually incorporated into Goals 2000: Educate America Act, for a total of eight goals. This legislation outlined goals of helping more students achieve higher standards, encourage local community –based support of the educational needs, and increased parent participation. States were given the flexibility to decide how they would implement their standards based education reform for all students (Gunderson, 2006; Carroll, 2008).

The Elementary and Secondary Education Act, renamed No Child Left Behind (NCLB) was reauthorization in 2001 in Congress. The legislation was signed on January 8, 2002, by President Bush with the addition of two key principles- accountability and enforcement. NCLB has had a significant impact on federal educational programs. The legislation is noteworthy for many reasons, but most particularly for the federal government's attempt to improve student achievement through educational reform (Chadd & Drage, 2006). The legislation has four goals: increased accountability for results from states school districts and schools; more flexibility for states and local educational agencies in how federal dollars are used; proven teaching methods; and more choices for parent and students attending low performing schools (US Department of Education, 2002).

NCLB requires every student to meet state identified standards by the conclusion of 2013-2014 school year. The aim is to have all students at grade level by 2014. Educational

systems are required to create annual assessments that measure children's abilities in English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history and geography (US Department of Education, 2002). Each state established goals to measure schools' and school districts' progress to the benchmarks and adequate yearly progress standards. The focus of the legislation is undeniably the core subjects and suggests that there is not as great a focus on areas such as the arts, world languages and career and technical education (Amrein & Berliner, 2002; Chadd & Drage, 2006; Gerrity, 2007). The New York Times (2006) even reports that, "thousands of schools across the nation are responding to the reading and math requirements laid out in No Child Left Behind . . . by reducing class time spent on other subjects and, for some low-proficiency students, eliminating it" (para. 1).

Tests have come to define school priorities. A key element of NCLB is the high-stakes assessments that are associated with the attainment of the benchmarks. High-stakes tests are defined by Amrein & Berliner (2002) as "...tests from which the results are used to make significant educational decisions about schools, teachers, administrators, and students. High-stakes testing policies have consequences for schools, for teachers, and for students (p.1)." A national longitudinal study conducted by the Center for Educational Policy suggests that No Child Left Behind has had a positive effect on our educational system and the achievement of our students (Jennings & Rentner, 2006). Jennings and Rentner (2006) in conjunction with the Center for Educational Policy (CEP), have conducted a continuous and comprehensive review of NCLB producing the papers *From the Capital to the Classroom*. Annually, the CEP surveys officials in state departments of education and a national representative sample of school districts to gather data surrounding the implementation of the NCLB legislation. The CEP also conducts case studies of individual school districts and generally monitors the effects of NCLB on school

districts. As a result of the CEP research, they note that the positives do not come without some concerns or unintended consequences. In the same research by Jennings and Rentner (2006), it is reported that NCLB has also caused schools to spend more time on tested subjects at the expense of others subjects that are not tested.

Amrein & Berliner (2002) conducted a study to analyze and examine whether or not states that have implemented high-stakes exams, such as graduation exams, have experienced unintended consequences that are associated with such tests. The researchers wanted to determine if high-stakes tests have increased the dropout rate, decreased high school graduation rates and increased the rate by which students have enrolled in General Education Diploma (GED) programs. Through quantitative data analysis and through anecdotal teacher reports, the researchers evaluated the indicators. At the time of their study, 16 states had implemented some form of graduation exams or high-stakes test. Results of their study concluded that 66 % of the states included in the study indicated that overall they were negatively impacted by the implementation of high-stakes tests. The negative impact included an increase in dropout rates, a decrease in graduation rates, and/or an increase of enrollment in GED programs. Sixty-two percent of the states in the sample posted increased dropout rates and 67 % of the states posted a decrease in graduation rates (Amrein & Berliner, 2002).

Some other unintended consequences of high-stakes testing mentioned by the researchers, Amrein & Berliner (2002) include high retention, expulsion and dismissal rates, teachers “teaching to the test”, an exodus of teachers and a narrowing of curriculum. The researchers also discovered that math and language arts are subjects most frequently tested and 69 % of teachers in poor schools report that high-stakes test were forcing them to concentrate heavily on these subject areas. Overall, the researchers conclude “using the best external measure available, evidence exists that high-stakes tests do create negative, unintended

consequences about which critics worry...” (Amrein & Berliner, 2002).

Virginia Standards of Learning

The Board of Education in Virginia recognized the importance of raising the learning expectations for all students in Virginia public schools. “...State officials sought to clarify what students need to know and to hold students and educators accountable for demonstrated performance” (Hess, 2002, p. 1). In an effort to do that in the 1970’s and 1980’s the Commonwealth of Virginia adopted and supported two testing programs that called for students to master particular skills and content before graduating. Before 1976, Virginia high school students only needed to accumulate the specific number and type of Carnegie credits to graduate. However in July of 1976, Virginia became the first state to implement a form of minimum competency testing (Hess, 2002). The Graduation Competency test, which passed the General Assembly, required students to demonstrate reading and math skills before they were allowed to graduate. This high-stakes test required that students demonstrate basic survival skills such as balancing a check book or completing a job application.

Under new leadership in the state government, amidst Scholastic Aptitude Test (SAT) scores that were flat for the Commonwealth of Virginia, and the release of *A Nation at Risk*, the Excellence in Education Committee was convened. This sixteen member committee introduced the Literacy Passport Test (LPT) to ensure that sixth grade students were performing at satisfactory levels in reading, writing and arithmetic. The LPT test also carried high stake consequences in that students who did not pass it were denied a diploma (Hess, 2002).

In June of 1995, the Board of Education in Virginia enacted the new Standards of Learning (SOL) in English, mathematics, history, social sciences, science and computer technology. These criterion referenced assessments associated with the SOLs sought to specifically measure student progress toward learning the content laid out in the curriculum and

learning standards. The Virginia SOLs set standards and targets for what teachers were expected to teach and what students were expected to learn. The tests were administered for the first time in 1998 and the first school report card was published in 1999 (Hess, 2002). The school report cards represent Virginia's commitment to keeping stakeholders informed of the progress of schools. The "report cards for schools, school divisions and the Commonwealth include data on student achievement by grade, subject and student subgroup and information on other indicators of school quality"(VDOE, 2011).

By early 2001, Virginia's educational system was being transformed by the Standards of Learning. The SOL accountability system was functioning on the premise that students would not graduate if they do not demonstrate acceptable performance on the assessments. Graduation requirements contingent upon students passing the SOL took effect in 2004. Students were required to have passed six SOL assessments for a Standard diploma and nine SOL assessments to receive an Advanced Studies diploma. In 2007 the General Assembly approved two additional types of diplomas—Technical diplomas. Each of the new Technical diplomas, Standard Technical and Advanced Technical, require students to earn at least 4 Carnegie credits in career and technical education. Many CTE proponents deemed this a victory for the respect level of CTE in the state of Virginia. Also, the Standards of Learning were linked to the performance based accountability system adopted by the Board in the Standards of Accreditation. In the adoption of the Standards of Accreditation, the Virginia Board of Education made it clear that student performance on the SOL assessments would have direct impact on school accreditation. In order to be fully accredited, 70 % of a school's eligible students must pass the SOL tests in the four core content areas. An exception was created to the third and fifth grade levels, where the board set the required pass rate at 75% for English and

math, and science and history scores would not be calculated toward a school's accreditation rating. This caused some opponents of policy to argue that not counting the science and social studies scores in elementary accreditation would send the message that the other subjects were not as important (Hess, 2002). In 2006, the School Accreditation policy was amended and the percentage of students passing the SOL tests in the four academic areas in the school would be used to calculate the accreditation rating... (VDOE, 2011).

Narrowing Curriculum

Testing has become a prevalent part of our educational system. High-stakes tests have become a priority for our nation's schools. The passage and implementation of No Child Left Behind has prompted educators to focus on a standards based curriculum and review and modify their curricular focus. As states, school districts and schools begin to adjust to the fact that 100% of their students in each of the nine subgroups must achieve proficiency in the academic standards, CTE programs will be at risk (Daggett, 2009). CTE programs will increasingly be "squeezed" out of the scheduling sequence in high schools unless CTE proponents and leaders can demonstrate the value of these programs (Chadd & Drage, 2006). There are two major areas in which CTE must demonstrate its value. Those areas are (a) contributing to the academic success of students as measured by the state academic tests and (b) serving as a motivation for students to stay in school and help students to perform better in their academic courses (Daggett, 2009).

As a result of the high-stakes assessments that are a part of the accountability of NCLB, schools use the content standards as the bases for the assessments. The standards are also used as a guide for teachers in daily classroom instruction. Districts and schools are increasingly focusing their resources on the subject areas covered in the accountability assessments, while

other subjects or areas receive less or no attention (King & Zucker, 2008). Also as a result, school districts have decreased the time teachers spend on areas not tested or the number of classes offered in elective areas. Thus, the unintended consequence has resulted in “narrowing the focus or curriculum” in schools.

Electives during the school day have been periodically squeezed out since the standards movement began in the late 1980s (Davis, 2006). In response to the call for higher academic standards and rigorous curriculum, CTE has responded in various ways over the last 20 years. Programs such as Tech Prep and School to Work were implemented into CTE to emphasize the academics needed to apply in contextual courses in CTE (Stone, et al., 2004). Despite the changes made by CTE leadership, including a name change from vocational education to career and technical education, the programs are still perceived by many as a program for students who do not plan on going to college.

Although CTE has always brought relevance to the high school curriculum, it struggles to provide rigor. In the latest report of 12th grade mathematics scores, two-thirds of CTE concentrators scored below basic on the National Assessment of Education Progress (NAEP). Historically, these types of statistics have lead educators to view CTE as a second-tier track that offers students few options and little preparation for the future. (Harris & Wakelyn, 2007, p. 2)

Thus, many educational leaders do not believe that CTE programs contribute to the attainment of academic proficiencies for state tests. Daggett (2009) states that if CTE is to remain a viable program in our secondary schools, it must demonstrate the ability to not only prepare students for the workplace, but also for the academic competencies required by NCLB.

Curriculum narrowing not only affects the elementary and middle schools music and arts

programs, in high schools it impacts other electives such as career and technical education, foreign languages and the arts. The federal No Child Left Behind Act is prompting schools to cut back on subjects such as social studies, music and art to make more time for reading and mathematics, the main subjects tested by the federal law (Davis, 2006). Many schools are responding to the reading and math requirements laid out in No Child Left Behind by reducing time spent in other elective subjects and in some cases eliminating the electives all together for some students. The intended goal of this legislation and standards based movement was to place more accountability on schools, teachers and students. However, the unintended result has been that areas such as math and language arts that are most frequently tested, has increasingly caused other areas such as social studies, science and other electives to be pushed aside. “Some school districts view the extra time for reading and math as necessary to help low-achieving students catch up. Others pointed to negative effects, such as short –changing students from learning important subjects, squelching creativity in teaching and learning, or diminishing activities that might keep children interested in school” (Jennings & Rentner, 2006). As the stakes increase for the state assessment systems, school districts are likely to redirect funding to areas that prepare students for the high-stakes tests, which will consequently cause students to have a less rich curriculum to choose from in high school (Dillon, 2006).

