A PHENOMENOLOGICAL STUDY EXAMINING THE EXPERIENCES OF FEMALE HIGH SCHOOL CAREER AND TECHNICAL EDUCATION COMPLETERS WHO PARTICIPATED IN A TECHNOLOGY-BASED PROGRAM OF STUDY

by

Stephen C. Tate

Liberty University

A Dissertation Presented in Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

Liberty University
2020
A PHENOMENOLOGICAL STUDY EXAMINING THE EXPERIENCES OF FEMALE HIGH
SCHOOL CAREER AND TECHNICAL EDUCATION COMPLETERS WHO
PARTICIPATED IN A TECHNOLOGY-BASED PROGRAM OF STUDY

by Stephen C. Tate

A Dissertation Presented in Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

Liberty University, Lynchburg, VA
2020

APPROVED BY:

James A. Swezey, Ed.D., Committee Chair

Andrea P. Beam, Ed.D., Committee Member
ABSTRACT

The purpose of this phenomenological study was to investigate how female high school students who earned Career and Technical Education (CTE) completer status in a technology-based program of study (POS) in Virginia describe their experiences. CTE completer status is defined as having met the Virginia Department of Education’s CTE completer requirements in a technology-based POS. This study was guided by three theories: Self-efficacy theory was applied as it relates to the participants’ status as completers in a technology-based CTE POS; Role-congruity theory suggests that men and women occupy social roles with attendant stereotypes which contributed to how participants described their experience in a technology-based POS; Social cognitive career theory focuses on the factors influencing occupational choice-making. Using interviews, electronic discussion boards, and photo essays, the experiences of 12 participants who earned Virginia CTE completer status in a technology-based POS were examined to address the central research question: How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS? Participants were selected through criterion sample. The data in this study was analyzed using the procedures of a transcendental phenomenology to gain a complete understanding of the participants’ shared experiences as females who earned completer status in a technology-based CTE POS. After thorough analysis of the data, three themes emerged: (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual.

Keywords: Career and Technical Education (CTE), college and career readiness, completer, gender roles, program of study (POS).
Dedication

After analyzing the data in this research, a key theme that emerged had to do with the value of acknowledging students as individuals for guidance and support. Sadly, many special people in my life who consistently exemplified the practice of showing care for individuals have passed into the Lord’s care. To my dear friend, Geoffrey McCabe, I dedicate the very concept of caring for the individual. That part of your character was experienced by your friends, family, and the many hundreds of students you impacted during your career in the classroom. The personalized cards and gifts for which you were known reflected God’s love to everyone in your life. Michael Fox, you were one of the first to encourage me as I started the path towards my doctorate and you tolerated my late nights as we traveled the country with our students for SkillsUSA while I worked to meet deadlines. You were both teachers, fathers, and friends who changed the lives of so many for the better and you are missed beyond words.

To my brother, James Tate, I dedicate the completion of this degree. You had come so close to completing your own degree and never got the chance to do so. In life you were very much an unfinished work, but it was you who shared the Gospel of Christ with me and allowed me to live in confidence for the finished work God has done in each of us through Christ. My earthly model of daily sacrifice was undoubtedly my mother, Barbara Tate. I dedicate all the effort this dissertation required to you, Mom, just as you were a tireless worker when it came to making our home and family a nurturing, encouraging environment in which unconditional love was modeled daily. To my grandparents, Clair and Emma Edwards, and Evelyn Tate: I was blessed to live into adulthood with an opportunity for my own children to know you before God called you home. May all of you rest in Heaven’s peace. While death remains a painful mystery to me, life makes more sense because of the lessons I learned from all of you.
Acknowledgments

First, I wish to acknowledge my Lord and Savior, Jesus Christ. It is the hope I have in His great love that sustains me as I seek to be the best teacher, friend, husband, and father I can be. I appreciate the pastors and congregants from both Craigs Church and Wilderness Baptist Church who have bathed me in prayer. Those prayers have availed much. I thank the thousands of students I have been blessed to work with during the first three decades of my career, and look forward to those I will have the honor to work with in the years to come. I thank the many friends who have yielded time with me the last 10 years as I worked to complete courses, research for my dissertation, collect data, and push through to this milestone. That is particularly true about you, Ted. You and your wonderful family will always be a very special part of mine.

Mr. Lipinski, Mr. Nesbitt, and Mr. Katsu were three teachers who made a huge impact on my life when I was a student. Each of you exemplified all the best traits of being a classroom educator and inspired me to pursue this career. There are so many teachers I have worked with, and administrators I served under, from whom I have learned so very much: Helen, Wendy, Karen, Carole, Mike, Dr. Seals, Jessica, Harold, Chris, Dr. Wright, Dr. Parsons, Lee, David, Meghan, Cara, and all of the faculty and staff at SCTC. Thank you. I must also mention the prayerful mentoring of Dr. Swezey during this challenging dissertation journey, and the input of Dr. Beam and the Liberty Theological Seminary and Liberty University family as a whole.

To my father, Gary, and brother, David, I hope you know how much I love you both and that I treasure all I learned about being a good father from each of you. Of course, I simply must thank my sons, James and Matthew, and my daughter Caitlyn for being such giving, compassionate children. Truly, the respect and love you showed me during the many hours I have put into these degrees taught me what it means to be supportive.
Yet, without question the most significant person in my life is my wife and partner, Jennifer. Throughout all my classes since our years in Blacksburg you have been my editor, sounding board, and helpmate. Your patience is unyielding, your prayerful encouragement is unceasing, and your faith in me defines the concept of longsuffering. While I realize that was the model of marriage you observed in your parents, it takes an abiding strength to follow the spiritual guidance of those generations which pointed us towards God’s Word as the only source of truth. I have heard it said the title “Doctor” ought to be awarded to both spouses once it is achieved because they are both deserving. There is no question in my mind that sharing life with you has been the impetus and inspiration for my every achievement since we fell in love as teenagers. When we became husband and wife God knew our strengths would complement one another’s weaknesses and see us through every trial. Thank you.
# Table of Contents

ABSTRACT ...................................................................................................................... 3
Dedication ......................................................................................................................... 4
Acknowledgments ............................................................................................................ 5
List of Tables .................................................................................................................. 10
List of Abbreviations .................................................................................................... 11

CHAPTER ONE: INTRODUCTION .............................................................................. 12
  Overview ....................................................................................................................... 12
  Background .................................................................................................................... 12
  Situation to Self ............................................................................................................ 21
  Problem Statement ..................................................................................................... 23
  Purpose Statement ...................................................................................................... 24
  Significance of the Study ............................................................................................ 25
  Research Questions ...................................................................................................... 27
  Definitions ..................................................................................................................... 28
  Summary ....................................................................................................................... 29

CHAPTER TWO: LITERATURE REVIEW .................................................................. 31
  Overview ....................................................................................................................... 31
  Theoretical Framework ............................................................................................... 32
  Related Literature ....................................................................................................... 39
  Summary ....................................................................................................................... 62

CHAPTER THREE: METHODS .................................................................................. 64
Overview .................................................................................................................. 64
Design .......................................................................................................................... 64
Research Questions ................................................................................................... 65
Setting .......................................................................................................................... 66
Participants .................................................................................................................... 66
Procedures .................................................................................................................... 68
The Researcher’s Role ................................................................................................ 69
Data Collection ............................................................................................................. 71
  Interviews .................................................................................................................. 72
  Electronic Discussion Boards .................................................................................... 76
  Photo Essays ............................................................................................................ 79
Data Analysis ............................................................................................................... 80
Trustworthiness ............................................................................................................ 83
  Credibility ................................................................................................................ 84
  Dependability and Confirmability ............................................................................. 84
  Transferability .......................................................................................................... 85
Ethical Considerations ................................................................................................. 85
Summary ....................................................................................................................... 85

CHAPTER FOUR: FINDINGS ....................................................................................... 87
Overview ....................................................................................................................... 87
Participants .................................................................................................................... 88
  Alice ........................................................................................................................... 88
  Katherine ................................................................................................................... 89
Betty .......................................................................................................................... 90
Chloe .......................................................................................................................... 91
Jasmine ....................................................................................................................... 91
Darwin ......................................................................................................................... 92
Elouise ......................................................................................................................... 93
Frankie ......................................................................................................................... 94
Gwen ............................................................................................................................ 95
Heather ....................................................................................................................... 96
Isabella ......................................................................................................................... 97
Lyra ............................................................................................................................. 98
Results ........................................................................................................................ 99
Themes ........................................................................................................................ 100
Research Question Responses .................................................................................. 121
Summary .................................................................................................................... 124
CHAPTER FIVE: CONCLUSION .............................................................................. 126
Overview ................................................................................................................... 126
Summary of Findings ................................................................................................. 127
Discussion .................................................................................................................. 130
Implications and Recommendations ......................................................................... 139
Delimitations and Limitations .................................................................................. 148
Recommendations for Future Research .................................................................... 150
Summary .................................................................................................................... 150
REFERENCES .......................................................................................................... 153
APPENDIX or APPENDICES ..................................................................................... 166
List of Tables

Table 1: Summary of Participant Demographics.................................................................99

Table 2: Analysis of Raw Data from Interviews, Discussion Board, and Photo Essays...........101
List of Abbreviations

Career and Technical Education (CTE)

Information Technology (IT)

Programs of Study (POS)

Science, Technology, Engineering, and Mathematics (STEM)
CHAPTER ONE: INTRODUCTION

Overview

The purpose of this chapter is to identify the background of female participation in technology-based programs of study (POS) in high school career and technical education (CTE) centers. Further, the researcher in this present study has identified the gap in the literature calling for qualitative inquiry into the shared experiences of female CTE program completers. The purpose and significance of this present study has been defined, establishing the foundation for the research questions to be addressed by a phenomenological approach to inquiry and data analysis.

The sections detailed in this chapter include: (a) a background summary of the relevant literature, (b) situation to self, which describes the researcher’s motivation for conducting this study, (c) the problem statement, (d) the purpose statement, (e) the significance of the study, (f) the research questions, including a brief description and discussion of each, (g) a definitions section to address some frequently used terms and phrases used within the study, and (h) a summary of the chapter content.

Background

The issue of diversity within the evolving demographics of modern education spans concerns over student achievement (Ceci, Williams, Sumner, & Defraine, 2011) to needs for special services to the goal of establishing equitable balances for course enrollment and career preparation (Wang & Degol, 2013). Race equity, gender equity, and opportunities for exceptional learners as well as students with special needs are just a few of the facets in the matter of diversity (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002), and the preponderance of research focuses on these issues. While current research has confirmed the gender imbalance in
secondary science, technology, engineering, and mathematics (STEM) and CTE (Aragon, Alfeld, & Hansen, 2013), there is a need for qualitative research describing the experiences of female CTE students who have completed a POS in the STEM fields (Carver & Kosloski, 2015; Fluhr, Choi, Herd, Woo, & Alagaraja, 2017).

This study focuses on the experiences of female high school students who earned CTE completer status in a technology-based POS. Low female enrollment in technology-based CTE courses and STEM courses in general is a concerning trend at the secondary level (Christensen, Knezek, & Tyler-Wood, 2014). In fact, females "continue to be a disadvantaged group compared to their male peers" (Aldridge & Goldman, 2007, p. 40) in developing various interests and areas of giftedness that have been identified in primary and elementary school.