The state assessment systems rarely measure workplace readiness skills or industry-specific skills on the state assessments. These skills are largely absent from the state education standards and as a result, CTE curricula typically does not fit well with the high-stakes testing in most states (Harris & Wakelyn, 2007). The use of high-stakes testing barriers to graduation have led to a narrowing of curriculum and many students’ increased disengagement from education, resulting in higher dropouts ...the pushing out of low performing students (Amrein & Berliner, 2002). It is also thought that reducing course offerings for students and reducing the number of

electives for students to take is a formula for an increase in high school dropouts (Dillon, 2006).

There are also those who report that the narrowing is not as prominent as some would have educators to think. The Center on Education Policy conducted a nationally representative survey of 299 school districts in 50 states regarding their reduction of the amount of time spent on subjects other than reading and math; and the majority of the school districts reported that the instructional time had been reduced only minimally or not at all. Yet, 27 % of the districts reported reducing the time devoted to teaching social studies somewhat or to a great extent, and 22 % reported reducing the time in science. Twenty percent reported cutting art and music, and 10 % reported reducing time for physical education (CEP, 2005).

Although 78% of schools report improved test scores by narrowing the curriculum, there are concerns that low- performing students will not receive the benefit of a well-rounded education due to the emphasis on rote learning and memorization with hopes of achieving success on the high-stakes assessments (Dillon, 2006). “Schools from Vermont to California are increasing—in some cases tripling—the class time that low proficiency students spend on reading and math, mainly because federal law, signed in 2002, requires annual exams only in those subjects and punishes schools that fall short of rising benchmarks” (Dillon, 2006, para. 2). Thus, the impact of the narrowing curriculum greatly impacts the low performing students or those who perform below grade level.

The intense focus on reading and math has changed the landscape of American schools. Schools are evaluating the instructional time spent on the tested subjects and have systematically reduced the time spent on non-tested subjects. This narrowing of curriculum not only affects CTE course offerings, but other areas such as art, music, and physical education have also experienced a reduction in the instructional time allotted for these courses. Some content area teachers have expressed concern that they do not even get to cover the full range of topics that

they feel leads to a complete education in their curriculum, due to the fact that they have to focus on the tested components of their curriculum (Center on Education Policy, 2009). A survey, by the Center on Education Policy, found that since the passage of the federal law, 71 % of the nation's 15,000 school districts had reduced the hours of instructional time spent on history, music and other subjects to open up more time for reading and math (Dillon, 2006). Even so, school officials interviewed as part of the study expressed concerns that NCLB's focus on high-stakes testing scores would take energy away from other important subjects such as gifted and talented, performing arts, career and technical education, foreign languages and extracurricular activities that are a source of pride for schools and communities (Center on Education Policy, 2005).

This study cited as an example, a junior high school in California where 150 of its 855 students spend 5-6 hours of their day in reading, math and a gym class. This only leaves the students with a 55-minute period to take a different course. In a high school example cited in New Jersey, low-performing ninth graders were not allowed to take foreign language, music or any other elective so they could take extra periods of math and reading. This school district felt that this practice in the ninth grade would serve as a motivator for students to increase their reading and math performance in order to have more flexibility in their schedules options in the upperclassmen years of high school (Center on Education Policy, 2005). However, the practice of schools increasing the instructional time spent on the tested areas has also caused a concern regarding the message that is being sent to students. Having students take hours of reading and math courses, sends a message to students that school is monotonous and repetitive, which could lead to other areas of concern such as student dropout (Plank, Deluca, Estacion, 2008).

The research of Chadd and Drage (2006) investigated the concerns of educators regarding the No Child Left Behind legislation and CTE. The concern of the researchers was that schools

and school districts would use funds and resources set aside for CTE programs to improve students' academic performance in areas directly mentioned in the legislation to meet accountability requirements. The objective of Chadd and Drage's work was to describe the perceptions of secondary principals and high school career and technical education teachers on how the NCLB Act has impacted their program. The researchers established three research questions as guides to investigating the topic. The questions were: (1) What are the perceptions of high school principals related to the benefits of CTE in helping high schools achieve the goals of NCLB? (2) What are the perceptions of high school CTE teachers related to the benefits of CTE in helping high schools achieve the goals of NCLB? and (3) Was there a difference in the perceptions of high school principals and teachers related to the benefits of career and technical education in helping high schools achieve the goals of NCLB (Chadd & Drage, 2006)?

In order to gather information about the perceptions of secondary principals and CTE teachers in regard to the impact of NCLB and the high-stakes testing associated with it, Chadd and Drage (2006) used the administrators and teachers in the state of Illinois as their subjects. Based on discussions at state conferences and literature addressing how elective courses support the goals outlined in NCLB, there was a growing concern regarding whether high school administrators and teachers were aware of the impact of career and technical education programs on students and schools in achieving NCLB goals. It was the opinion of the researchers that the future of these programs rests on those who make decisions regarding which programs to cut or support. "In order for CTE to survive, these individuals (high school administrators) must recognize the contributions that CTE programs and classes make in achieving NCLB objectives" (Chadd & Drage, p.87).

This quantitative study was based on the data collected from the researcher generated survey. As a result of their study, Chadd and Drage (2006) found that high school principals

agreed that CTE courses help to prepare students to take standardized tests that assess English (79 %) and math (86 %). Eighty-six percent (86 %) of principals agreed that CTE courses help all students to reach the high standards set forth by the state of Illinois. Furthermore, principals (95%) felt that CTE courses helped their school to meet the goal of increasing graduation rates.

In response to the push for stronger academic achievement and NCLB, CTE has evolved into a program that focuses on a broad range of options. For a CTE program to survive in this time of uncertainty, it must have a sustainable teaching model that integrates the math and reading standards and benchmarks into its curriculum (Pundt, et al, 2007). Researchers (Chadd & Drage, 2006, Plank et al., 2008, Harris & Wakelyn, 2007) have found that the teaching strategies used in CTE courses are effective in helping students learn and retain content and motivating them to stay in school.

CTE Student Academic Performance and Graduation Rates

For years career and technical education, formally known as vocational education, has prepared generations of students for the demands of the workplace and helped students to transform academic knowledge into useful practical application. However, as the manufacturing jobs disappeared in the 1970s and 80s, the need for jobs-focused preparation declined and enrollment in vocation courses fell off (Castellano, Stringfield, Stone et al., 2004). Therefore, in response to the changing demands of the workplace, career and technical education made a transformation in the 1990s to focus on more academic rigor to prepare students for the workplace, college or technical schools. In many cases, CTE has integrated academics into the occupational or career pathway training provided in its courses. Even with the reforms CTE has made to prepare students for postsecondary study, in many instances, CTE still carries the stigma of being a program for low achieving and/or non-college bound students.

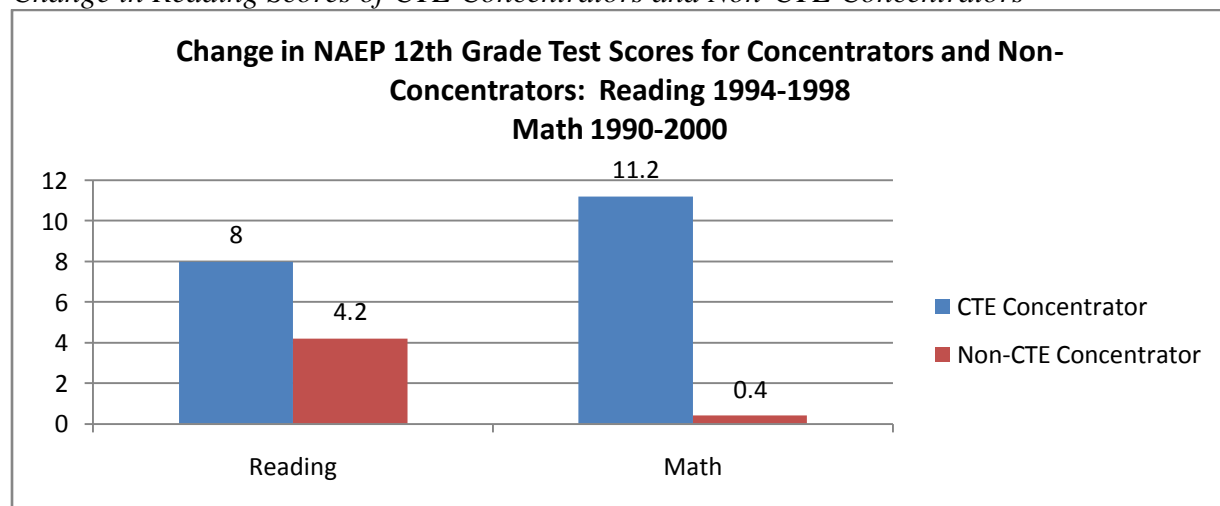
CTE has always provided students with relevance in the classroom, but it has not performed as well in providing rigorous curriculum (Harris & Wakelyn, 2007). On the National Assessment of Educational Progress (NAEP) assessment of 12th graders, two thirds of CTE concentrators scored below basic in mathematics. Historically, these sorts of data have lead school reformers to view CTE as a second tier track that offers students few options and little preparation for the future (Harris & Wakelyn, 2007). Based on reports such as the 2004 National Assessment of Vocational Education (NAVE), a common belief has grown that CTE students in general do not perform as well non-CTE students (Silverberg, Warner, Fong, Goodwin, 2004). Though this research revealed that CTE students have made substantial progress in math and reading achievement, they were still less likely to be proficient in math and reading as compared to the general education students. The NAVE study utilized national data based on the National Longitudinal Survey of Youth to gather data for this study. The NAVE study set out to answer the research question: how does or can vocational education (career and technical education) improve the outcomes of secondary students and what impact vocational education enrollment could have on sub-baccalaureate outcomes (Silverberg et al, 2004). The researchers (Silverberg, et al, 2004) also found that CTE concentrators increased as did their 12th grade scores on the NAEP by 8 scale points in reading and 11 points in math, while those who took little to no CTE courses only showed a 4 point improvement (Figure 2). The researchers suggest that this increase was due to increased academic course taking as opposed to the influence of CTE enrollment.

In a study conducted on the math performance of CTE concentrators the researchers evaluated the course taking patterns of these students. The population used for this study attended schools which adopted one of the three school reforms – Career Academies, Career Pathways or High Schools that Work. Stone (2004) conducted this research to answer two

research questions: (1) How does CTE concentrators' course-taking in math compare with that of general concentrators and (2) what impact have the three reform models had on the students' course taking patterns? The data used for this study was collected as part of the National Longitudinal Survey of Youth 97. Stone (2004) notes in his findings, that CTE concentrators and general concentrators had similar academic performance in math courses. The researcher also cautions that a comparison of these type of data are problematic in that it does not take into account the fact that CTE students as a group were less academically proficient when they entered high school. Factors such as economically disadvantaged, academically disadvantaged, single parent family, ethnicity, learning style, gender, and limited English proficiency could have a statistically significant difference in the high-stakes test scores of these students (Elliot et al., 2005).

Figure 2

Change in Reading Scores of CTE Concentrators and Non-CTE Concentrators



Source: *National Assessment of Vocational Education Report 2004*

The study conducted by Elliot, et al. (2005) was designed to determine if students with strong academic course work achieve at a higher level than those students who have a career and technical (CTE) background. Quantitative data analysis was used to compare approximately

2500 students (CTE and non-CTE) each year for five years. The participants in the study were high school students representing five districts from three different geographical regions.

The dependent variable was the high-stakes test scores and the independent variables were curriculum choice, CTE concentrator or non-CTE concentrator, as well as gender, race, learning style, and subject selection. The data were analyzed using frequencies, means, standard deviations, correlations and regressions. The finding of the research was that career and technical education students scored lower than other students on the high-stakes tests, but factors other than curriculum choice had a significant influence on test scores (Elliot et al, 2005).

Researchers(Elliot et al, 2005, Bae et al 2007, Palmer & Gaunt, 2007) note that when these extraneous factors are controlled, no difference is found in the academic performance between CTE concentrators and general education students. One of the implications of this finding is that educators need to understand the effects of these extraneous factors on student performance and how raw score comparisons on standardized tests must be interpreted.

Bae, Gray, and Yeager (2007) studied Pennsylvania CTE and non-CTE participants' performance on the state mandated 11th grade math and reading tests. The researchers took into account the academic proficiencies of the students in the population of this study. Eighth grade academic performance was used to establish a cohort of students with similar academic performance. To examine whether or not there was a difference between the 11th grade math and reading performance of CTE and non-CTE students, the researchers used an independent *t*-test. The result of the study was that there was no statistically significant difference in the reading and math proficiency on the state mandated 11th grade test for either cohort with the independent *t*-test. It was reported in this study that CTE students as a group took fewer college prep math courses, which was associated with the students' lower performance. The findings of the study

also indicate that the course taking patterns of the students in the cohorts were not taken into account, thus they could also have had an impact on the study results (Bae et al., 2007).

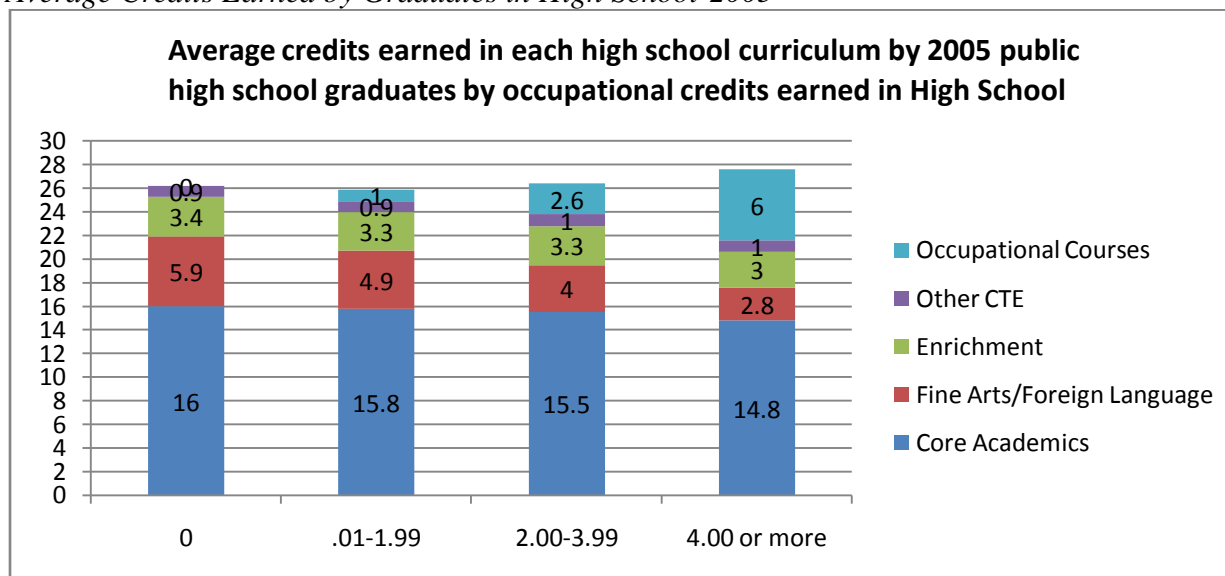
This national study was conducted as part of the work of the National Center for Education Statistics (NCES), which collects and reports data regarding education. Levesque, et al. (2008) examined the outcomes associated with participation in career and technical education, including academic attainment, post-secondary education and employment and earnings. Quantitative data analysis was used on various national data to compare different groups at a .05 level of significance. The study evaluated several factors of CTE participation; however, as it relates to academic attainment, the CTE participants meeting the college preparatory academic coursework in secondary school increased 17-42 percentage points (Levesque et al., 2008). Thus, the CTE students were exposed to more rigorous course work.

Levesque et al. (2008) study suggests that there is a tradeoff between the numbers of occupational or CTE credits that a student earns and the academic credits (Figure 3). The course taking patterns of students taking CTE courses may be different based on the program area (e.g. business, marketing, technology education, family and consumer sciences) in which they are pursuing as well as the requirements for graduation. Contrary to the general perception of career and technical education programs, Castellano et al.'s (2004) study of CTE enhanced schools found that there was a somewhat consistent pattern in which many students in the CTE-enhanced schools attempted advanced or higher-level English and science courses. The CTE students in these schools attempted rigorous courses more than the students at the control schools. The study examined comprehensive high schools that were organized around career clusters and career pathways. While this was not found for every cohort in the researchers' study, it might explain why student grades in the CTE-enhanced schools were not consistently better than at the control schools. Castellano et al. (2004) notes that students in the identified schools

might have been challenging themselves by remaining in academic course sequences longer than students at the non-CTE enhanced schools.

Figure 3

Average Credits Earned by Graduates in High School-2005



Source: U. S. Department of Education, National Center for Educational Statistics

Researchers (Bae et al., 2007, Elliot et al., 2005, Castellano et al., 2004) have measured academic performance in two main ways, analyzing trends in both the academic course taking and tested achievement of CTE participants. These analyses have shown that, since 1990 and earlier, both the amount and rigor of CTE participants' academic course taking have increased and the percentage of public high school graduates combining rigorous academic coursework with concentrated CTE coursework has also increased (Levesque et al., 2008; Silverberg et al. 2004). The results of this increased course taking and rigorous course work is evident in the increase of the performance of students on the NAEP assessment.

Despite CTE's past reputation as a less-demanding track, research proves career and technical education motivates and engages students by offering real work learning opportunities leading to lower dropout rates and greater earnings for high school graduates.(ACTE, 2010,

Glenn, 2005, Levesque et al., 2008, Plank et al., 2008). The Association for Career and Technical Education (ACTE) also reports the following regarding CTE and academic achievement:

- A ratio of one CTE class for every two academic classes minimizes the risk of students dropping out of high school.
- 81 percent of dropouts said that “more real-world learning” may have influenced them to stay in school.
- The more students participate in CTE and its student organizations, the higher their academic motivation, academic engagement, grades, career self-efficacy and college aspirations.
- Students who complete a rigorous academic core coupled with a career concentration have test scores that equal or exceed “college prep” students.
- CTE students are significantly more likely than their non-CTE counterparts to report that they developed problem solving, project completion, research, math, college application, work-related, communication, time management, and critical thinking skills during high school. (ACTE, 2010).

The National Association of State Directors of Career and Technical Education Consortium (NASDCTEC) conducted a three part study in 2010 on the gains that CTE has made in increasing the student achievement of students. In response to President Barack Obama’s Race to the Top initiative, which has four top priorities for education, the NASDCTEC study set out to demonstrate how CTE has made gains toward these goals (NASDCTEC, 2010). The Race to the Top four priority areas are adopting standards and assessments, building data systems, cultivating effective teachers and principals and turning around struggling schools. The case

study report by the NASDCTEC examined schools in rural, suburban, and urban settings to highlight the transformations that the CTE programs have made into becoming rigorous college programs with positive outcomes on student achievement. The urban school program was touted for its progress in helping students pass the state assessments. After implementing CTE reforms and increasing the rigor in the CTE coursework offered at this New Jersey Vocational Academy, the once struggling school now has passing scores. Between 2003 and 2009, student scores on state assessments rose dramatically – by 48 percentage points in mathematics and 25 percentage points in Language Arts (NASDCTEC, 2010).

As another example of how CTE practical integration with core academics demonstrates improvement in student achievement, Pennsylvania's Central Tech Academy was recognized for its improvement in school test scores. In 2004 the school's scores more than doubled in reading and math after the implementation of a "push in" model of CTE. The teachers and administrators aligned the CTE curriculum with the Pennsylvania standards in math and reading. CTE and core content teachers planned together and co-taught lessons to incorporate math and reading directly into the CTE labs where the lessons were taught (Pundt et al., 2007). Since this model facilitates organization of subject matter in a way that builds on a student's prior experiences and knowledge, "the end result is true integration of academic and career and technical skills" (Pundt, et al., 2007, p. 29).

Researchers (Levesque et al., 200; Bae et al., 2007; Elliot et al., 2005) have found that CTE participation has slight to moderate impact on high school achievement and course-taking but also on graduation rates, labor market outcomes and postsecondary enrollment. Students who take CTE courses are less likely to drop out, especially if the students are more at risk to do so (Harris & Wakelyn, 2007). The study by the National Research Center for Career and Technical Education found that CTE student course taking at a ratio of 3 CTE courses to 4

academic courses would increase a student's persistence toward graduation than those only taking academic classes (Gray, 2002). Students taking a heavy course load of CTE courses were identified as having an increased risk of dropping out of high school.

Regarding graduation rates of CTE students, no clear answers have emerged regarding the connection of CTE course taking and graduation. Despite the lack of clear answers, Plank et al. (2008) offers possible explanations as to why CTE may motivate a student to graduate. Plank et al. (2008) examines the association between CTE to academic course taking ratio and the likelihood of dropping out. Interviews, surveys and transcript data from the NLSY 97 were analyzed. Descriptive statistics and regressions were used on several variables to evaluate the relationship. The findings of the study indicate that high school entry age is a critical factor in the likelihood of a student dropping out as well as the ratio to which a student takes CTE courses to general education courses. In this study the researcher also finds that CTE courses empower students by providing them with a wide range of learning options through contextual learning. Plank et al. (2008) goes on further to report that for many students applying academic and technical skills to real world application, such as using the computer or occupational specific tools, helps students to relate the learning to the real-world. Thus, CTE courses are more interesting, motivating and educationally powerful than standard academic classes (Plank et al., 2008).

In addition to the hands-on, contextual experiences that CTE courses provide as a motivation for students to stay in school, career focused student organizations known as CTSOs- Career and Technical Student Organizations provide students with employability and leadership skills. CTSOs provide students with extracurricular involvement which is linked to interpersonal competence, lower dropout rates, and enhanced academic achievement (Alfred, Stone, Aragon, Hansen, Zirkle, Conners, Spindler, Romine, Woo, 2007). The researchers Alfred et al 2007

conducted a cross-sectional pre and posttest of 2,485 students in CTE classes with CTSOs and students in CTE classes without CTSOs. The students started the school year with similar academic performance and scores. The finding of the study noted that students in CTE classes with CTSOs maintained (did not gain or lose) academic achievement throughout the school year. The researchers report that there is a positive association between the amount of CTSO participation and academic motivation, academic achievement, and self-efficacy of students participating in the co-curricular organizations of CTE. As students are more engaged and motivated with the instruction in the classroom the less likely they are to drop out.