Although societal influences, such as preconceptions about gender roles within the CTE community, have an influence on program demographics, current trends appear to stand at odds with areas of interest and aptitude that are observed in the middle school female population. In other words, females within this generation of digital natives are not only more comfortable with emerging technologies that drive institutions of industry, commerce, medicine, education, and even recreation than those from previous generations, but they are in fact seeking opportunities for technology-based training prior to commencing college studies and securing entry-level jobs within their chosen careers (Garcea, Linley, Mazurkiewicz, & Bailey, 2012).

**Historical Context**

Information technology (IT) courses in the 1980s and early 90s were very general in their content and were often taken as exploratory courses by most of the students at the middle and early high school level (History of CTE, 2014). Keyboarding, data processing, and basic computer design were topics implemented into such courses. However, as these general courses
evolved into more specific topics such as computer maintenance, networking, computer assisted design, advertising design and graphics, audio and video production and editing, and network security the schools turned more and more to the professionals from the IT field to assist in curriculum development and in many cases instruction itself. The more specialized the course, the more likely it was to wind up in a magnet school or CTE center and staffed by retired IT professionals or career switchers who were making a transition after the dotcom bubble burst in the late 90s (History of CTE, 2014).

The concern that soon emerged from this trend was that employees from within organizations that had been primarily staffed by males for a generation would bring their perceptions, language, and stereotypes from the corporate workplace into the classroom environment (Wang & Degol, 2013). This being the case, even when females were placed in a technology-based CTE course, the instructors would teach the course in such a way as to superimpose upon instruction the same kind of habits of mind that were prevalent in their prior place of employment (Carver & Kosloski, 2015). While a boy sitting in a networking course might not be personally offended when the instructor describes the network interface cable as being the male end of a connection and the network interface port as being the female end (IT Essentials, 2018), the adolescent mind might struggle to compartmentalize this imagery in ways that would make it hard for a female adolescent to appropriately process. This impact is likely to be amplified in an environment where the class of students has just one or two females participating (Christensen et al., 2014).

The secondary student guidance system is bound to certain pre-conceptions about the proper courses for female and male program enrollment (Ceci et al., 2011). In the CTE realm, male students are disproportionately enrolled in carpentry, masonry, and automotive courses and
females are disproportionately enrolled in cosmetology, nursing, early childhood development, and dental assisting programs (Falco, 2016). Studies have indicated there is an interest on the part of females to participate in technology-based CTE programs at the secondary level, but that there is frustration at the hurdles that stand in their way (Wang & Degol, 2013). “As cultural, social, political and economic changes take place, the secondary or high school curriculum should reflect and respond to changing needs and aspirations of students” (Mativo, Womble, & Jones, 2013, p.103). It is incumbent upon stakeholders in the field to be responsive to these changing needs and aspirations and move beyond stereotypes that serve no purpose in advancing America’s standing in the global marketplace of products and ideas (Christensen et al., 2014).

While the implementation of the STEM umbrella has allowed Title IX-watchers to suggest that female participation in technology and the sciences has grown, female participation in very specific technology majors has been on the decrease for software development and systems engineering programs during the past decade (Fletcher, 2012). The value of CTE programs for jobs that exist at the end of the STEM pipeline has been established. The existence of a gender gap in STEM courses and technology-based CTE programs of study has been a pervasive concern at the secondary level (Jacobs et al., 2002). Given the gap in qualitative research, the insights of females who have completed a technology-based POS may help bring stakeholders together in terms of how secondary education can go about encouraging female participation in IT training strands and reveal pedagogical considerations for instructors.

**Theoretical Context**

When technology functions as designed, it can allow for a more efficient workplace, improve resources for recreation and education, and provide dynamic opportunities for employment. When technology fails to function as designed, the very troubleshooting and
problem-solving skills required to get the boxes functioning can still provide dynamic employment potential (Christensen et al., 2014). Historically, men designed technologies to improve their lives and the lives of those around them at home, on campus, and in the workplace (McLeod & Allard, 2013). Women benefited from the explosion of the technology age but were kept from interacting with technologies beyond the front door of the home by social conventions of the time (McLeod & Allard, 2013). Role-congruity theory indicates that men and women occupy social roles with attendant stereotypes and prescriptions, and this may contribute to the gender imbalance in technology-based POSs as well as how female students describe their experiences (Eagly & Karau, 2002).

Self-efficacy theory relates to the conditions under which the contribution of self-efficacy to performance may increase, remain stable, or decline over time (Bandura, 2012). In terms of career self-efficacy and seeking the training required for jobs in IT, females have taken to the faceless avenues of technology implementation at a higher rate than their male counterparts. For instance, during the first decade of the new millennium not only did females take online courses 7% more often than males, they also completed online programs of study 11% more often than males (Tempelaar, Niculescu, Rienties, Gijselaers, & Giesbers, 2012).

Many online learning programs are looking for basic qualifications to be met for acceptance. A formal interview and application process is not required (Van Noy et al., 2016). Thus, females need not concern themselves with whether a stereotype will be applied to their acceptance or denial into a program of study. Additionally, these universities can use the enrollment and persistence numbers for gender and ethnicity to bolster their general enrollment data, thereby complying with Title IX of the Education Amendments without making substantial changes to existing admissions policies. Be that as it may, the new millennium has begun to yield
a balance at the university level for female participation in STEM and IT-focused degree programs (Tseng, Chang, Lou, & Chen, 2013). The marketplace has been slow to catch on to this trend, particularly in management roles and for salaries in positions of comparable responsibility (Fluhr et al., 2017; National Science Foundation, 2017).

Social cognitive career theory (SCCT) incorporates elements of Bandura’s general social cognitive theory and combines it with such concepts as how interests, abilities, values, and environmental factors impact how a person goes about selecting and pursuing training for a given career. Brown (1990) asked, “What are the relationships among values, needs, aptitudes, and interests as they operate in concert to influence occupational choice making” (p. 346)? SCCT was designed to answer such questions, offering a potentially unifying conceptual framework that might link these variables together. Therefore, SCCT highlights relevant experiential and learning processes, as well as ability-acquisition characteristics, and seeks to define the impact they might have on career development as a function of the bridge between self-efficacy beliefs, outcome expectations, and personal learning goals (Lent, Brown, & Hackett, 1994).

**Social Context**

A greater percentage of females are interested in technology-based CTE courses, an increasing percentage of females are enrolling in college and university level STEM-based programs, and the percentage of female workers within the information technology field is slowly growing (Garcea et al, 2012; Lester, 2010; National Science Foundation, 2017). While CTE programs of the past, which were referred to in the previous generation as vocational centers, were typically populated by students who were not pursuing advanced diplomas or formal college training, this is no longer the norm. In fact, the effectiveness of the hands-on
nature of CTE training and problem-based learning (PBL) strategies which have been implemented into many CTE programs now generally map to entry-level industry training certifications and the opportunity to bypass or secure dual enrollment credits for first-year college courses (Tillman & Tillman, 2008). School counselors concerned that "they may suffer in their professional evaluations if they fail to meet quotas for advanced diplomas and college enrollment” (Malik, 2005, p.82) might find an unexpected ally within emerging models of CTE implementation. Perhaps, once this hurdle is overcome, guidance departments will be more willing to yield in their pattern of almost exclusively placing females in traditional programs of career preparation such as cosmetology, nursing, early childhood development, and dental assiting.

Although hands-on, PBL environments abound within CTE learning communities; instructors are often hired from within the ranks of the professions and industries upon which the POS focuses. As a result, these instructors are just beginners when it comes to the craft of teaching, developing units of instruction, and facilitating learning in such a way as to avoid reflecting traditional gender bias from within that profession or industry (Dawson, 2014; Grossman & Porche, 2013). Although their experience working within their professional and industrial fields is important, educator training for those making the transition from industry to the classroom ought to focus on the idea that "teachers now need to teach higher-order thinking skills and use a learner-centered constructivist approach which necessitates changing the mindset of teachers and adding skills such as instructional technology and sustainable development” (Manley & Zinser, 2012, p. 490). It is worth considering that sustainability is more likely to be achieved through an acknowledgement of the trends within college STEM programs and STEM-centric careers. Over the last three decades in the United States, these trends have shown an
increase in female interest and participation (Baruch, 2014).

Knowing what trends exist in female ownership and use of consumer IT products can be a valid predictor of female interest in IT in general (Sexton, King, Aldridge, & Goodstadt-Killoran, 1999). This interest and aptitude with IT is the same indicator that is used by school counselors and others involved in the process of selecting programs of study for CTE placement (Lapan, Hinkelman, Adams, & Turner, 1999). It is therefore important to know what kinds of technologies are owned and utilized by females, as well as their perceptions of their appropriate usage, to identify that there is a legitimate need for steering females into a technology-based POS beyond the obvious career benefits inherent to the STEM arena.

As with any program of instruction beyond the core curriculum, school divisions and colleges are constantly working to improve student persistence, which is the measure of how likely a program participant is to complete the required courses and earn the relevant credentials. In evaluating statistics from the National Center for Educational Statistics (NCES), it has been determined that students with CTE backgrounds completed credential programs almost 7% more often that those without (Hirschy, Bremer, & Castellano, 2011). Given that more females participate in college-level CTE programs leading to industry certification than males and considering the value of a CTE background in terms of persistence, there does appear to be incentive for stakeholders to prioritize female participation in technology-based high school CTE programs.

Career and technical education administrators have sought data on gender equity within certain occupations and occupational training opportunities for at least the last 50 years (Dougherty & Lombardi, 2016). For decades, students have progressed through a system that seems to define the male/female role stereotype, despite adoption of Title IX of the Education
Amendments of 1972, which intended to address this very kind of discrimination. In CTE training programs for such careers as cosmetology and nursing, female enrollment has remained steadily high perhaps because these are fields that are predominantly staffed by women.

Jobs in STEM fields continue to be an area of consistent growth, in the number of jobs available as well as compensation levels (Vilorio, 2014). Not only is this trend predicted to continue into the foreseeable future (Vilorio, 2014), but the current and future need to address a gender imbalance in STEM training and STEM careers (Sassler, Glass, Levitte, & Michelmore, 2017) has served as a wake-up call in secondary and post-secondary education to identify curriculum changes and improvements to start preparing tomorrow's workers today in order to fill these gaps. There is a need to work towards balancing opportunities for females and minorities in these training programs (Sassler et al., 2017). Perhaps the starkest examples of male-dominated STEM careers can be observed in the areas of technology and engineering (Franklin, 2013; Grossman & Porche, 2013).