As Perkins IV requires states to report CTE graduation rates, increases have been reported in the four-year cohort graduation rate. In North Carolina, 30 school districts report four-year cohort graduation rates of 90 % or above for the students completing a four year CTE course concentration. The state reported a 72 % cohort graduation rate for all students (Lavender, 2010). The State Superintendent in North Carolina reports “career and technical education plays an important role in helping to prepare students to be globally competitive and college-and career-ready” (p.1). North Carolina’s Career-Ready Commission reports that CTE courses provide students with a way to connect what they learn in school with their plans for future education, training and work (Lavender, 2010).

Chapter Summary

Even though CTE courses utilize contextual learning and real world application, the courses are typically offered as electives and since CTE is not mentioned in the NCLB legislation, it may be difficult for policymakers, educators and teachers to see how CTE courses can contribute to achieving the goals of the legislation. Policy makers and educators have generally acknowledged the value of the practical skills taught in CTE courses, but they rarely receive the status or importance attributed to academic skills and knowledge learned in career

and technical education courses. The literature acknowledges that CTE provides students with practical occupational experiences that help students to see the relevance of school, but as the demands of NCLB continue to increase, educators are making decisions to have students spend more instructional time in core content courses. The reviewed literature indicates that a “narrowing curriculum” has evolved as a result of increased accountability requirements. As a result, CTE is in a position that it must demonstrate its contribution to student achievement.

Based on the contextual approach used in CTE courses, student achievement and learning are improved (Glenn, 2005). In addition, there is an increased emphasis on incorporating core academic skills into CTE. As a result of the Carl D. Perkins Vocational and Technical Education Act of 2006, many states have closely aligned their CTE competencies with state academic standards, which has resulted in case study results that demonstrate isolated successes. The literature in this chapter has yielded mixed results regarding the impact of CTE on student achievement and graduation rates. Studies reviewed in this chapter indicate that CTE student achievement may not surpass that of their non-CTE counterparts, but there has been an increase in their academic performance and course taking patterns. The purpose of this chapter was to investigate the historical perspective of career and technical education and how it has evolved to meet the needs and demands of changing educational reforms, including the current legislation of NCLB and high-stakes testing. The literature also indicates that there is a need for CTE to continually demonstrate its contributions to the accountability benchmarks set forth in NCLB in order to avoid the narrowing curriculum.

Chapter Three

Methodology

After reviewing the literature regarding narrowing curriculum and CTE student achievement, it was determined that investigating CTE student achievement and graduation rates in Virginia was worthy of investigation. The purpose of this study was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning Grade 11 English reading, literature, and research (RLR) and mathematics assessments, as well as cohort graduation rates. Evaluation of SOL pass rates in reading and mathematics as well as graduation rates provided data regarding the performance of CTE completers as compared to non-CTE completers. The research questions that guided this study were:

1. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured by SOL math pass rates of the highest level of Math completed (Algebra I, Algebra II, and/or Geometry)?
2. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured Grade 11 English reading, literature, and research SOL pass rates?
3. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. non-CTE completer) and the graduation rates of students?

This study utilized a quantitative evaluation methodology to determine the difference between career and technical education concentrators and non-concentrators in regard to academic achievement and graduation rates of high school students. According to Miller and

Salkind (2002), evaluation research involves assessing the strengths and weakness of a program to evaluate effectiveness or merit. In this study the “program” is career and technical education and the value or “merit” is the impact of CTE concentration on student achievement. As indicated in the review of literature, there is a narrowing of curriculum which has caused schools to reduce the number of electives offered or reduce the instructional time provided for non-content electives. Educators are taking these measures because they feel there is a need to spend as much time as possible on core content area instruction to meet state mandated test requirements. Thus, research that provides data to support the fact that elective instruction, as it relates to career and technical education, would assist educators in making decisions for their schools regarding these courses.

Population

The population for this study was the 131 school divisions in the Commonwealth of Virginia. Data submitted to the Virginia Department of Education (VDOE) by each school division served as the database for this study. CTE and divisional data for this study are public domain regarding CTE completers’ English and mathematics SOL pass rates and graduation rates as a result of information submitted to the Virginia Department of Education annually.

Data Collection

Data collected for the 2008, 2009, and 2010 school years with regard to SOL student performance as well as graduation data for the same years were used for evaluation. For the purposes of this study, student achievement was measured by mathematics and Grade 11 English reading, literature, and research (RLR) SOL pass rates. The mathematics data were based on the highest level taken during the Adequately Yearly Progress (AYP) reporting year. Data used for this study were gathered from the VDOE Office of Educational Information Management and the VDOE websites. Three VDOE website reports provided much of the data necessary for this

study:

1. CTE Annual Performance Report (by school division)
2. VDOE School Division Report Card and Virginia Assessment Results
3. VDOE High School Graduates and Completion Report

Descriptive information was gathered regarding school divisions as a part of this study; however, no school division names were identified.

Career and technical education performance is reported annually by the Virginia Department of Education to outline the attainment of the performance measures included in the Carl D. Perkins Act of 2006. The CTE Performance Reports provide data by school division as they pertain to the attainment of the Perkins Act performance measures. These measures include academic achievement, occupational competence, CTE completer graduation rates, nontraditional career preparation, successful transition to careers and further education.

Table 2

Data Collection Sources for this Study

Data	Location	Years
School Division Math and English SOL Performance	Virginia Department of Education website- School Division Report Cards https://p1pe.doe.virginia.gov/reportcard/	2008-2010
School Division Cohort Graduation Rate	Virginia Department of Education website-Cohort Reports and Virginia Assessment Results http://www.doe.virginia.gov/statistics_reports/graduation_completion/cohort_reports/index.shtml	2008-2010
CTE Concentrators Graduation Rates	Virginia Department of Education Career and Technical Education Performance Reports http://www.doe.virginia.gov/instruction/career_technical/statistics_reports/index.shtml	2008-2010
CTE Concentrators SOL Math and English Performance	Virginia Department of Education Career and Technical Education Performance Reports http://www.doe.virginia.gov/instruction/career_technical/statistics_reports/index.shtml	2008-2010

For the purposes of reporting academic performance of students for the Carl D. Perkins Act of 2006, student academic achievement is measured by student performance on the Standards of Learning assessments in mathematics and reading. The Reading Performance standard is measured by the number of CTE concentrators who took the SOL assessments in reading/language arts whose scores were included in the school division's computation of adequate yearly progress (AYP) and who, in the reporting year, left secondary education (VDOE, 2011). The Mathematics Performance standard is reported as the number of CTE concentrators who took the SOL assessments in mathematics (highest level) whose scores were included in the school division's computation of AYP and who, in the reporting year, left secondary education. Data regarding CTE completer graduation rates are also included on each school division's CTE Performance Report. Each school division's annual performance report is found on the Virginia Department of Education-Career and Technical Education website.

Student achievement in Virginia is measured by the Standards of Learning assessments and they serve as the high-stakes assessment that determines student graduation and school accreditation. High school students are expected to pass a minimum of two English, one mathematics, one science, one social studies and one student selected end-of-course assessment in order to graduate from a Virginia high school. Data on school division report cards include student achievement based on grade level of the students in the division and end-of-course assessment results. By definition, a CTE completer is a student who has met all of the career and technical education concentration requirements and all requirements for high school graduation. Therefore, data for this study include Grade 11 English RLR and mathematics (highest level) SOL results for the reported completers during the identified school years and non-CTE completers in order to provide a conventional comparison. Groups were compared based on

their high-stakes test scores over three years.

Lastly, the High School Graduates and Completion report collects data on an annual basis during the fall, following students' completion year. Each locality submits data for their schools for the combined regular and summer terms. The data are then compiled and division and state totals are calculated (VDOE, 2010). This report provides graduation numbers for each of the 131 school divisions in the Commonwealth of Virginia. Data collected on the cohort graduates for the 2008, 2009, and 2010 school years were used for this study.

Research Design

According to Cohen, Manion, et al. (2007) ex post facto research is also called causal-comparative research. In ex post facto research, there is an attempt to relate an after the fact treatment that cannot be manipulated by the investigator to an outcome or dependent measure. The specific type of ex post facto research design that was used in this study is criterion-group. Cohen, Manion et al. (2007) also writes that "in the criterion group approach, the investigator sets out to discover possible causes for a phenomenon being studied, by comparing the subjects in which the variable is present with similar subjects in whom it is absent" (p. 266). The "phenomenon" or "variable" in this study is CTE concentration. The dependent variables are student achievement and graduation rates.

The data for the school divisions were divided into two categories: CTE completers and Non-CTE completers. CTE completers are students who have met the requirements for a career and technical education concentration and all requirements for high school graduation, or an approved alternative education program. Completers have passed at least 80% of the program competencies in an approved CTE concentration sequence or set of sequential electives. The number of CTE completers is reported on the school divisions' CTE Performance Reports and these data provided the researcher with the exact number of CTE-completers reported each of the

years investigated. Non-CTE completers are students who have not completed an approved CTE concentration, therefore to derive the number of non-CTE completers, the CTE-completers were subtracted from the total number of students taking SOL tests in mathematics and Grade 11 English RLR in each school division.

The independent variable group was categorized by CTE completers and non- CTE completers. The CTE completer achievement data were obtained from the CTE Performance Reports for each school division. The numbers of CTE completers attaining a passing score on the end-of-course tests are reported by the VDOE. For the purposes of this study the Grade 11 English reading SOL pass rates were used for student achievement in English, and the mathematics SOL data were based on students attaining a passing score on highest level of mathematics end-of-course test as reported by the VDOE. The graduation data were derived from the VDOE Graduation and Completion report and the CTE Performance reports for each of the school divisions. These dependent variable data, student achievement and graduation rates, were downloaded from VDOE to an Excel spreadsheet for analysis. Student achievement was reviewed for the 2008, 2009 and 2010 school years.

Data Collection Procedures

The various data collected for this study were based on the research questions. Information from the VDOE State Division Report cards, VDOE Career and Technical Education Performance reports and the VDOE Graduation and Completion report are submitted annually to the Commonwealth. The data were analyzed using statistical measures to determine the differences in the performance of each of the identified groups –CTE completers and non-CTE completers. A spreadsheet was developed to organize the collected data for further analysis.

Data Analysis

In analyzing data for this quantitative study, Microsoft Excel and Statistical Package for the Social Sciences (SPSS) were used to do the statistical calculations. Statistics were generated for SOL English Reading, SOL Math, and graduation rates for CTE completers and non-CTE completers for each school division in the Commonwealth of Virginia. Longitudinal data for three years were compared to assess if CTE concentration impacts student achievement. Data were analyzed using descriptive statistics including frequencies, means and standard deviations. The descriptive statistics were used to describe what was occurring in the data. The numbers of CTE completers and non-CTE completers as well as the corresponding dependent variables for each category were calculated. Total CTE completer students by school division were coded as were the students who had not completed an approved concentration sequence.

A *t*-test was used to determine the statistical differences in the sample groups. The *t*-test analysis was used to assess whether the means of the two sample groups (CTE completers vs. non-CTE completers) were statistically different from each other (Trichim, 2006). To test the level of significance, an alpha level of .05 was used to determine whether there was a significant difference in the means of the two groups. After completion of training in human subjects protection (Appendix A), permission to conduct the study was requested and approved from the Virginia Polytechnic Institute and State University's Institutional Review Board (Appendix B).

Chapter Summary

The purpose of the study was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates. The population for this study was the 131 school divisions in the Commonwealth of Virginia. Results from the 2008, 2009, and 2010 Standards of Learning assessments were used. Data

collected from three reports (VDOE School Division Report cards, CTE Division Performance Reports, and the VDOE Graduation and Completion report) were used to determine the impact of CTE concentration on student achievement. Data analysis using descriptive statistics were used at an alpha level of .05. A *t*-test analysis was conducted. The results are reported in Chapter 4 of this study.

Chapter Four

Results

In this chapter, the results of the study are presented. The purpose of the study was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates. This investigation included the 131 school divisions in the Commonwealth of Virginia inclusive of students who are identified as CTE completers and those who have not completed an identified career and technical education completer sequence of courses. The researcher gathered ex-post facto public domain data available on the Virginia Department of Education website to conduct a quantitative study regarding graduation rates and student achievement in the identified subjects.

Chapter Four reports the results gathered regarding the research questions which provided the framework for this study. The research questions were:

1. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured by SOL Math pass rates of the highest level of Math completed (Algebra I, Algebra II, and/or Geometry)?
2. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured Grade 11 English reading, literature, and research SOL pass rates?
3. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. non-CTE completer) and the graduation rates of students?

This chapter presents the results of the analyses conducted for the years 2008, 2009, and 2010. The Commonwealth of Virginia had over 110,000 students who participated in career and technical education to the level of being considered CTE completers. CTE completers are students who have taken two sequential CTE electives in a prescribed program area with 80% proficiency in the competencies required for the courses. Table 3 shows the number of students enrolled in one or more Career and Technical Education courses and the number of CTE completers for the Commonwealth of Virginia during the years of this study.

Table 3

Number of Career and Technical Education Completers in the Commonwealth of Virginia 2008-2010

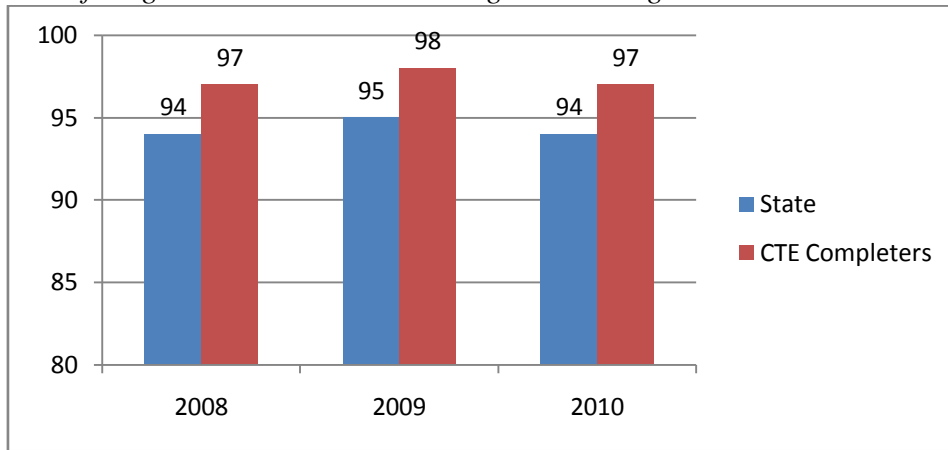
Academic Year	Students enrolled in CTE courses (duplicated count)	CTE Completers (N) (unduplicated count)
2008	593,429	35,024
2009	598,029	38,341
2010	591,322	37,801

Virginia Department of Education, Career and Technical Education (2011) www.vdoe.gov/CTE

For the purposes of this study, the reading data were based on the end-of-course Grade 11 English reading, literature and research (RLR) Standards of Learning (SOL) assessment. The mathematics data were based on the math course for which a SOL assessment is required. Figures 4 and 5 illustrate the performance levels of CTE completers to the state's overall performance on the mathematics and English RLR Standards of Learning assessments. The Standards of Learning assessments are given in the spring of each school year. All students enrolled in end-of-year courses (EOC) take the associated EOC SOL test. In each of the years of this study, CTE completer pass rates outperformed those of the rest of the students on the reading SOL by at least three percentage points. In the area of mathematics during the years of 2009 and

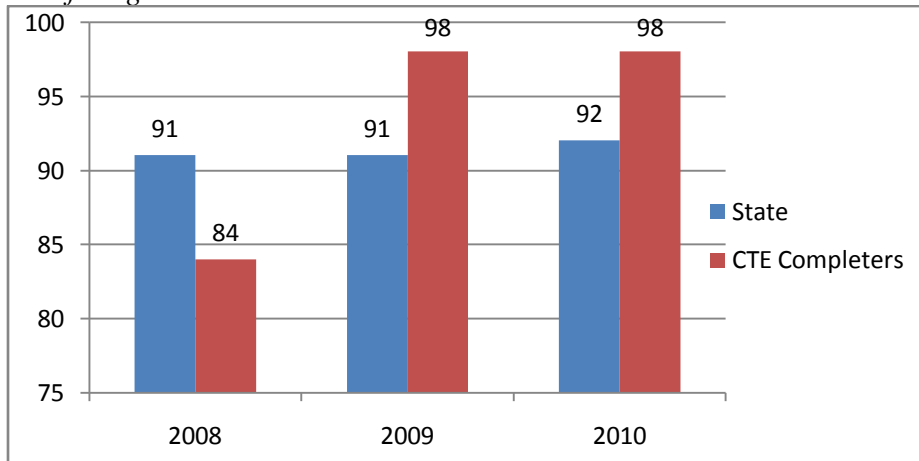
2010, CTE completers had pass rates 7-10% percentage points higher than the rest of the Commonwealth of Virginia. The only exception was during the 2008-2009 school year where the CTE completer mathematics pass rate was lower than the pass rate of the state. During the year of 2008, the state pass rate on the Algebra I, Algebra II, and Geometry SOL was 91% where the performance of CTE completers for that same year was only 84%.

Figure 4
Commonwealth of Virginia Pass Rates on the English Reading SOL 2008-2010



Virginia Department of Education, <https://p1pe.doe.virginia.gov/reportcard/>

Figure 5
Commonwealth of Virginia Pass Rates on the Mathematics SOL 2008-2010



Virginia Department of Education, <https://p1pe.doe.virginia.gov/reportcard/>

Data were gathered for the CTE completers from each school division's CTE

Performance Report and organized in an Excel spreadsheet. The English reading, mathematics and graduation rates were also organized in a spreadsheet with an adjustment being made for those students in the data who were CTE completers. Thus, the CTE completer population was deducted from the total number of students taking and passing the SOLs in the “non-CTE completer” category to allow for rescaling. This rescaling process assured that CTE completers would not be included in the data for non-CTE completers. Upon completion of the re-scaling adjustment, the data were then transferred to SPSS for analysis. Each set of data for the research questions is presented in a similar format.

Research Question One-Results

What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured by SOL Math pass rates of the highest level of Math completed (Algebra I, Algebra II, and/or Geometry)?

Data regarding Math SOL pass rates for each school division were downloaded from the Virginia Department of Education website and placed in an Excel file for organization and rescaling. Once the data for school years 2008, 2009, and 2010 were downloaded and re-scaled to adjust for the CTE completers which were included in the division pass rates, the data were analyzed.

A breakdown of school divisions by pass rate categories was organized to illustrate the number of school divisions by CTE enrollment status that fell within the selected pass rate bands. In 2008, fifty-seven of the school divisions had a CTE pass rate in mathematics of below 82%. However, the following two school years over 120 of the school divisions had CTE pass rates in mathematics above 95%. In the category of non-CTE completers an average of 22 school divisions had mathematics pass rates above 95%. Table 4 presents a summary of the number of school divisions in each of the pass rate bands.

Table 4

2008-2010 Summary of the Number of School Divisions by SOL Math Pass Rate Bands based on CTE Concentration Status

Concentration	100-98%	97-95%	94-92%	91-89%	88-86%	85-83%	82% or less
2008							
CTE Completers	4	6	10	20	17	17	57
Non CTE Completers	4	26	34	27	20	12	8
2009							
CTE Completers	97	27	5	1	1	0	0
Non CTE Completers	3	13	26	31	23	18	17
2010							
CTE Completers	79	39	10	2	1	0	0
Non CTE Completers	4	18	29	29	19	18	14

Note: N=131

Descriptive statistics were calculated for the CTE completers and non-CTE completers for the years of the study. Using the rescaled student population numbers, the data were imported into Statistical Package for Social Sciences (SPSS) for analysis. As illustrated in Table 5, descriptive statistics of mean and standard deviation were calculated for analysis. The mean mathematics SOL pass rate for non-CTE completers in 2008 was 90.65 with a standard deviation of 5.14, and CTE completers had a mean pass rate of 82.91 with a standard deviation of 9.55 for that same year. In the years of 2009 and 2010, CTE completers had mean pass rates of 97.86 with a standard deviation of 2.05, and 97.61 with a standard deviation of 2.26 respectively. Non-CTE completers for the same school years had mean pass rates of 88.53 with a standard deviation of 5.37; and 88.83 with a standard deviation of 6.22. The highest mean mathematics pass rate was among the CTE completers in 2009 at 97.86, and the lowest mean mathematics pass rate was also among the CTE completers in 2008 at 82.91.

Table 5

Mean and Standard Deviation for Math SOL Scores 2008-2010 by CTE Concentration Status

Concentration	<u>2008</u>		<u>2009</u>		<u>2010</u>	
	M	SD	M	SD	M	SD
CTE Completers	82.91	9.55	97.86	2.05	97.61	2.24
Non-CTE Completers	90.65	5.14	88.53	5.37	88.83	6.22

Upon further analysis of the data, an examination of standardized coefficients of skewness and kurtosis were conducted to determine the normality of the distribution. The coefficient of skewness provided information regarding the degree of departure of the data from that of a normal distribution. The skewness of the distribution of data must be determined to evaluate if the distribution is significantly skewed to the left or right tail of the distribution. If the skewness is within the range of +3 or -3, then skewness is not seriously violated. The coefficient of kurtosis provided information regarding the peakness of the distribution or the concentration of data to the center, the upper and lower ends, and the shoulder. A normal distribution will have a kurtosis value of zero, with a range of normality of ± 3 . With eleven of the 12 skewness and kurtosis factors beyond the range of ± 3 , it was determined that each of the distributions depart from that of a normal curve for the dependent variable of mathematics SOL pass rates. Depicted in Table 6 are standardized kurtosis and skewness coefficients for the mathematics pass rate data. Eleven of the twelve coefficients calculated are beyond the range for a normal distribution.

Since the Math SOL pass rates for CTE completers and non-CTE completers were not normally distributed, a nonparametric statistical procedure was utilized. Nonparametric statistics are used when the data does not fit in a normal distribution. Nonparametric statistics are also referred to as distribution free in that the statistical procedures are not assuming that the data falls

within a normal distribution and reduce the influence of outliers on the statistic results.