It seems clear that high school programs of study that focus on career readiness have an impact on employability for jobs requiring STEM skills and training (Falco, 2016), and yet technology-based secondary and college programs of study (POS) tend to be dominated by White and Asian males (Franklin, 2013; Grossman & Porche, 2013; Shoffner, Newsome, Barrio Minton, & Wachter Morris, 2015). In the United States, White and Asian males hold most of the positions in STEM occupations as well (Dawson, 2014; National Science Foundation, 2017). Even when females persist to completion in a technology-based POS, those who hold degrees in technology and engineering are less likely than men with similar degrees to be employed in these fields, constituting 23% of the technology and engineering labor force (National Science Foundation, 2017). This has largely been attributed to a lack of self-confidence, low career self-
efficacy for STEM-related occupations (Grossman & Porche, 2013), and lack of social support and encouragement to pursue STEM-related career opportunities (Shoffner et al., 2015).

Over the last two decades, the Vocational Education Centers of the past have evolved their curricula to include a host of STEM-related POS offerings (Manley & Zinsser, 2012). This has led many trade and industrial training centers in secondary education to update their title from Vocational Education to Career and Technical Education, or CTE, Centers. Doyle (2012) noted that “the demand is rising for highly trained and skilled individuals in the United States and around the world” (p. 53). Just as Vocational Education Centers were largely responsible for contributing to the skilled trades workforce in the previous generation (Wang & King, 2008), CTE centers are being tapped by secondary education as models for providing rigorous, authentic, hands-on training of the digital native generation in STEM (Van Noy, Trimble, Jenkins, Barnett, & Wachen, 2016; Vilorio, 2014).

**Situation to Self**

I am passionate about the value of education and the opportunities provided by CTE for students who have identified career goals early on in their educational experience. In working with fellow educators, students, parents, and community stakeholders, I have come to believe that students who are provided the opportunity, within the hands-on environments that are common to CTE, to develop career-readiness skills are better prepared to make career training decisions and to ultimately achieve their professional goals. That is my position ontologically.

With that said, one of the prevailing trends in CTE is that training programs for certain trades are populated by students from certain genders, often based upon traditional social norms. Because most carpenters and mechanics tend to be males, and most nurses and cosmetologists tend to be females, the students who take courses in those programs of study follow along the
gender lines that are typical to the career itself. However, there are some careers that are of interest to males and females equally, at least according to interest inventories among middle school students, and many of those careers fall into the STEM area. In the generation described as digital natives, males and females seem to be equally adept at utilizing and engaging modern technology. I have been frustrated at how hard it seems to be to get school counselors to buy into the importance of steering females who have a desire to pursue a STEM career into a STEM POS at the CTE center where I work, and consequently my classes of 15 to 18 students typically have just three or fewer females. Often there is only one.

My experience is that the females who take my technology classes tend to do very well. However, there are far fewer females moving through this STEM pipeline, which is full of lucrative, exciting career opportunities. The constructivist epistemological paradigm asserts that humans can utilize their individual sensory experiences and observations to make sense of the world around them (Creswell, 2013). Therefore, the lack of female role models, both in the learning environment and within trade and industry, goes a long way towards explaining the efficacy issues impacting female participation in STEM-related CTE programs of study. Women are not taking advantage of these opportunities because of not only perceived bias that exists within STEM careers but because of the impact of school counseling and scheduling norms and pre-conceived gender roles that manifest within the typical American home and are transferred from parent to child. These gender-based values are imposed upon females in the home and school environments for years, culminating in decisions that impact career training choices and influencing efficacy. Because I am a teacher in a technology-based CTE POS, I have considered these axiological beliefs by placing myself inside the study, acknowledging my own bias as I seek to learn about the participants’ lived experiences as a function of social constructivism.
My interest in this study has been to see what themes emerged from the shared experiences female students have been enrolled in technology-based CTE courses, and particularly those who persisted to earn completer status within their POS. What interested them in the POS? What challenges did they face? What characteristics of these young women provided the impetus for them to earn their industry certification and complete the POS? The answers to these questions should provide valuable information for counselors, administrators, teachers, and students considering STEM training and STEM careers.

**Problem Statement**

Advances in modern technology have generated a need for professionals who have been trained for science, technology, engineering, and mathematics (STEM) careers (Daggett, 2013; U.S. Dept. of Education, 2012). Career and technical education (CTE) has been tapped as a conduit for addressing this need because not only does it have a history of filling gaps in the workplace (Alfeid & Bhattacharya, 2012; Castellano, Sundell, Overman, Richardson, & Stone, 2014), but a CTE program of study (POS) exposes students to many of the soft skills employers seek in entry-level workers (Castellano et al., 2014; U.S. Dept. of Education, 2012). CTE programs have historically experienced a gender imbalance in STEM courses in general and technology-based courses in particular (Baruch, 2014; McLeod & Allard, 2013). Despite evidence that females are comfortable with technology and benefit from its application to education and training, given that at the college level women take online courses 7% more often than males and complete online programs 11% more often than males (Tempelaar, Niculescu, Renties, Gijselaers, & Giesbers, 2012), this concerning trend in secondary CTE continues. The problem addressed in this study is whether females who complete a technology-based POS in CTE have common experiences that might point instructors and administrators towards ways to
revise recruitment practices, content, delivery, or classroom environments to increase female participation. While current research has confirmed the gender imbalance in secondary STEM and CTE (Aragon et al., 2013), there was a need for qualitative research describing the experiences of female CTE students who have completed a POS in the STEM fields (Carver & Kosloski, 2015; Fluhr et al., 2017). The researcher in this study sought to address the gap in literature and examine the experiences of female CTE students who have completed a technology-based CTE POS.

**Purpose Statement**

The purpose of this transcendental phenomenological study is to investigate how female high school students who earned Career and Technical Education (CTE) completer status in a technology-based program of study (POS) in Central Virginia describe their experiences. CTE completer status is defined as having met the Virginia Department of Education’s CTE Completer requirements in a technology-based POS. This study was guided by Bandura’s (2012) self-efficacy theory and Eagly and Karau’s (2002) role-congruity theory. Self-efficacy theory has been applied as it relates to the “conditions under which the contribution of self-efficacy to performance may increase, remain stable, or decline over time” (p. 39). Role-congruity theory indicates that men and women occupy social roles with attendant stereotypes and prescriptions, and this contributes not only to the gender imbalance in technology-based programs of study but also has an impact on how female students describe their experiences (Eagly & Karau, 2002). The researcher of this study has described the characteristics of female students who persist in a technology-based POS while emphasizing their perceptions and experiences. The information gathered adds to the existing quantitative data relative to the gender imbalance for technology-based CTE POS completers and has been explored to address
the gap in qualitative research.

**Significance of the Study**

Current research quantitatively confirms that a gender imbalance exists in technology-based CTE programs (Sassler et al., 2017; Vilorio, 2014) as well as in careers that require STEM skills (Franklin, 2013; Grossman & Porche, 2013). Further studies have evaluated strategies that have been used to address the gender imbalance (Manley & Zinsser, 2012). However, qualitative research that specifically describes the experiences of female pioneers in technology-based CTE programs of study is lacking (Goins, 2016).

**Empirical Significance**

CTE programs have historically experienced a gender imbalance in STEM courses in general and technology-based courses in particular (Baruch et al., 2013). Despite evidence that females are comfortable with technology and benefit from its application to education and training, given that at the college level women take online courses 7% more often than males and complete online programs 11% more often than males (Tempelaar et al., 2012), this concerning trend in secondary CTE continues. Since there is little empirical research examining female students’ experiences and influences in pursuing technology-based CTE programs of study (Carver & Kosloski, 2015; Fluhr et al., 2017), the results of this study provide a deeper understanding of female students’ experiences before, during, and after their involvement with a technology-based CTE POS. The textural and structural descriptions of themes (Moustakas, 1994) should assist those who develop course content for technology-based CTE programs, guidance departments and administrators involved in recruiting CTE participants, and help guide accepted pedagogy in ways that will make these programs more appealing to female CTE candidates. Stakeholders, such as educators, industry recruiters and curriculum developers within
post-secondary trade and industry training programs, and especially the students seeking training and employment in STEM-focused careers should be informed by the findings in this study.

**Theoretical Significance**

This study is guided by Bandura’s self-efficacy theory (2012), Eagly and Karau’s (2002) role-congruity theory, and Lent, Brown, and Hackett’s social cognitive career theory (1994). Self-efficacy theory has been applied as it relates to the “conditions under which the contribution of self-efficacy to performance may increase, remain stable, or decline over time” (p. 39). Role-congruity theory indicates that men and women occupy social roles with attendant stereotypes and prescriptions, and this contributes not only to the gender imbalance in technology-based programs of study, but also impacts how female students describe their experiences (Eagly and Karau, 2002). Both self-efficacy and role congruity impact the likelihood that a female CTE student in a technology-based POS will persist to earn completer status. Lent, Brown, and Hackett's social cognitive career theory (1994) highlights experiential and learning processes and ability acquisition characteristics and considers the impact they have on career development as a function of the bridge between self-efficacy beliefs, outcome expectations, and personal goals.

**Practical Significance**

The experiences of these women should inform educators, industry recruiters and curriculum developers within post-secondary trade and industry training programs, and especially the students seeking training and employment in STEM-focused careers as to potential environmental influences on female persistence in technology-based CTE programs (Lester, Struthers, & Yamanaka, 2017; Smith, 2017), and have pedagogical implications as well (Sassler et al., 2017; Smith, 2017). Additionally, motivational factors involved in female students selecting a technology-based POS (Garcea et al., 2012; Fluhr et al., 2017) has been revealed in
such a way that it can serve to inform school counselors, administrators, and instructors about ways to improve recruitment and retention of female CTE students. Although CTE programs are noted for their potential to offer students a variety of post-graduation opportunities, CTE programs continue to face challenges in terms of gender imbalance within certain programs of study. This qualitative study of the experiences of female students who earned completer status in a technology-based POS has practical implications for stakeholders in administration and guidance, in the classroom, and in STEM-based trade and industry careers themselves.

**Research Questions**

The following questions guided this study:

**Central Research Question:** How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS? Females participate in technology-based CTE programs of study at a rate far lower than their male peers (Sassler et al., 2017) and consequently far fewer females secure technology-based jobs that wait at the other end of the STEM career pipeline (Franklin, 2013; Grossman & Porche, 2013). Insight into the experiences of females who take and complete a technology-based POS helps to explain their enrollment motivation and characteristics of the program and participants that led to their POS completion.

**Sub-Question 1:** How do participants describe the social environment as females participating in a technology-based POS? Presumptions about gender roles can influence a student's experiences in class (Lester et al., 2017) and have the possibility to impact learning and life decisions in general (Eagly & Karau, 2002), as a function of Role Congruity Theory. The answers to this question reveal the extent of this influence as well as characteristics of female students who persist despite it.
**Sub-Question 2:** How do participants describe the learning environment as females participating in a technology-based POS? CTE programs are made up of elective courses and program participants choose their own POS (Jacques & Potemski, 2014). Given that high school graduation does not require a CTE POS, the answer to this question helps to explain what factors contribute to female enrollment and persistence in CTE programs. Participants' experiences confirm aspects of Self-Efficacy Theory (Bandura, 2012) as well.

**Sub-Question 3:** How do participants describe the education system’s support for their participation in a technology-based POS? Research indicates that program persistence for technology-based CTE courses is a challenge in secondary education (Farías & Sevilla, 2015) for males and females alike. Self-Efficacy Theory speaks to the conditions that influence performance increases and stability (Bandura, 2012). The experiences of female technology-based POS completers provide insights into how Self-Efficacy and POS persistence are linked to the instructional and career-planning support structures that are in place.