Table 6

Standardized Skewness and Kurtosis Coefficients for Math SOL Pass Rates for CTE Completers and Non-CTE Completers 2008-2010

Year	Concentration	Standardized Skewness Coefficient	Standardized Kurtosis Coefficient
2008	CTE Completers	-5.03	5.03
	Non-CTE Completers	-3.75	20.99
2009	CTE Completers	-11.17	20.99
	Non-CTE Completers	-3.19	2.61
2010	CTE Completers	-8.11	11.22
	Non-CTE Completers	-5.65	4.65

Accordingly, a Wilcoxon's t -test was used to address the research question. A Wilcoxon's t -test is used to compare two related samples to assess if their means differ. A Wilcoxon's t assumes that the data are not normally distributed and that the data are ordinal in nature. The results the t -tests are presented in Table 7. The results indicate that there is a statistically significant difference ($p < .05$) in the performance of CTE completers on the mathematics SOLs, $p < .001$. Cohen's d effect size was also calculated to measure the strength of the difference between the variables. This statistic measures the overlap of the data of one sample group to that of the other. Based on Cohen's effect size criteria, effect size of $d \geq .8$ indicates the non-overlap of the distributions. Table 8 illustrates the effect size for the means of the two groups for the years of this study. In each of the years of the study, the effect size was found to be large (2008, $d=1.01$, 2009, $d=2.29$, 2010, $d=1.88$) for the mathematics SOL pass rates. CTE completers had a statistically significant difference in their pass rates on the mathematics end-of-course SOL test as compared to their non-CTE completer counterparts.

Table 7

Summary of Wilcoxon's t-test for Mathematics SOL Pass Rates

	Concentration	Z	Sig
2008	CTE Completers		
	Non-CTE Completers	-8.075	.000
2009	CTE Completers		
	Non-CTE Completers	-9.789	.000
2010	CTE Completers		
	Non- CTE Completers	-9.704	.000

* $p < .05$

Table 8

Cohen's d- Effect Size for SOL Mathematics Pass Rates

Year	Concentration	Cohen's d
2008	CTE Completers Non-CTE Completers	1.01
2009	Completers Non-CTE Completers	2.29
2010	Completers Non-CTE Completers	1.88

Research Question Two-Results

What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured Grade 11 English reading, literature, and research SOL pass rates?

When considering the second research question, Grade 11 English reading SOL pass rates were examined. School division pass rates were initially reviewed based on the frequency of school divisions in the pass rate bands. The number of school divisions in each of the pass

rate bands is depicted in Table 9. Nearly all of the CTE completer school division pass rates were at 89 % or above. Only one of the CTE completer school divisions in the three years of this study had a pass rate below 89%. Whereas, non-CTE completer pass rates were on average evenly split above and below 89%.

It is illustrated further in Table 10, that the mean CTE completer pass rates for the three years examined in this study were higher than non-CTE. The mean CTE completer pass rate for the English reading (RLR) SOL in 2008 was 97.53 as compared to the mean 2008 non-CTE completer pass rate of 90.39. In 2009, the mean CTE completer pass rate was 97.99 with non-CTE completers having a mean pass rate of 89.16. Table 10 also illustrates that in 2010, the CTE completer pass rate (97.32) was higher than that of the non-CTE completers at 89.11. Standard deviations for each of the groups were also calculated and are displayed in Table 10. Furthermore, the highest mean Grade 11 English RLR SOL pass rate was among CTE completers in 2009 with a mean pass rate of 97.99 and a standard deviation of 1.83.

Table 9

2008-2010 Summary of the Number of School Divisions by SOL Reading Pass Rate Bands based on CTE Concentration Status

Concentration	100-98%	97-95%	94-92%	91-89%	88-86%	85-83%	82% or less
2008							
CTE Completers	75	42	10	3	0	1	0
Non CTE Completers	10	21	35	21	11	14	19
2009							
CTE Completers	98	26	5	2	0	0	0
Non CTE Completers	8	22	28	22	21	8	22
2010							
CTE Completers	75	43	10	3	0	0	0
Non CTE Completers	17	20	32	23	18	4	17

Note. N=131

An examination of the standardized skewness coefficient and the standardized kurtosis

coefficient for the English reading SOL pass rates revealed that the distribution of the data departs from that of a normal distribution. Table 11 depicts the standardized coefficients and the extent of the departure from the boundaries of normality ± 3 . Since the English reading SOL scores of the CTE students was not normally distributed, a Wilcoxon's t test was utilized to address the second research question.

Table 10

Mean and Standard Deviation for Grade 11 English Reading SOL Pass Rates 2008-2010 by CTE Concentration Status

Concentration	2008		2009		2010	
	M	SD	M	SD	M	SD
CTE Completers	97.53	2.26	97.99	1.83	97.32	2.57
Non-CTE Completers	90.39	9.32	89.16	7.61	89.11	8.69

Table 11

Standardized Skewness and Kurtosis Coefficients for Grade 11 English Reading SOL Pass Rates 2008-2010

Year	Concentration	Standardized Skewness Coefficient	Standardized Kurtosis Coefficient
2008	CTE Completers	-6.30	5.64
	Non-CTE Completers	-12.07	26.82
2009	CTE Completers	-7.39	8.08
	Non-CTE Completers	-4.67	4.05
2010	CTE Completers	-9.03	15.75
	Non-CTE Completers	-3.80	12.97

Further analysis of the Grade 11 English reading SOL pass rates was used to determine if there was a difference in students' performance on the assessment with regard to CTE enrollment

status. The findings of the Wilcoxon's t -test analysis conducted on the data indicated that there was a significantly significant difference in the performance of CTE completers to non CTE completers ($p < .001$). The t -test yielded a statistically significant result for each of the years examined. As illustrated in Table 12, each year the significant difference between CTE completers and non-CTE completers was $z = -9.704, -9.789, \text{ and } -8.075, p \leq .001$ respectively for the years 2008, 2009 and 2010 (Table 12). This t -statistic also represents that the likelihood of this happening by chance is 5% or less. The acceptable level of significance for social sciences is .05; however, the significance level of .000 is well under the .05 level and the more stringent .01. This analysis revealed a statistically significant difference in the Grade 11 English reading SOL performance and pass rates of CTE completers than that of non-CTE completers.

Table 12

Summary of Wilcoxon's t-test Results for Grade 11 English Reading SOL Pass Rates

	Concentration	Z	Sig
2008	CTE Completers	-9.358	.000
	Non-CTE Completers		
2009	CTE Completers	-9.119	.000
	Non-CTE Completers		
2010	CTE Completers	-7.779	.000
	Non-CTE Completers		

* $p < .05$

The effect size associated with the difference in the Grade 11 English reading SOL pass rates, Cohen's d , was also calculated on the data to illustrate the magnitude of the difference between the groups. In each instance, the Cohen's d effect size was found to be large (2008, $d = 1.32$, 2009, $d = 1.60$, and 2010, $d = 1.02$) for each year. Cohen's d equal to or above .8 indicates a

large effect size ($d \geq .8$). The large effect size emphasizes the size of the difference in the mean English reading SOL pass rates of the two groups in this study. Large effect size as defined by Cohen equates to ‘grossly perceptible’ and therefore corresponds to the finding of CTE completers Grade 11 English reading SOL pass rates above those of students who have not completed a prescribed set of CTE courses and are not considered CTE completers.

Table 13

Cohen’s d- Effect Size for Grade 11 English Reading SOL Pass Rates

Year	Concentration	Cohen’s d
2008	CTE Completers Non-CTE Completers	1.32
2009	CTE Completers Non-CTE Completers	1.60
2010	CTE Completers Non-CTE Completers	1.02

Research Question Three-Results

What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. non-CTE completer) and the graduation rates of students?

When evaluating the third research question, graduation rates were gathered for the groups evaluated in this study. Data regarding the graduation rates of CTE completers and non - CTE completers in the Commonwealth of Virginia are included in Table 14. The cohort graduation rates were included based on the graduation band in which the school divisions’ performance dictates. As indicated in the review of literature, NCLB requires the nation’s public schools to be held accountable for achieving high levels of educational performance for all students. While achievement testing is the central component of the accountability systems, high

school graduation rates are also a requirement indicator of performance at the secondary level. With this, states, including Virginia, have redirected attention to graduation rates and reshaped the way in which they measure this indicator. The number of school divisions with graduation rates of non-CTE completers above 89% increased from 17 to 50 school divisions over the three years of the study. However, many of the school division in the Commonwealth of Virginia have non-CTE completer graduation rates below 89% (Table 14). On average nearly 50 percent of the school divisions in the state had non-CTE completer graduation rates of 82% or below.

Table 14

2008-2010 Summary of the Number of School Division by Graduation Rates Bands based on CTE Concentration Status

Concentration	100-98%	97-95%	94-92%	91-89%	88-86%	85-83%	82% or less
2008							
CTE Completers	115	10	2	0	0	0	4
Non CTE Completers	1	3	5	8	12	14	88
2009							
CTE Completers	39	46	24	13	6	1	2
Non CTE Completers	3	7	8	19	14	12	68
2010							
CTE Completers	36	43	24	21	4	2	1
Non CTE Completers	12	8	15	15	19	13	49

Note. N=131

Table 15 illustrates the mean and standard deviation data for the graduation rates in the Commonwealth of Virginia by CTE concentration status. The highest mean graduation rate was among the CTE completers in 2008 with a mean of 98.08 and a standard deviation of 8.77. This mean is notably higher than the mean graduation rate for non-CTE completers in that same year of 85.50 with a standard deviation of 7.66. The extreme difference in the mean graduation rates

may be an indication of the change in reporting of high school graduates in response to on-time graduation rates and the mandates of No Child Left Behind. Mean CTE completer graduation rates remained above 90 % for the three years of the study; whereas, non-CTE completer cohort graduation rates were in the mid 80 % range. School year 2010 had the lowest mean CTE completer graduation rate (94.90), while the non-CTE completers in that same year had their highest cohort graduation rates (88.88). Though the non-CTE completers had an increase in their mean graduation rate it was still nearly 10 percentage points below that of CTE completers.

Table 15

Mean and Standard Deviation for Graduation Rates 2008-2010 by CTE Concentration Status

Concentration	<u>2008</u>		<u>2009</u>		<u>2010</u>	
	M	SD	M	SD	M	SD
Non-CTE Completers	85.50	7.66	86.69	6.64	88.88	6.04
CTE Completers	98.08	8.77	95.19	4.07	94.90	3.86

An examination of the graduation rates of the subjects of this study to that of a normal distribution remain consistent with the findings for the previous two research questions. A review of the histogram and the coefficients of skewness and kurtosis indicated that the data were not normally distributed. The calculations of the standardized skewness and kurtosis coefficient values, as illustrated in Table 16, indicated that the data did not conform to that of a normal distribution. Coefficients of skewness and kurtosis that are ± 3 , indicate that the distribution of data are not consistent with a normal distribution. The closer the coefficient is to zero, the closer the data to a normal distribution. It was noted that the coefficients for the 2008 CTE completer data are extremely skewed (-40.82) and peaked (201.02), which are consistent with the distribution of the 115 school divisions in Table 14 who had graduation rates of 98-

100%. It is also noted that the coefficient of kurtosis for CTE completers and non-CTE completers has less of a disparity in the 2009 and 2010 school years.