**Definitions**

CTE, which used to be referred to as vocational education, has experienced a significant evolution over the last quarter century as curricula required the addition of emerging technologies. The following terms are commonly used within the fields of CTE and STEM education.

1. **Career and Technical Education (CTE):** For the purpose of this study CTE has been defined as a school, institution, or educational program that specialize in the skilled trades, applied sciences, modern technologies, and career preparation (CTERS User's Manual, 2016).

2. **Career Pathway:** For the purpose of this study a career pathway represents a common set of skills and knowledge, both academic and technical, necessary to pursue a full range of
career opportunities ranging from entry level to management, including technical and professional careers (CTERS User's Manual, 2016).

3. CTE Completer - For the purpose of this study CTE completers are those students who have met the requirements for a CTE concentration (sequence) and all requirements for high school graduation or an approved alternative education program (CTERS User's Manual, 2016).

4. College and career readiness: For the purpose of this study college and career ready students are those who have met the minimum academic readiness targets as demonstrated by the ACT College Readiness Benchmarks for grades 8-12 on the EXPLORE, PLAN, ACT and WorkKeys Assessment test and are more likely to be successful in post-secondary education and training that leads to a career (ACT, 2014).

5. Digital native: For the purpose of this study, digital natives are students who have been immersed in a world of technology and are comfortable with navigating and operating today’s gadgets (Miller & Martin, 2016).

6. Program of Study (POS): For the purpose of this study a POS is a coherent sequence of state-approved courses in career and technical education (CTERS User's Manual, 2016).

Summary

High school CTE programs of study that focus on career readiness have an impact on employability for jobs requiring STEM skills and training (Falco, 2016). The problem is that CTE programs have historically experienced a gender imbalance in STEM courses in general and technology-based courses in particular (Baruch, 2014; McLeod & Allard, 2013). This has largely been attributed to a lack of self-confidence, low career self-efficacy for STEM-related occupations, and lack of social support and encouragement to pursue STEM-related educational and career opportunities (Grossman & Porche, 2013; Shoffner et al., 2015).
The purpose of this phenomenological study was to describe the experience of female high school students who earned CTE completer status in a technology-based POS in Central Virginia. Current research quantitatively confirms that a gender imbalance exists in technology-based CTE programs as well as in careers that require STEM skills (Franklin, 2013; Grossman & Porche, 2013). Role-congruity theory suggests that men and women occupy social roles with attendant stereotypes and prescriptions (Eagly & Karau, 2002), and this contributes not only to the gender imbalance in technology-based programs of study, but also impacted how female students described their experiences. The experiences of these women should inform stakeholders as to potential environmental influences on female persistence in technology-based CTE programs (Lester et al.; Smith, 2017), and has pedagogical implications as well (Sassler et al., 2017; Smith, 2017).
CHAPTER TWO: LITERATURE REVIEW

Overview

The purpose of this chapter is to ground this phenomenological study in research and theory relevant to female participation in technology-based CTE programs of study, and related courses and career implications. Included in this comprehensive literature review on females in technology-based CTE programs of study are the benefits of CTE in general, trends in CTE and efforts to address gender imbalances in various programs of study, student’s perceptions of CTE in general, STEM training and career needs, and a thorough investigation of literature relevant to female participation in STEM CTE courses and careers. The literature review also covers information concerning the theoretical framework relevant to the phenomenon.

In conducting this literature review on the topic of female high school students who earned completer status in technology-based CTE POS, numerous studies address the following themes: (a) the benefits of CTE education for students interested in STEM careers, (b) the existence of a gender gap in technology-related CTE programs of study, and (c) quantitative studies regarding efforts that have been made to address this gender imbalance. However, I have been unable to locate studies of a qualitative nature about female CTE completer's opinions about their experiences in a technology-based POS. In support of this research gap, Carver et al. (2015) established the importance of considering the input of CTE completers in planning instruction for CTE programs of study and Sassler et al. (2017) pointed to a need to consider the input of females who have persisted in acquiring the training necessary to participate in the STEM workforce.

The CTE research studies to be reviewed in this chapter that are most relevant to the current study focus on strategies for increasing female participation in STEM CTE courses
(Wang & King, 2015) and quantitative research into career self-efficacy in general (Choi et al., 2012). Doctoral students examined the experiences of high school CTE graduates (Goins, 2015) and benefits of very specific CTE programs of study (Hendren, 2016), outcomes related to gender stereotyping in CTE (Fluhr, 2014), and School Counselors' Perceptions about Female Participation in Non-Traditional Secondary CTE Programs (Malik, 2005). Each of these studies contributes to the existing literature related to CTE characteristics and has established the foundation upon which this current study is based.

In this study, I will examine the experiences of female students who earned completer status in a technology-based CTE program of study. The theoretical framework of this study is based upon Badura's self-efficacy theory (2012), Eagly and Karau's role-congruity theory (2002), and Lent, Brown, and Hackett's social cognitive career theory (1994). By examining the shared experiences of female CTE completers in a technology-based POS, it is hoped that this study will contribute to a greater understanding of the characteristics common to women who persist in such a program of study as well as informing school counselors, administrators, and instructors on ways to address the challenges of female CTE recruitment, retention, and program completion.

**Theoretical Framework**

Learning is a process that requires stakeholders to develop strategies for overcoming a great many obstacles. While students with disabilities and gifted learners elicit the bulk of the attention that leads to specialized resource implementation, there are other challenges that educators and students face every day in working to ensure that every student is afforded an opportunity to work towards college and career-readiness. In this generation of high-stakes, standardized testing, subgroup is a buzzword that represents categories of students with varied
ethnicities or special needs in which low test score trends have been observed. However, within
the specialized curriculum areas of career and technical education the trends for low scoring and
program participation are often a function of family training and work history in many areas, and
gender in most areas. This study is guided by three theories relevant to why people choose
certain career paths, what intrinsic and extrinsic forces guide those decisions, and the motivation
a student might have to achieve, or feel they have something meaningful to contribute, within a
given field of study or in their future employment. These theories are Bandura’s self-efficacy
theory (2012), Eagly and Karau’s role congruity theory (2002), and Lent, Brown, and Hackett's
social cognitive career theory (1994).

**Self-Efficacy Theory**

Self-efficacy is one’s ability to succeed in specific situations or accomplish a task. Psychologist Albert Bandura, within the self-efficacy theoretical construct, suggests that a person’s self-efficacy can play a major role in how one approaches goals, tasks, and challenges (Bandura, 2012). Consequently, choices regarding behavior are shaped by the qualities of this intrinsic motivation and impact academic productivity. Thus, self-efficacy theory is important within the field of education in general, and critical within the area of career and technical education (CTE) due to the impact these choices might have on a student’s career training and readiness for employment.

Bandura (2012) identified four factors affecting self-efficacy. The first factor, experience or enactive attainment, relates to the importance of experiencing success within a given environment and how these experiences can raise one’s self-efficacy (Bandura, 2012). While CTE programs of the past, which were referred to in the previous generation as vocational centers, were typically populated by students who were not pursuing advanced diplomas or
formal college training, this is no longer the norm. In fact, the effectiveness of the hands-on nature of CTE training and problem-based learning (PBL) strategies which have been implemented into many CTE programs now generally map to entry-level industry training certifications and the opportunity to bypass or secure dual enrollment credits for first-year college courses (Tillman & Tillman, 2008). Such hands-on training can provide students with the opportunity to experience mastery of very specific skills that employers and advanced training programs expect participants to have when they hit the ground, providing an ideal climate for enactive attainment of skills.

The second factor, modeling or vicarious experience, has to do with seeing others succeeding at a given task (Bandura, 2012). Simply put, when we see someone succeeding, our own self-efficacy increases. Conversely, when we see people failing, our self-efficacy decreases. This effect can be amplified in situations in which we see ourselves as similar to the person modeling the behavior. A CTE program of study (POS) is intended to move students through training in which industry credentials can be earned that provide opportunities for entry-level career-preparedness, which is why instructors are typically selected from within the given industry for which the training is intended. While a greater percentage of females are interested in technology-based CTE courses, an increasing percentage of females are enrolling in college and university level STEM-based programs, and the percentage of female workers within the information technology field is growing (Lester, 2010), instructors for these courses are still predominately middle-age white males (Fluhr, Choi, Herd, Woo, & Alagaraja, 2017). This can make it complicated for female students who are enrolled in a technology-based program of study to identify with the individual responsible for modeling the required skills and industry competencies.
Next, social persuasion is a factor influencing self-efficacy (Bandura, 2012). Social persuasion generally manifests as direct encouragement or discouragement from another person. Discouragement is generally more effective at decreasing a person's self-efficacy than encouragement is at increasing it. Although hands-on learning environments abound within CTE communities, instructors are often hired from within the ranks of the professions and industries upon which the programs of study focus. As a result, these instructors are just beginners when it comes to the craft of teaching, developing units of instruction, and facilitating learning in such a way as to avoid reflecting traditional gender bias from within that profession or industry (Manley & Zinser, 2012). The discouragement a female student may feel because of such trends, combined with the lack of teacher training that can be observed within the ranks of CTE faculties, can contribute directly to a student’s self-efficacy. Program instructors selected from the within the ranks of experienced industry professionals are critical for the success of a CTE program of study, but they do tend to carry with them a legacy of gender-bias that can impact the classroom setting (Manley & Zinser, 2012).

Lastly, there is the consideration of how physiological factors affect self-efficacy (Bandura, 2012). People can exhibit physiological signs such as fatigue, aches and pains, and nausea in stressful environments. In educating adolescents and teens, teachers can often be challenged with just how to respond to physiological concerns within the classroom environment, relegating the handling of such behaviors to a school nurse or administrator. However, these factors can have a direct negative impact on self-efficacy (Bandura, 2012) and instructors are not always trained in methods for mitigating its impact on learning.

**Role-Congruity Theory**

Role-congruity theory proposes that a group will be positively evaluated when its
characteristics are recognized as aligning with that group's typical social roles (Eagly & Deikman, 2005). While focused primarily on females in leadership roles, this theory has applicability to female participation in technology-based CTE programs of study for two reasons. First, participants in a CTE POS are generally striving for early career training because they have goals which involve leadership within a given career or industry (Tillman & Tillman, 2008), and seek the opportunity to get a head start on those who wait until after high school or college to experience an immersive training environment. Also, the characteristics described by the role-congruity theory have a direct correlation that can be observed within the ranks of students who are receiving advanced training for industry credential certification. The theory suggests “a potential for prejudice exists when social perceivers hold a stereotype about a social group that is incongruent with the attributes that are thought to be required for success in certain classes of social roles” (Eagly & Karau, 2002, p.574).

Two forms of prejudice have been identified by role-congruity theory. The first has to do with women having less-favorable potential for success in an area that is more stereotypical for participation by men than women (Eagly & Karau, 2002). While stereotypes suggest that certain technology and technology-related activity is for men, research indicates that when a female's work (or play) involve technology use, women are just as likely as men to learn the most effective ways to apply given technologies within the appropriate settings (Thornham & McFarlane, 2011). For decades, students have progressed through a system that seems to define the male/female role stereotype, despite adoption of Title IX of the Education Amendments of 1972, which intended to address this very kind of discrimination. In CTE training programs for such careers as cosmetology and nursing, female enrollment has remained steadily high perhaps because these are fields that are predominantly staffed by women (Malik, 2005). However, the
perpetuation of gender-based social stereotyping speaks directly to the applicability of the foundational prejudice identified within role-congruity theory and the need for effective female role models in instructional and leadership positions within the career and technical education environment.

The other prejudice in role-congruity theory suggests that women might receive less favorable evaluations than men specifically because the behaviors that are indicative of success are less desirable in a woman than in a man (Eagly & Karau, 2002). In other words, role-congruity theory proposes that industry has taken the cliché that a maturing child ought to learn to “act their age” and adopts it within certain leadership environments to imply women ought to learn to “act their gender.” CTE student organizations are common within centers that focus on CTE training programs (Aragon, Alfeld, & Hansen, 2013), and these organizations seek to train participants within a POS to take their skills to the next level and strive towards developing both industry and leadership skills. There are no distinctions made within the context of leadership training for organizations such as SkillsUSA, Future Business Leaders of America (FBLA), or the Technology Student Association (TSA) that imply that skill and leadership development is a function of gender. Comparatively, role-congruity theory states “to the extent that women fulfill their roles in a particularly dominant, assertive, directive, or self-promoting style, they present greater deviation from the injunctive norms of the female gender role and would receive less positive reactions.” (Eagly & Karau, 2002).

Social Cognitive Career Theory

Social cognitive career theory (SCCT) incorporates elements of Bandura’s general social cognitive theory and combines it with such concepts as how interests, abilities, values, and environmental factors impact how a person goes about selecting and pursuing training for a
given career. Brown (1990) asked, “What are the relationships among values, needs, aptitudes, and interests as they operate in concert to influence occupational choice making” (p. 346)? SCCT was designed to answer such questions, offering a potentially unifying conceptual framework that might link these variables together. Therefore, SCCT highlights relevant experiential and learning processes, as well as ability-acquisition characteristics, and seeks to define the impact they might have on career development as a function of the bridge between self-efficacy beliefs, outcome expectations, and personal learning goals (Lent, Brown, & Hackett, 1994).

Self-efficacy beliefs impact SCCT due to four factors; personal performance accomplishments, vicarious experiences, social persuasion, and physiological and emotional states. Within the self-efficacy theoretical construct, Bandura (1012) suggested that a person’s self-efficacy can play a major role in how one approaches goals, tasks, and challenges. Consequently, the impetus for decision-making regarding behavior is shaped by the qualities of this intrinsic motivation and impact the academic productivity, which may in turn influence career decisions and skill development.

Outcome expectations are beliefs about the consequences or outcomes of performing certain activities. Bandura (1986) distinguished between the anticipation of physical, social, and self-evaluative outcomes. Each of these outcomes have the potential to impact career development. Physical expectations, such as the motivation for monetary compensation, is very distinct from social expectations, such as earning a given level of approval from family and peers. Nonetheless, it is the confluence of these and other outcome expectations such as the level of self-satisfaction one experiences within a given career or career-training environment, which can impact career decisions and career-related skill development positively or negatively (Lent,
Personal goals “play an important role in the self-regulation of behavior” (Lent, Brown, & Hackett, 1994, p.84). A person’s intention to follow a certain path, such as selecting a college major or pursuing a CTE POS, or to earn establish a given performance trend such as earning all A’s in a course or passing an industry credentialing examination, are what is referred to in SCCT as personal goals. People set goals that are consistent with how they perceive their own abilities and of the outcomes they expect from pursuing a course of action. Consequently, success or failure in reaching personal goals becomes important evidence for confirming one’s self-efficacy beliefs and outcome expectations.

**Related Literature**

This literature review examines the experiences of high school students who have participated in a CTE program of study through related literature identifying the benefits of CTE programs, trends in CTE education, student perceptions, and social perceptions of CTE education and female participation in a CTE program of study. Literature focusing on science, technology, engineering, and mathematics (STEM) training and career opportunities as well as establishing the gender imbalance in these opportunities will be examined in order to create a platform that acknowledges the inherent value of CTE education, and the challenges faced in providing equal opportunities for females to take advantage of the rigorous, hands-on nature of training programs which have been shown to contribute to the likelihood that participants will gain an edge when seeking to secure STEM career options and technology-based jobs in industry.

**CTE Trends**

As the world emerged from World War I, the industrial revolution of the late 18th century
began to once again pick up steam. The Smith-Hughes Act of 1917 recommended federal grants be distributed to states to promote vocational education, focusing on training vocational teachers to pass on skills learned from working in a variety of agricultural and industrial fields to the next generation (Prosser, 1918). When the industrial age gave way to the information age it required western culture to adapt to new technologies, vocational competencies, workplace readiness characteristics, and the resulting training needs. The Smith-Hughes Act of 1917 saw its federal grant programs perpetuated with the 1998 reauthorization of the 1984 Carl D. Perkins Vocational and Technical Education Act (Friedel, 2011).

The vocational centers of the 20th century gave way to Career and Technical Education centers in the 21st century, and curricula expanded to incorporate computer aided design, computer networking, advertising design, IT forensics, and a variety of other STEM-related content (Friedel, 2011). Additionally, existing programs in auto servicing, building trades, cosmetology, and nursing were forced to adapt to accommodate instruction related to emerging technologies in traditional programs of study. Because of the inherent hands-on nature of CTE instruction, employers and stakeholders in advanced training programs at community and four-year institutions were not only encouraged to observe these trends but sought to confirm that the benefits of vocational education translated to similar benefits in the burgeoning CTE-era of program development.

Research results have been promising. Students who participated in capstone CTE programs of study score significantly higher on summative assessments within their respective fields, and advanced training credential exam scores also reflect the benefit of having completed a CTE program of study prior to entering a two or four-year advanced training program (Richard, Walter, & Yoder, 2013; Wagner, Newman, & Javitz, 2016). Not only have employers, colleges,
and universities begun to fully embrace the benefits of CTE in terms of preparedness, but by 2017 states such as Virginia began to implement requirements for students to complete at least a single two-year elective program within a business or CTE cluster as part of the profile for earning a high school diploma (Love & Strimel, 2016).

Beyond general STEM-centric programs of study, many of the more specific technology-based curricula such as computer science, computer systems, computer networking, and computer programming have experienced a boost as well. In response to the growing emphasis on the critical need for more student exposure to programs of study within the computer science field and the increased national support for K-12 education in information technology, various states have allowed technology-based CTE coursework to be used to fulfill high school graduation requirements. The number of states allowing technology-based CTE coursework to fulfill high school graduation requirements has increased from 12 in 2012 to 33 in 2016 (Computer Science Education Coalition, 2016). In addition, states have begun to partner with computer science credentialing organizations to specifically align instructional competencies with content that can be found on both the written and practical examinations that map to industry certification (Love & Strimel, 2016).

The No Child Left Behind Act of 2001 was signed into law to ensure children in the United States receive quality education and learn the skills needed to be successful. CTE was never mentioned in the legislation, which led many to fear that CTE courses may be dropped from high school master schedules. Studies were commissioned by departments of education in multiple states to investigate the academic performance of CTE completers and non-CTE completers (Blowe & Price, 2012). The Commonwealth of Virginia performed internal research on the standards of learning English reading and mathematics assessments as well as cohort
graduation rates, aligning the results with graduate portraits that included CTE completer status. Findings indicated that statistically CTE completers had higher mathematics and Grade 11 English reading pass rates as well as higher cohort graduation rates than those of non-CTE completers (Blowe & Price, 2012).

While the Elementary and Secondary Education Act of 1965 (ESEA) had a significant impact on K-12 education in the United States, enhancing federal funding, ESEA has shifted over more than 50, most recently with the Every Student Succeeds Act (ESSA) in 2015. In contrast to its predecessor, the No Child Left Behind Act (NCLB) of 2001, ESSA is noted for shifting authority for assessment and curriculum development from the federal government back to the states. College and career-readiness is one of the driving components of ESSA (Darling-Hammond, Wilhoit, & Pittenger, 2014), and career-readiness has long been a foundational element of CTE.

CTE programs often lead to an industry-recognized credential, postsecondary certificate, and/or degree, and include college-credit dual enrollment opportunities. The 2006 reauthorization of the Carl D. Perkins Vocational and Technical Education Act (Perkins IV) funds programs of study that provide enhanced career preparation and postsecondary access (Bragg, 2012).

However, by 2010 it was becoming apparent that in the United States very few students, and especially underrepresented students, were pursuing STEM educational and occupational goals (Falco, 2016). This underscored the need for school counselors to maximize opportunities for student success in STEM. Seeing the writing on the wall, and in an acknowledgement of the increasing concern that the demand for STEM workers in the United States would exceed the supply, there has been a radical evolution in the approach school counselors, and counseling
programs, have taken in starting to move students into the ranks of CTE participation (Falco, 2016).

There is evidence that those involved in program-development for CTE have been ahead of the curve in terms of establishing an infrastructure for STEM-career preparedness. Be that as it may, some concerning trends in terms of participation have been revealed as well. Based on an analysis of the 1997 National Longitudinal Survey of Youth (NLSY) data set that examined high school graduates' occupational choices in 2006, findings reported by Fletcher (2012) indicated that CTE graduates were 2.7 times more likely to be employed in STEM fields, while college preparatory graduates were 1.8 times more likely to be employed in business, management, and administration occupations. In addition, gender was significantly related to all occupational choices. Implications of this study called for CTE teachers and leaders to find new strategies to attract more diverse students, particularly females and minorities, into programs that have predominately White and/or male (Fletcher, 2012).

To meet these demands and begin to address the concern over participation by under-represented groups, strategies have been adopted by administrators and those involved in program development to balance course rigor, program recruitment, and program retention. Schools have been encouraged to:

1) Assess whether coursework requirements are in fact a barrier to recruitment, particularly in hard-to-staff CTE subject areas.

2) Create paths to renewable certification for CTE teachers in fields that do not require a bachelor’s degree and establish strong connections to ongoing professional learning opportunities.

3) Assess whether existing certification requirements ensure that CTE instructors enter
the classroom with the skills they will need to be effective (Jacques & Potemski, 2014).

It is thought that implementation of such strategies, combined with improvements in instructor performance evaluations student growth measures, CTE programs will continue to show the way forward for general education programs which have mastered balancing student-group representation, but lack the skill transferability required to ensure that graduates are career and college ready (Jacques & Potemski, 2014).

Experiential learning strategies are not new to CTE programs (Smith, 2017). In fact, “experiential learning has been a major component of career and technical education for many years” (Clark, Threeton, & Ewing, 2010). This is a characteristic of CTE that makes programs so appealing not only for stakeholders in STEM-related industries, but indeed for students looking to gain the experience required to gain the knowledge, skills, and credentials required to enter the workforce.