Table 16

Standardized Skewness Coefficients and Standardized Kurtosis Coefficients for Graduation Rates 2008-2010

Year	Concentration	Standardized Skewness Coefficient	Standardized Kurtosis Coefficient
2008	CTE Completers	-40.82	201.02
	Non-CTE Completers	-5.32	2.70
2009	CTE Completers	-4.37	3.38
	Non-CTE Completers	-4.68	2.59
2010	CTE Completers	-4.81	2.94
	Non-CTE Completers	-3.98	2.93

Table 17 represents the Wilcoxon's *t*-test data for the independent variables for this research question. Because the data for the graduation rates were not normally distributed as proven by the coefficients of skewness and kurtosis, the nonparametric statistic was used for these data as well. The Wilcoxon's *t*-test yielded a statistically significant difference between CTE completers and non-CTE completers with regard to graduation rates $z = -9.350, -9.208$ and $-8.102, p < .001$ for the respective years of 2008, 2009 and 2010.

Table 17

Summary of Wilcoxon's t-test for Graduation Rates

	Concentration	Z	Sig
2008	CTE Completers	-9.350	.000
	Non-CTE Completers		
2009	CTE Completers	-9.208	.000
	Non-CTE Completers		
2010	CTE Completers	-8.102	.000
	Non-CTE Completers		

* $p < .05$

Delving deeper into the results of the Wilcoxon, the effect size associated with the difference in the graduation pass rates was found to be large using Cohen's *d* criteria (Table 18). Respectively, the effect sizes calculated were 1.53, 1.54 and 1.19 for the years 2008, 2009 and 2010. A large effect size illustrated the difference between the CTE completers and non-CTE completers based on graduation rates in standard deviation units. Therefore, the distributions of the graduation rates for these groups do not extensively overlap.

Table 18

Cohen's d- Effect Size for Graduation Rates

Year	Concentration	Cohen's <i>d</i>
2008	CTE Completers Non-CTE Completers	1.53
2009	Completers Non-CTE Completers	1.54
2010	Completers Non-CTE Completers	1.19

Chapter Summary

This study explored the academic achievement and graduation rates of students in the Commonwealth of Virginia for the years 2008-2010 based on CTE enrollment status. Table 19 illustrates a summary of the data set that were used for the calculations and data analysis in Chapter Four. Chapter Four presents the results of the study in three sections based on the guiding research questions. The dependent variables for the research questions were Grade 11 English reading SOL pass rates, mathematics SOL pass rates (Algebra I, Algebra II, and Geometry) and graduation rates. The first structure analyzed in section one was the student achievement of CTE completers and non-CTE completers based on the pass rates for the highest

math SOL taken. The *t*-test analysis revealed that there was a difference in the student achievement of students on mathematics SOLs based on CTE enrollment status. This result was found to be true for each of the years of the study.

Table 19

Summary of Math, Grade 11 English Reading and Graduation Rates for the Commonwealth of Virginia 2008-2010

Measure	Total Tested/ Cohort	Total Pass/ Grad	State Pass/ Grad Rate	Total CTE Tested/ Cohort	Total CTE Pass/ Grad	CTE Pass/ Grad Rate	Non-CTE Tested	Non-CTE Passed	Non CTE Pass/ Grad Rate
Math									
2008	258,059	233,557	91%	31,382	26,261	84%	226,677	207,296	92%
2009	264,227	240,671	91%	37,634	36,966	98%	226,593	203,705	90%
2010	273,283	250,315	92%	39,295	38,573	98%	233,988	211,742	91%
Reading									
2008	88,243	82,893	94%	33,698	32,866	98%	54,545	50,027	92%
2009	89,765	84,831	95%	37,796	37,068	98%	51,969	47,763	95%
2010	89,756	85,497	95%	39,355	38,518	98%	50,401	46,979	93%
Graduation Rates									
2008	97,731	82,832	85%	34,973	33,180	95%	62,758	49,562	82%
2009	97,591	87,126	89%	37,314	35,569	95%	60,277	51,557	86%
2010	97,399	87,126	89%	39,657	37,968	96%	57,742	49,158	85%

The second structure analyzed was the Grade 11 English reading pass rates for the populations in the study. The descriptive statistics and *t*-test analysis revealed that there was a significant

difference in the student achievement of CTE completers and non-CTE completers on the Grade 11 English reading SOL. The academic achievement of this group of students proved consistent for the three years of the study with nearly all of the CTE completer school divisions having pass rates above 90 %.

The third section of the chapter focused on the graduation rates of students based on CTE enrollment status. As with the Grade 11 English reading SOL pass rates for CTE completers, the graduation rates for this group of students indicated that nearly 95% of the school divisions had CTE completer graduation rates above 90%. As the accountability requirements of No Child Left Behind continue to increase, these data will become increasingly important to school divisions. Each of the sections in Chapter Four outline specific data regarding the research questions, data collection and rescaling procedures, relevant descriptive statistics, Wilcoxon's *t*-test and effect size for the dependent variables of this study. The data analyzed and data tables representing the each of the independent variable groups have been presented. A discussion of the results, findings and recommendations for further research are discussed in Chapter Five.

Chapter Five

Findings, Implications for Further Study, and Reflections

The purpose of this study was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates. This study focused on the pass rates and graduation rates for each of the 131 schools divisions in the Commonwealth of Virginia based on data which were reported to the Department of Education. There were two independent variables in the study based on CTE concentration status. Subjects of the study were categorized as CTE completers or non-CTE completers. The three dependent variables were the pass rates on the Grade 11 English reading, literature, and research (RLR) SOL and the mathematics SOL pass rates for which the students were enrolled. The graduation rate data were based on the cohort information as reported to the VDOE. This chapter reports the findings, implications for practice, recommendations for further research and researcher reflections.

The researcher discusses the findings regarding student performance based on the CTE concentration status of the subjects of the study and if there is a difference in their SOL pass rates. As a result of numerous discussions about high-stakes testing and narrowing curriculum (Chadd & Drage, 2006; Davis, 2006; Jennings & Rentner, 2006), this study sets out to quantify the impact that career and technical education has on student performance. Career and technical education has been viewed as a second-tier track that offers students few options and little preparation for the future (Harris & Wakelyn, 2007). One of the intents of this study was to determine if CTE is a viable program that can contribute to the academic proficiencies required for high-stakes testing, such as Virginia's Standards of Learning. Furthermore, this study is intended to be a medium to provide quantifiable data to public school divisions when making

decisions regarding curriculum and program evaluation in this era of accountability and No Child Left Behind. The purpose of this study, which was to investigate the academic performance of CTE completers and non-CTE completers in the Commonwealth of Virginia on the Standards of Learning English and mathematics assessments, as well as cohort graduation rates, is supported by the research questions. The research questions which guided this study were:

1. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured by SOL Math pass rates of the highest level of Math completed (Algebra I, Algebra II, and/or Geometry)?
2. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. Non-CTE Completer) and student achievement as measured Grade 11 English reading, literature, and research SOL pass rates?
3. What is the difference, if any, between high school CTE enrollment status (CTE Completer vs. non-CTE completer) and the graduation rates of students?

Discussion of Findings

Finding 1. In the study populations, the pass rate for CTE completers was higher than the pass rate for non-CTE completers on mathematics SOLs.

Results from the statistical analysis reveal that there is a difference in the pass rates of students who have completed a prescribed CTE concentration from those who have not completed a CTE program. Overall, the results support the finding that CTE completers earned higher mean pass rates on the mathematics SOLs, during the 2008-2009 and 2009- 2010 school years. The Wilcoxon's *t*-test was conducted to compare the pass rates of students considered

CTE completers to the pass rates of students who have not completed a prescribed sequence of CTE courses. There was a significant difference in the mathematics SOL pass rates of CTE completers and non-CTE completers for the three years of the study ($z = -8.075, -9.789, -9.704$, $p < .001$). Specifically, CTE completers had a mean pass rate nine percentage points higher than non-CTE completers during the 2009 and 2010 school years. These results suggest that CTE completers do outperform their non-CTE counterparts on mathematics SOLs.

As noted in the literature, there are a lack of studies that examine the impact of CTE on student performance (Gordon et al, 2007). Also noted in the literature as a key element of NCLB are the high-stakes assessments and the attainment of benchmarks (Amrein & Berliner, 2002). NCLB has caused educators to focus on standards based curriculum and review their curricular focus. School districts throughout the country are increasing the time that students spend on reading and math, thus reducing the time spent in elective courses (Dillon, 2006). This narrowing of curriculum could lead to the reduction of electives or CTE courses offered simply because school leaders are not aware of the impact CTE has on the attainment of the NCLB benchmarks. Contrary to much of the research (Harris & Wakelyn, 2007; Silverberg et al, 2004; Elliot et al, 2004; Bae et al, 2007), this study suggests that there was a difference in the mathematics pass rates and performance of CTE completers from those of non-CTE completers. This study also revealed that the mean mathematics pass rate for CTE completers during the years of 2008-09 ($M = 97.86$) and 2009-2010 ($M = 97.61$), were higher than those of non-CTE completers.

Finding 2. In the study populations, the pass rate for CTE completers was higher from that of the non-CTE completers on the Grade 11 English reading, literature and research (RLR) SOL.

Data indicate that the academic achievement and pass rates of CTE completers on the Grade 11 English RLR SOL are different than those of the non-CTE completers. The mean reading SOL pass rates for CTE completers during the years of this study were 7-8 percentage points higher than that of the non-CTE completers. It should also be noted that for the years of this study, CTE completers had 99-100% of the school divisions to have reading SOL pass rates at or above 90%. This is higher than the non-CTE completers where an average of 55% of the school divisions had pass rates of 90% or higher on the reading SOL. The Wilcoxon's *t*-test conducted on the reading SOL pass rates did elicit that there was a difference in the pass rates of CTE completers to non-CTE completers ($z = -9.358, -9.119, -7.779, p < .001$).

For most educational leaders, this statistic and finding would be noteworthy in their evaluation of the contribution of CTE to student performance. Consistent to the findings of the research conducted by the National Assessment of Educational Progress (NAVE), CTE students have made substantial progress in reading achievement (Silverberg et al, 2004). The NAVE research found that CTE concentrators increased their reading scores by eight scale points, while those who took little to no CTE courses only showed a four point improvement. This increase in reading performance was attributed to the increased course taking, which has become part of the required courses for students. The National Association of State Directors of Career and Technical Education Consortium (2010) also tout increasing student achievement in reading when CTE school reforms are implemented. This research found that student scores on state assessments rose by 25 percentage points in reading/language arts when CTE courses became a focus for the identified schools (NASDCTEC, 2010).

Finding 3. In the study populations, the cohort graduation rates for CTE completers were higher than those of non-CTE completers.

Similar to the results of the previous dependent variables- mathematics and reading SOL pass rates- CTE completers also attained mean high school cohort graduation rates of 6-13% higher than non-CTE completers for the years of the study. Data indicate that CTE completers had a statistically significant difference in their cohort graduation rate to that of the students who had not completed a CTE approved sequence of courses. Students in CTE courses graduated with their cohort of classmates at an average graduation rate of 96% where the average non-CTE cohort graduation rate was 87% for the three academic years of the study.