**CTE Benefits**

CTE participation has been linked to improved post-high school employment outcomes, increased likelihood of full-time employment after high school, and enhanced opportunities for transition-planning and graduation rates for students with disabilities (Wagner et al., 2016). Students completing a high school CTE POS are more likely to persist in both two and four-year college programs related to their POS (Gottfried, Bozick, Rose, and Moore, 2013), and students who earn completer status in a CTE POS before entering the military are more likely to complete advanced individual training for military occupational specialties related to their POS (Pema & Mehay, 2012).

When considering the importance of increasing female participation in technology-based
programs of study, it is worth considering the kind of advantages that are realized by those who participate in CTE in general. With the focus on college and career readiness that is embedded in the 2010 ESSA revisions of the Elementary and Secondary Education Act of 1965 (Darling et al., 2014), just what evidence exists to indicate the benefits of CTE are legitimate? For students with learning disabilities, research has shown that there is indeed a link between taking high school CTE courses and securing post-high school employment (Wagner et al., 2016). General education students with CTE training are also more likely to not only secure post high-school employment, but also more likely to find full-time employment in fields related to their CTE POS (Kim & Passmore, 2016). Not only are these findings significant, but indeed female and racial minority students who participate in career and technical education leadership programs realize improved high school grades, psychosocial, and achievement outcomes (Aragon et al., 2013).

While career readiness and industry credentialing are hallmarks of CTE programs in general, not all CTE participants stop their career training after high school. Research indicates that students who pursue two and four-year college programs related to their CTE POS are more likely to persist in their college programs (Gottfried et al., 2013). Given that “recent and repeated calls for accountability have created an environment in which programs must not only educate students but also show some proof that the credentials students attain have worth beyond the classroom” (Matheny, Chan, and Wang, 2015), recent research has focused on this very issue. At least in industries related to manufacturing, there is a higher rate of program completers entering careers in the manufacturing industry after completing training programs than their counterparts who had no CTE training (Matheny, Chan, and Wang, 2015).

After high school, some CTE completers go directly into the labor market, some seek
additional training in two and four-year college programs, and some go on to contribute to the economy and our society through military enlistment. Research into the experiences of CTE participants who go from high school into the military show that the military occupation-specific training received in CTE reduces early turnover and improves long-run job stability for those who choose military jobs, “suggesting that an important effect of vocational training is to improve job match quality” for enlisted personnel who select military occupational specialties related to their CTE POS (Pema & Mehay, 2009).

High school students who pursue programs of study leading to industry credentials in career and technical education realize benefits whether they go directly into the workplace, enlist in military service, or seek additional training at institutions of higher learning. There are benefits for students with learning disabilities, for racial minorities, and for females who persist in a CTE program of study. Consequently, colleges and universities, the military, and various labor and industry markets all benefit from programs that provide CTE training to high school students.

**Science, Technology, Engineering, and Mathematics Training Needs**

Given the benefits realized by students who participate in career and technical education programs of study in general regarding career-readiness, it is worth examining what STEM-based industry representatives identify as the training needs and characteristics that are sought by employers. It has become more the norm to find industry representatives sitting on curriculum-writing teams which establish competencies for CTE training programs (VERSO, n.d.). Beyond the core skills students learn in math, science, history, and language arts employers have a need for candidates who possess not only industry-specific skillsets that are available in CTE training programs, but also the soft skills which are some of the most unique attributes inherent in CTE
Competencies (Falco, 2016). These soft skills include customer service skills, interpersonal and business communication abilities, problem-solving and critical thinking, teamwork, and workplace discipline which can enable or interfere with success on the job (ACT, 2017). When females and racial minorities are under-represented in the career and technical education environment, missing out on these soft skills is yet another indicator of the importance of balanced enrollment in CTE programs of study.

Employers indicate a need for candidates that have training in not merely mathematical processes but applied mathematics. CTE programs embed learning experiences which promote critical thinking, mathematical reasoning, and problem-solving techniques for situations that occur in the workplace (ACT, 2017). The ability to read and interpret charts, graphs, diagrams, and floorplans is called graphic literacy. Such skills are not only necessary to hit the ground running in the workplace but are also part of a sound CTE program of study (Doyle, 2012). Employers are looking for applicants that can deal with workplace documents such as memos, letters, and professional email etiquette. Workers who are able to follow written directions, signs, and notices are highly valued. The modern IT workplace requires that employees follow procedural bulletins, written policy manuals, and job regulations in order to comply with standards set forth by the Occupational Safety and Health Administration. Similarly, agencies such as the Institute of Electrical and Electronics Engineers are involved in setting IT standards for network and data security, with which even entry level IT workers must comply (ACT, 2017).

Experience with applied technologies involving electricity, mechanics, fluid dynamics, and thermodynamics are other areas of importance that are both sought after and included in CTE programs including computer aided design, computer systems, automotive mechanics,
construction trades, heating/ventilation/air-conditioning and refrigeration, metal trades, and robotics (Gammill, 2015). CTE programs also provide practice in business writing, such as documenting troubleshooting analyses on work orders and workplace observations. This includes the development of skills involving observing, following, understanding, evaluating, and documenting processes, demonstrations, and other critical workplace procedures (ACT, 2017; Gammill, 2015).

Yet another element of workplace readiness that is often overlooked in typical career-planning strategies but is inherent in the CTE training environment and very much sought by potential employers is the concept of occupational fit (ACT, 2017). A student who has spent two to three years learning the foundations for and practicing a trade in a hands-on environment that involves critical thinking, problem-solving, and applied hard and soft skill development specific to a given trade or industry will necessarily have some idea as to whether that trade is a fit for their interests and abilities. Students who are locked out of the opportunity to practice applied skills risk finding themselves in a cycle of learning the hard way, starting from scratch, and potentially being underemployed or overwhelmed in careers that are a poor fit for their particular skillsets.

“Adolescence is a critical time during development when students are exploring and acquiring academic and career-related interests as well as attitudes and self-beliefs related to their competence in different domains” (Falco, 2016), and middle school is typically the time when most students begin to express interest in STEM careers and courses (Grossman & Porche, 2013). By the time a student enters high school some of the most significant changes in motivation, self-concept, self-efficacy, and achievement have already occurred (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). This is the time to tap into the enthusiasm for learning a skill
that is expressed by students of all ethnic backgrounds and genders. Employers are on the hunt for applicants who have had the opportunity to gain industry hard and soft skills, and a venue already exists within the career and technical education environment to address these specific skill development needs.

**CTE Career Clusters and Pathways**

Career and technical education programs of study offer some significant benefits in terms of college and career-readiness (Kim & Passmore, 2016). Many of the skills and characteristics employers are looking for in job candidates line up well with the advantages afforded students who have CTE training in their background (ACT, 2017; Doyle, 2012; Gammill, 2015). Current research has confirmed that a gender and racial imbalance exists in secondary STEM and CTE enrollment (Aragon, Alfeld, & Hansen, 2013). While this may precipitate an imbalance in females and racial minorities having access to technology-based and STEM-centric careers, what kind of opportunities are not being made available to members of these subgroups given the current trends in enrollment and program persistence?

In Virginia, CTE focuses on programs of study that are grouped into career clusters intended to establish a variety of career pathways. The clusters in Virginia align with those set forth by the National Association of State Directors of Career and Technical Education Consortium (NASDCTEc), and there are 16 recognized career clusters accounted for in the Virginia CTE competencies (NASDCTEc, n.d.), including:

- Agriculture, Food, and Natural Resources
- Architecture and Construction
- Arts, A/V Technology, and Communications
- Business Management and Administration
• Education and Training
• Finance
• Government and Public Administration
• Health Science
• Hospitality and Tourism
• Human Services
• Information Technology
• Law, Public Safety, Corrections, and Security
• Manufacturing
• Marketing
• Science, Technology, Engineering, and Mathematics
• Transportation, Distribution, and Logistics

Since all careers a student might pursue fall within one of the career clusters, the pathways help to bring focus to an individual’s career path and future career goals, and while STEM-relevant elements can be read into all of Virginia’s CTE clusters, only a few fall into what the Virginia Department of Education identifies as STEM-centric (VERSO, n.d.). These include:

• Arts, A/V Technology, and Communications
• Information Technology
• Science, Technology, Engineering, and Mathematics

Students who intend to pursue training in any of the career clusters recognized by NASDCTEc may choose to enroll in an orientation-style course that samples and assortment of
specific training strands within a given cluster (VERSO, n.d.). For instance, a student may be interested in Information Technology, but not be certain about what specific training program to pursue in a multi-year series of courses intended to allow a student to earn completer status. In that case, program participants may take an orientation/exploratory course that includes Computer Systems Fundamentals, Cybersecurity Fundamentals, Computer Networking Hardware Operations, and Digital Input Technologies (Verso, n.d.), each accounting for one-fourth of an academic year. After having the opportunity to explore some of the varied offerings that may exist at a given CTE Center or high school, participants will then select one of the cluster paths to follow for a two or three-year training program in their local CTE center or high school.

This process allows students to address the issue of occupational fit (ACT, 2017), and identify a career training program that aligns with an area of interest and aptitude. Students may make their decision based on the level of enjoyment they experience within a given strand of fundamentals-level orientation training or may make a decision based on the earnings benefits that are perceived within a given area of training (Melguizo & Wolniak, 2012). Regardless of the reasons a program candidate may have for pursuing a given career path, the cluster design of the CTE environment provides a host of options for students to consider when choosing a path to follow for career training, and the options are all intended to be experienced within a rich, hands-on learning environment that provides students exposure to the following twelve Career-Ready Practices (NASDCTEc, n.d.):

- Act as a responsible and contributing citizen and employee
- Apply appropriate academic and technical skills
- Attend to personal health and financial well-being
• Communicate clearly, effectively and with reason
• Consider the environmental, social and economic impacts of decisions
• Demonstrate creativity and innovation
• Employ valid and reliable research strategies
• Utilize critical thinking to make sense of problems and persevere in solving them
• Model integrity, ethical leadership and effective management
• Plan education and career path aligned to personal goals
• Use technology to enhance productivity
• Work productively in teams while using cultural/global competence

Each of these practices align with qualities and characteristics that have been communicated to the National Association of State Directors of Career and Technical Education Consortium by representatives of trade and industry in each of the 16 career clusters identified by the Virginia Department of Education (NASDCTEc, n.d.). Addressing the process of selecting a program of study that aligns with a candidate’s interest in a given program of study, Spielmaker (2013) declares “career choices affect our personal finances and our free time - greatly impacting and influencing how our life goals are achieved and the economic security of the state and nation” (p. 1). There is a variety of opportunities available to those who choose to pursue career training in a formal CTE POS, and these opportunities ought to be available to students on an equal basis regarding race, gender, and special needs.