Interestingly, the research has no clear answers regarding the connection of CTE course taking and graduation (Plank et al, 2008). As the research shows (Plank et al, 2008, Gray 2002, Alfred et al, 2007), there are some plausible explanations as to why CTE may motivate students to graduate. CTE courses often empower students by providing a range of options for learning and allowing students to apply technical skills to real world situations. The Carl D. Perkins Act of 2006, which is legislation aimed to increase the quality of academic and technical skills in the United States, stipulates that academic achievement data- including graduation rates- collected by states should be in compliance with NCLB. These NCLB data are the metric used to evaluate academic performance of CTE students. As the benchmarks for NCLB and Perkins require states to report graduation rates, school districts have become increasingly aware of the importance. Lavender (2010) reports that graduation rates have increased for CTE concentrators because career and technical education provides a way for students to connect what they have learned in school with what they plan to do in the future. School leaders have progressively focused more attention on graduation rates as they have become one of the performance indicators for No Child Left Behind and the Carl D. Perkins legislation.

Implications for Practice

The results of this study indicate that career and technical education impacts student achievement and graduation rates. As school divisions make decisions regarding cutting CTE programs the results of this study should be reviewed as it concludes that students who complete a CTE sequence of courses demonstrate higher mathematics, reading and graduation pass rates. Several implications for practice were identified from the findings of this study. The research indicates that there are mixed reviews regarding CTE's impact on student achievement and graduation rates. These inconclusive studies served as the impetus for this study in the Commonwealth of Virginia, and the desire of the researcher to investigate the performance of CTE completers in the state. Based on the implications below, educators should explore further the role of career and technical education in the achievement of students.

Implication 1. School administrators interested in increasing mathematics and reading SOL performance should encourage more students to enroll in and complete CTE sequenced courses.

The mathematics and Grade 11 English reading SOL pass rates of CTE completers are higher than that of the students who are non- CTE completers. As school divisions look to meet the increasing NCLB benchmarks, consideration should be given to courses and programs that help to support the attainment of the requirements AYP. Since career and technical education is not mentioned in the NCLB legislation, educators must see the merit in CTE programs and its impact student achievement. Daggett (2009) and Thomas (2004) state that the experiential and contextual learning environment of business, marketing, technology education, and trade and industrial courses provide the best environment for students to develop the academic skills needed for success on state assessments. CTE courses provide practical hands-on experiences for students to receive purposeful instruction to strengthen basic skills (Glenn, 2005). Therefore,

enrollment in CTE courses will contribute to the attainment of NCLB goals and school accreditation. The findings of this study indicate that there is a difference in the mathematics and reading SOL pass rate performance of CTE completers. For this study, CTE completers demonstrated a statistically significant higher pass rate on the mathematics and Grade 11 English reading SOL than their non-CTE counterparts. Therefore, school divisions and educational leaders should encourage enrollment of students in CTE courses.

Implication 2. School administrators interested in increasing cohort graduation rates should encourage more students to enroll in and complete CTE sequenced courses.

Since the three-year evaluation of cohort graduation data yielded significant differences in the performance of CTE completers and non-CTE completers, educational leaders and school divisions should consider encouraging students to enroll in CTE courses. Alfred et al (2007), conducted research that indicated there is a positive association between the CTE enrollment, career and technical student organization association and the likelihood of dropping out of school. Based on the results of this study, the CTE completer cohorts had an average graduation rate of 95%, which was well above the average for non-CTE completers during the same years and the AYP benchmarks. Lavender (2010) notes in the research that the four year cohort graduation rates for CTE course concentrators' was 18% higher than all students in the state of North Carolina. His research attributes the increased graduation rate to the connection CTE makes with students' plans beyond high school.

Implication 3. School administrators should encourage non-CTE completers in CTE courses to complete a sequence of CTE courses and become completers.

Data indicate that for each year of this study there were 500,000 (duplicated count) or more students enrolled in one or more CTE course. Of that number each year, only approximately 6% of those students become CTE completers. Chadd and Drage (2006)

encourage school leaders and educators to continue to document how CTE courses support students in meeting academic standards and persisting to graduation. Increasing the number of non-CTE completers taking sequenced courses and becoming completers would benefit school divisions and students. As evidenced by the pass rates of CTE completers, student participation in courses that are not included in the state mandated testing could prove to be as valuable for future plans as time spent preparing for the required academic assessments (Daggett, 2005).

Implication 4. Career and technical educators should continue to document and collect data on the performance of program completers to monitor CTE effectiveness.

For this study, public domain data were used to evaluate the academic performance of CTE completers. These data basically provided the number of students tested and the number of students who passed the high-stakes SOL. In order to promote CTE as a program viable in meeting benchmarks, disaggregated data regarding specific program areas and course work should be investigated. In this time of narrowing curriculum and data driven decisions, CTE must continue to collect, document and promote CTE courses. The 2006 Carl D. Perkins legislation requires states to maintain specific data on its programs and the utilization of grant funds; however, few states have conducted studies to evaluate the impact of career and technical education programs on the NCLB requirements (Gordon et al, 2007). The collection of this data would be helpful in the promotion of CTE courses and increasing student enrollment.

Implication 5. School administrators should evaluate instructional practices used in CTE courses for their merit and value with integrated instruction.

Educational leaders should evaluate the instructional practices utilized in CTE to determine their value in school reform. As part of the NCLB legislation various reform models have been identified as effective. Perhaps in an effort to demonstrate the viability of career and technical education, educators can investigate the contextual approach used in CTE to determine

if any of these practices can be incorporated into core content areas. Educators acknowledge that students learn more when the work is connected to their interests, to real world problems and the world of work and college (Partnership for 21st Century Skills, 2011). The contextual framework used in CTE helps students to see the relevance in the work, thus they perform accordingly.

Researchers (Wagner, 2008; Glenn, 2005; Partnership for 21st Century Skills, 2011) add that the use of academic content to teach basic skills, including 21st Century skills will help to increase academic rigor for students and their student achievement.

Recommendations for Further Research

Daggett (2009) states that in order for career and technical education to establish and maintain itself as a viable component of the comprehensive school program, there is a need to determine how students that have completed a CTE concentration of sequenced courses perform on state high-stakes tests. Therefore, the researcher recommends that more quantitative studies are conducted to determine the impact of career of technical education on the academic achievement and graduation rates of students. Researchers note there are limited studies on the impact of career and technical education on NCLB and high-stakes testing (Gordon, 2007). Thus, there is much more quantitative research that should be done. Some of the recommendations of further research in the area are:

Recommendation 1. A quantitative study utilizing actual CTE completer and non-CTE completer student scores instead of pass rates on the high-stakes assessments.

Recommendation 2. Replicate this study in one or more additional states to add to the generalizability of the study to overall CTE student performance.

Recommendation 3. Further research could be conducted through a quantitative study to analyze student academic performance based on identified CTE program areas

(agriculture, business, marketing, family and consumer sciences, health occupations, and technology-trade and industrial education).

Recommendation 4. The mathematics data used for this study included a cumulative mathematics SOL pass rate for secondary math. The researcher suggests that a study could be conducted to evaluate Math performance of CTE completers by specific Math course (Algebra, Algebra II, and Geometry).

Recommendation 5. As the review of literature suggests, there are many extraneous factors, such as course selection, which influence student performance. A study to investigate previous course taking patterns and curriculum choices of students would provide information regarding skill levels prior to entering CTE completer sequences and taking SOL assessments or state assessments.

Recommendation 6. A longitudinal study to investigate and compare CTE student performance and graduation rates based on the type of school division (rural, suburban, urban) would provide information on the correlation of school district size, amount of Carl Perkins funding, and student achievement.

Recommendation 7. A study to quantitatively compare CTE completer and non-CTE completer performance by AYP subgroups would offer greater insight into the benefit of CTE to an identified subgroup.

Recommendation 8. More research on cause and effect would help to expose the true impact of career and technical education courses on student achievement. A study that evaluates curriculum and instructional strategies utilized in CTE courses would contribute to the body of literature that currently exists regarding contextual learning and CTE.

Reflections

As an educator and career and technical education educator, the researcher had a vested interest in the topic of this study. Through personal experiences and anecdotal accounts, the researcher has seen the growth, success, and accomplishments of students who have completed career and technical education programs and progressed to postsecondary education or the world of work. Through the extensive research process of this topic, the researcher learned about the current literature concerning the topic of academic performance of students in career and technical education and the topic of narrowing curriculum. Furthermore, the researcher discovered how little information exists regarding the academic performance of CTE concentrators on high-stakes state assessments. There seemed to be numerous national studies and anecdotal data regarding CTE student performance, but given the increased focus on NCLB benchmarks, the researcher discovered limited research on CTE performance on the high-stakes standardized tests required by each state. With the growing accountability requirements, it is especially important for CTE teachers and administrators to take this opportunity to highlight the success of their program areas and courses as it relates to student progress and graduation rates.

Reflecting on the experiences of conducting this research, the researcher acknowledges that her previous experiences as a CTE teacher and administrator were prevalent in the investigation of this topic. To control for this possible bias, the researcher decisively chose a quantitative study and used existing public domain data. Statistical analyses were also used to eliminate the influence of researcher bias.

Investigating CTE completer performance through this study peaked the researcher's interest, regarding which instructional practices and contextual learning strategies utilized in career and technical education courses produce the successful student academic performance as demonstrated in this study. This investigation of Virginia's CTE completer pass rates compared

to students who have not completed a CTE program and students' success on the Standards of Learning assessments, has the researcher curious as to if this positive performance is only inherent to Virginia and its CTE programs or if CTE students have met this same success on state and national benchmarks in other states.

As the nation begins to embrace the concept of 21st Century Skills, performance based learning, and President Obama's college and career readiness initiatives, it is time for career and technical education to showcase how its programs support and encompass these concepts. Therefore, the researcher agrees with Bill Daggett (2009) who suggests that CTE must continue to clearly demonstrate that these programs contribute to the academic success of students and motivates students to stay in school through graduation. This study is one of many others that are needed in statistically proving that CTE students perform at or above those who are not CTE concentrators on state mandated high-stakes tests.

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

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Appendix A

Institutional Review Board Certificate of Completion


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Certificate of Completion
 This certifies that
Eleanor Blewe
 Has completed
Training in Human Subjects Protection
 On the following topics:
 Historical Basis for Regulating Human Subjects Research
 The Belmont Report
 Federal and Virginia Tech Regulatory Entities, Policies and Procedures
 on
June 23, 2009


 David Moore, IRB Chair

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Appendix B

Institutional Review Board Approval Letter



VirginiaTech

Office of Research Compliance
 Institutional Review Board
 2000 Kraft Drive, Suite 2000 (0497)
 Blacksburg, Virginia 24060
 540/231-4606 Fax 540/231-0959
 e-mail irb@vt.edu
 Website: www.irb.vt.edu

MEMORANDUM

DATE: July 11, 2011

TO: Carol Cash, Eleanor Blowe

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: The Impact of Career and Technical Education on the Academic Achievement and Graduation Rates of Students in the Commonwealth of Virginia

IRB NUMBER: 11-621

Effective July 11, 2011, the Virginia Tech IRB PAM, Andrea Nash, approved the new protocol for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at <http://www.irb.vt.edu/pages/responsibilities.htm> (please review before the commencement of your research).

PROTOCOL INFORMATION:

Approved as: **Exempt, under 45 CFR 46.101(b) category(ies) 4**

Protocol Approval Date: **7/11/2011**

Protocol Expiration Date: **NA**

Continuing Review Due Date*: **NA**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

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

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