**Impact of CTE on Secondary Education**

While career and technical education has been promoted as a means of improving the workplace preparedness for students with interests spanning a variety of career clusters, the hands-on nature of CTE has been observed to improve the learning experience for students in
secondary education who have not yet decided upon a career path (Wagner et al., 2016). This can include students with special needs (Wagner et al., 2016), those participating in programs for gifted learners (Muratori & Smith, 2015), and dual enrollment students with plans to pursue two or four-year college programs after completion of high school (Haag, 2015). In fact, the Virginia Department of Education, in 2017, included a requirement for completion of at least one sequential CTE program of study in their description for the portrait of a Virginia graduate (Verso, n.d.), as a means of ensuring that students are moving towards what the state describes as college and career readiness.

Wagner, Newman, and Javitz (2016) evaluated data from the national Longitudinal Transition Study – 2 (NLTS2) to study the impact of enrollment in a CTE program of study on the employment outcomes of students with learning disabilities (LD). The study acknowledges the importance of evaluating such effects due to goal driving education reform on many fronts that “every student graduates from high school well prepared for college and a career” (Wagner et al, 2016). Although the study revealed no specific benefits for LD students overall in terms of academic achievement, data did demonstrate a significant positive effect for participating in a concentration of occupationally specific CTE in the first two post-high school years. The background research for this study points to an article supporting the first National Assessment of Vocational Education (NAVE), a meta-analysis of which concluded that CTE participation increased the odds of non-college-bound students finishing high school by about 6% (Kulick, 1998). Additionally, Analyses of data from the National Longitudinal Survey of Youth 1997 found that students who completed three or more years of CTE courses had a 90% high school completion rate compared with 72% for high school students overall (Plank, DeLuca, & Estacion, 2008).
Data from studies such as these have led to the decision by many states to adopt graduation standards requiring participation in CTE programs that can help in the development of soft skills and industry-specific competencies prior to entering the work force or moving on to seek additional training at the college or university level (Bruns, Filmer, & Patrinos, 2011). However, the history of career and technical education dating back to the vocational center model of the twentieth century pointed to an emphasis on workplace preparedness for students who were not college bound, and that line of thinking not only impacted curriculum programming and enrollment because it “remained embedded in the culture of many secondary CTE centers” (Haag, 2015), but it informed the decision-making of school counselors and administrators as it related to program placement for special needs, general education, and college-bound students alike (Falco, 2016).

However, the implementation of STEM-centered programs of study into the CTE model of instructional clusters and ever-present need to incorporate 21st Century technology competencies across non-STEM CTE has changed the college and career readiness dynamics of CTE outcomes for students in dual-enrollment programs, resulting in the earning of college credit for completing certain CTE programs of study (Scheffel, McLemore, & Lowe, 2015). In the end, the goal of career and technical education is for program completers to be employable. Cai (2013) defined the concept and perception of employability as “a set of achievement skills, understandings, and personal attributes that lead to gainful employment, success in their chosen occupations which benefits themselves, the workforce, the community, and the economy” (p. 458). According to Jordan, Dechert, and Wainwright (2012), CTE instructors should work with students in “three key areas of development: technical skills, academic skills, and 21st century skills” (p. 10).
Traditionally, it was rare to find students in gifted and talented programs participating in CTE programs of study. The implementation of STEM-centered programs of study have had an impact on this population as well (Muratori & Smith, 2015). As CTE clusters have expanded to include audio visual technology and communications, information technology, and even evolved to include 21st Century technology training across non-STEM CTE clusters, an increase in CTE participation has been observed (Muratori & Smith, 2015). This, combined with the fact that states are changing their requirements for graduation to incorporate proof of college and career readiness training such as the completion of a CTE course sequence (Love & Strimel, 2016), has resulted in students working towards general studies as well as advanced diplomas being required to participate in some level of business or industry program of study (VERSO, n.d.).

**Student Perceptions of CTE**

As cited in the Carl D. Perkins Act of 2006, CTE is defined as organized educational activities that offer a sequence of courses that provides individuals with the academic and technical knowledge and skills they need to prepare for further education and for careers in current or emerging employment sectors. (U.S. Department of Education, 2007, sec. 3). Students participating in a CTE POS are provided the opportunity to graduate from high school with real-world skills, and in many cases official industry credentials. That can mean an opportunity to secure entry-level positions in the work force, be better prepared for more advanced training, and in some cases earn college credits for courses taken within their CTE strand (Van Noy, Trimble, Jenkins, Barnett, & Wachen, 2016).

There are elements beyond the opportunities afforded by program completion that are valued by the typical CTE participant. Students report that instructor support, the opportunity to participate in hands-on learning, peer interaction, and personal relevance to career goals are
some of the most significant factors that benefit them in the CTE learning environment (Carver & Kosloski, 2015). The fact that CTE instructors generally are hired from within the ranks of experienced industry professionals contributes to ability of the instructor to not only support student instructional requirements, but to do so from a perspective that can directly impact self-efficacy. Role models for participating in a given career are built into the CTE instructor hiring practices. Hands-on learning experiences that require students to problem solve and collaborate with peers help to make the learning experience come alive in ways that not only align with industry competencies, but also allow students to acquire relevant knowledge and skills that have meaningful transfer into future training and employment, which can be particularly beneficial for youth with disabilities (Wagner et al., 2016).

The authenticity of the CTE learning environment is one of the most significant characteristics that students report as being a benefit towards career readiness (Carver & Kosloski, 2015). Because curricula, instructional labs, teacher training, and program competencies in CTE programs of study have evolved over the years to align specifically with industry training and credentialing standards, they have become models for effective learning within general education programs of study as well (Mativo, Womble, & Jones, 2013). Findings in research about student perceptions in technology-based CTE programs suggest students valued their courses, benefitted from the hands-on nature of the CTE learning environment, planned to continue their education, made good grades, and had positive career expectations for jobs (Mativo et al., 2013).

**Social Perceptions of Females in CTE**

In a culture which has seen radical change in the definition of marriage, health care rights, executive authority from within what was intended to be a three-branch government that
honored the checks and balances of the others, changes in the perception of a sub-group’s place in a given field of employment is not uncommon. Society makes links between the essence of womanhood and trends in the work force, motherhood, and consumer participation, and these links can serve to either limit women to the positions they have traditionally held in the home and workplace, or they can serve to release women beyond the bounds of conservative norms from the past (Negra, 2009).

Beyond society in general, the guidance system in secondary education is bound to certain pre-conceptions about the proper courses for female and male program enrollment (Ceci, Williams, Sumner, & Defraine, 2011). In the CTE realm, male students are disproportionately enrolled in carpentry, masonry, and automotive courses and females are disproportionately enrolled in cosmetology, nursing, early childhood development, and dental assisting programs (Eardley & Manvell, 2006). There is potential for technology-based courses such as radio and television broadcasting, advertising design, computer assisted design, computer systems, and networking courses to stand in that gender gap, especially considering the interests exist in IT college programs and the IT workplace at more of a balance than what can be observed in secondary CTE programs.

Studies have indicated there is an interest on the part of females to participate in technology-based CTE programs at the secondary level (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Thornham & McFarlane, 2011), but that there is frustration at the hurdles that stand in their way (Wang & Degol, 2013). “As cultural, social, political and economic changes take place, the secondary or high school curriculum should reflect and respond to changing needs and aspirations of students” (Mativo, Womble, & Jones, 2013, p.103). The very fact that females are showing an interest in participating in these programs of study indicate it is incumbent upon
stakeholders in the field, from administrators and school counselors to curriculum developers and program instructors, to be responsive to these changing needs and aspirations. It is time to move beyond stereotypes that serve no purpose in advancing America’s standing in the global marketplace of products and ideas.

While the implementation of the STEM umbrella has allowed Title IX watchers to suggest that female participation in technology and the sciences has grown, female participation in very specific technology majors has been on the decrease for software development and systems engineering programs during the past decade (Fletcher, 2012). Part of this may have to do with inadequate high school and community college preparation, but there is also research to suggest that women have steered clear of certain segments of the IT field due to their own perceptions of the work environment or the job descriptions themselves (Harris, Cushman, Kruck, & Anderson, 2009). “These perceptions include the feeling that technology and computing are ‘nerdy,’ and a career in the IT field would mean sitting in front of computers all day with little social interaction” (Harris et al., 2009, p.23). Therefore, not only are decisions being made about female participation in technology-based training, IT college majors, and IT jobs because of outside influences with respect to societal perceptions, but internal influences as well regarding how women view certain training and work environments.

**Research Related to Female Technology Use**

Demiray (2010) performed a study of 1100 individuals (550 males and 550 females between the ages of 16 and 64) in which the participants completed a 25-question survey about their use and perceptions of information technology. Residents of Turkey, the questionnaire's participants all had cell phones. Many also owned multimedia devices, digital cameras, and desktop and laptop computers. No significant difference was found between male and female
ownership of technology products, according to the study. However, “women's computer use tended to be for communication (social networking, e-mail, chat), work purposes, research, surfing on the Net, and typing, while men used computers mostly for surfing on the Internet, communication (MSN, e-mail, chat), work purposes, playing computer games, and research” (Demiray, 2010, p.14). Although men and women may own and use technology at similar rates, the technology use itself varies along gender lines.

The author of the study concludes there is no difference between male and female possession of technology, but survey results show that 70% of the females own a personal computer compared to 80% of the males (Demiray, 2010). Likewise, 34% of female respondents owned a laptop, which was 13% less than the males (Demiray, 2010). Here again, ownership of technology and the types of devices and purposes seem to vary by gender. Discrepancies in ownership such as this would seem to indicate that there is a difference in technology possession and use between male and female populations.

Based upon data collected through interviews with adult women gamers in the United Kingdom, and female teenage participants in digital media workshops organized by the British Broadcasting Corporation, Thornham and McFarlane (2011) researched what it means to claim to be technologically competent in relation to gender. More intimate in its research design than Demiray's (2010) survey format, the researchers spent up to five days accumulating anecdotal evidence on each subject while observing and interviewing the gamers and workshop participants. The study concluded that women quickly move beyond the stereotype of the traditional feminine “position of incompetence cover story for not engaging technology” (Thornham & McFarlane, 2011, p.81) when they are embedded in a technology-rich environment such as that which one would expect to find in a hands-on, technology-based CTE
program. Challenging gender-based assumptions of technology competence would seem to be a matter of providing a broader range of opportunities for female participation in technology-rich learning environments.

While the article includes descriptions of the participants’ daily living habits and technology use, it also incorporates quotes from interviews to support its position. A rich picture of how technology is used in the daily professional and recreational lives of the female participants is presented when one reads anecdotal feedback from Chloe, an interview respondent, who holds a professional position as a computer programmer and enjoys gaming, and yet steers clear of Grand Theft Auto because "it's a boy thing' and therefore not for her" (Thornham & McFarlane, 2011, p.71). Such feedback is typical throughout the results presented in the study, indicating a wild mix between females in terms of affinity for technology as well as willingness to engage technology that has content which might speak to traditional issues of gender bias.

Stereotypes suggest that certain technology is for men, and this research indicates that when a female's work (or play) involve technology use, women are just as likely as men to learn the most effective ways to apply given technologies within the appropriate settings (Thornham & McFarlane, 2011). Most female participants also indicated a desire to problem-solve and troubleshoot technology by applying resources such as the utilization of online forums, message boards, and embedded technical support found in manuals and other documentation rather than merely consulting the nearest male to find a solution (Thornham & McFarlane, 2011). Therefore, the results of this study are revealing in terms of what can happen on the other side of securing increased female IT usage and engaging females in the nuts and bolts of a hands-on, technology-based CTE program.
Gender Imbalance

Low female enrollment in technology-based CTE courses continues to be a trend at the secondary level. In fact, females "continue to be a disadvantaged group compared to their male peers" (Aldridge & Goldman, 2007, p. 40) in developing various interests and areas of giftedness that have been identified in primary and elementary school. Although societal influences, such as preconceptions about gender roles within the CTE community, have an influence on program demographics, current trends appear to stand at odds with areas of interest and aptitude that are observed in the middle school female population (Franklin, 2013). In other words, females within this generation of digital natives are not only more comfortable with emerging technologies that drive institutions of industry, commerce, medicine, education, and even recreation than those from previous generations, but they are in fact seeking opportunities for technology-based training prior to commencing college studies and securing entry-level jobs within their chosen careers (Garcea et al, 2012).

According to Maslow’s hierarchy of needs, direction, intensity, and persistence are indicators of a properly motivated individual. Increasing female participation in technology-based CTE programs is a goal that is worthy of pursuit as far as industry is concerned only if the process produces motivated employees that are trained and capable of functioning in such a way as to improve performance (Bowen & Sadri, 2011). Therefore, increasing female participation in STEM-based training and careers ought not be an exercise merely in mathematics, but in efforts that will result in a value-added outcome for skill training as well as implementation within trade and industry.

If the key to being welcomed through the door of the IT workplace is motivation, and one of the indicators of motivation is “direction,” the females who have expressed an interest in
receiving training for careers in IT and have chosen this as their area of interest should be afforded at least the opportunity to enroll in the courses (Lin, Shih, & Lu, 2013). Such motivating factors are part of training that is experienced by school counselors, and so there would be buy-in right there if the female candidates can communicate the desire to be placed in such a program of study (Kim & Passmore, 2016). Again, this may require a targeted recruitment effort that involves class participants, instructors, and administrators capable of speaking to the merits of enrolling in CTE programs. Involving female stakeholders in this process can provide representation by individuals with whom female candidates are more likely to relate, addressing the issue of “modeling” that contributes to self-efficacy concerns (Bandura, 2012).

STEM-centric training programs and employers face a continuing crisis related to the lack of females pursuing and succeeding in the relevant fields. Companies may suffer due to reduced product quality, students suffer because educators have failed to adjust to diverse populations, and future generations suffer due to a lack of role models and continued challenges in the environment (Franklin, 2013). While females express interest and aptitude for IT careers in middle school, and university-level program completers in STEM-centric fields are nearly balanced in terms of gender, high school STEM courses and technology-based CTE programs still have a long way to go in addressing the established and continuing gender imbalance trends (Eardley & Manvell, 2006).

**Summary**

The purpose of utilizing a phenomenological research design is to study the experiences of female students of a technology-based CTE POS who earned completer status. In a field of training dominated by males, the characteristics necessary to persist in such a program are unique. This chapter investigates such characteristics as well as the benefits of CTE in general,
trends in CTE and efforts to address gender imbalances in various programs of study, students’ perceptions of CTE, STEM training and career needs, and present a thorough investigation of literature relevant to female participation in STEM CTE courses and careers.

The theoretical framework of self-efficacy theory and social cognitive career theory (SCCT) inform the arena of CTE. Self-efficacy speaks to one's ability to succeed in specific situations or accomplish a task, and SCCT deals with interest development, choice making, and performance. The theory of role-congruity, while typically applied to women in leadership roles, has been expanded upon by Deikman and Eagly (2000) to include elements of gender roles and their impact on female acceptance and performance in non-traditional environments such as STEM-centric CTE courses. To that end, this chapter reviewed the body of literature relating to this study.
CHAPTER THREE: METHODS

Overview

The purpose of this phenomenological study was to understand and describe the experiences of female students who earned completer status in a technology-based CTE program of study (POS) in Central Virginia. Through analysis of the participants’ responses related to their experiences, I was able to learn about the challenges they faced in their POS, the factors that influenced their decision to enroll in the POS, and what factors influenced their POS persistence. Phenomenological research seeks the meaning and essence of human experiences in ways that “are not approachable through quantitative approaches” (Moustakas, 1994, p. 21). This phenomenological study is important because it obtained information regarding the participants’ experiences while completing a technology-based POS.

In this chapter, I describe the study methods and research design that was used. Specifically, I collected data in the form of responses provided by female CTE students who participated in this study. Three instruments of inquiry were used to collect information to answer the four research questions that constituted the foundation for this study. Topics detailed in this chapter include: (a) design, (b) research questions, (c) setting, (d) participants, (e) procedures, (f) the researcher’s role, (g) data collection, (h) data analysis, (i) the trustworthiness of the study, (j) ethical considerations, and (k) the chapter summary.

Design

Qualitative research is a naturalistic inquiry involving the collection of data from individuals about their personal experience (Creswell, 2013; Moustakas, 1994; Patton, 1990). A qualitative approach is required to describe the shared, personal experiences of female students who have completed a technology-based POS in CTE. Moustakas (1994) explained that
phenomenological inquiry searches “for meanings and essences of experience rather than measurements and explanations” (p. 21). The data collected from individuals with a shared experience in their own environment allowed for a deeper understanding of their experience (Creswell, 2013; Moustakas, 1994; Patton, 1990). Since phenomenology allows the researcher to go beyond a mere description, this approach was chosen to provide the opportunity to make interpretations regarding the participants’ experiences regarding the phenomenon.

Phenomenological questioning regards “the data of experience as imperative” to understanding how people behave (Moustakas, 1994, p.21). Thus, to provide meaning from within the context of a deep, rich description of the participants’ shared experience (Moustakas, 1994; Patton, 1990), the research questions in this study address foundational aspects of the phenomena, informed by the theoretical framework. This researcher used a phenomenological approach to identify essential elements of the participants’ experiences with the phenomena, with questioning strategies that allowed participants to describe the details of their experience, and to reflect on the meaning and implications of their experience.

The transcendental approach describes the experiences and themes in such a way as to allow the bracketing of personal and professional biases (Creswell, 2013). A transcendental phenomenological approach (Moustakas, 1994), in which participants explain their experience from a first-person point of view to provide meaning to the experience, has been applied to this study. A qualitative, transcendental phenomenological research design was selected to allow the data and its interpretation to be based upon the participants’ first-person descriptions, while intentionally suspending this researcher’s personal prejudices.

**Research Questions**

The following questions will guide this study:
Central Research Question: How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS?

**Sub-Question 1:** How do participants describe the social environment as females participating in a technology-based POS?

**Sub-Question 2:** How do participants describe the learning environment as females participating in a technology-based POS?

**Sub-Question 3:** How do participants describe the education system’s support for their participation in a technology-based POS?

**Setting**

CTE Centers and embedded CTE courses within Central Virginia high schools, categorized by the Virginia Department of Education as the CTE Red Region, was the location in which this research has been performed. The Red Region, a pseudonym, is being selected as the research site because it has multiple centers and high schools with technology-based STEM programs of study typifying the national trend of low female enrollment.

Red Region is located in Central Virginia and is comprised of rural and suburban school districts with populations between 10,000 and 30,000. The CTE programs from which the participants were drawn have enrollments of approximately 500 to 1,500 and the technology-based POS courses generally have class sizes of 5 to 25. While females make up roughly 50% of the CTE program populations, less than 25% of technology-based POS students are female. The ethnic breakdowns of the school districts within Red Region vary significantly, but all students are in grades 9-12.

**Participants**

The participants for this study were drawn from a criterion sample (Patton, 1990) of
female, high school students who earned completer status in a technology-based POS at CTE Centers and high schools in Central Virginia, from the Virginia Department of Education CTE Red Region. A total of 12 female CTE completers participated in this study. Polkinghorne (2005) suggested “researchers interview from 5 to 15 individuals who have all experienced the phenomenon” (as cited by Creswell, 2013, p. 81), and Gay (1996) confirmed that a small sample can produce “in-depth understanding” (p. 213) in a qualitative study. Ary, Jacobs, Razavieh, and Sorensen (2006) advised that “qualitative researchers should select purposeful samples believed to be sufficient to provide maximum insight and understanding of what was being studied” (p. 472). Therefore, participants were selected purposefully with a specified criterion (Polkinghorne, 2005). Their selection was based on having earned completer status in a technology-based CTE POS in Central Virginia’s Red Region.

Criterion sampling “works well when all individuals studied represent people who have experienced the phenomenon” (Creswell, 2013, p.157), and a purposeful sample “can best inform the researcher about the research problem under investigation” (p.148). This criterion sample utilized the Virginia CTE follow-up survey site database to identify participants, as this database includes contact information as well as completer status and POS descriptions for all high school students who participated in a CTE POS in the state of Virginia. Technology-based CTE instructors assisted the researcher in recruiting participants in accordance with school division IRB stipulations. Participants that were selected completed their POS within the last three years to attempt to ensure that the experiences from their CTE courses were fresh in their mind. Upon securing contact with potential participants, an electronic survey was used to validate demographics and confirm criterion. The demographics survey asked candidates to identify their: (a) name, (b) gender, (c) age, (d) race or ethnicity, (e) occupation, (f) CTE
program of study, (g) whether completer status was earned, (h) degree/diploma earned, and (i) certifications held.

**Procedures**

Permission was obtained from the degree-granting institution prior to collecting data (Creswell, 2013). For this study, no research was performed without permission from the Institutional Review Board (IRB) at Liberty University. This step ensured that the study was: (a) developed and designed in an appropriate, acceptable method; (b) aligned with the university standards; and (c) conducted in an ethical manner.

After IRB approval, participants in the study were identified and contacted utilizing the https://ctefollowup.cooper.virginia.edu/ database. Participants were high school graduates or current students who earned completer status in a technology-based CTE POS in the last three years. The database identified included contact information such as phone numbers and email addresses. Because maintaining the database with accurate information was a challenge, and in order to comply with division IRB stipulations, I contacted 6 CTE instructors directly, as they had more accurate contact information for students, have records as to the completer status and POS concentration for former students, and have a rapport with the students that allowed for less awkward initial contact.

The CTE instructors contacted potential candidates via email or by phone to invite them to participate in face-to-face interviews, contribute to an online discussion board, and submit a brief photo essay. Subsequent contacts were initiated until the 12 participants were identified. A short survey was included to confirm demographics and criterion compliance. I interviewed only participants who earned completer status in technology-based programs of study in order to establish as consistent a pool as possible within the area of CTE STEM course experiences.
Creswell (2013) confirms that “is it essential that all participants have experience of the phenomenon being studied,” (p. 157) and therefore a narrow sampling strategy is appropriate. When conducting the face-to-face interviews, an audio recording device was used to capture conversations. I then transcribed the interviews to allow as high a level of familiarity with the participant responses as possible, and to ensure the essence of the interviews were captured. Subsequently, I developed codes and themes using the transcripts and the field notes taken during the interviews.

The online discussion board allowed female CTE completers to interact with the researcher and one another to answer questions about their experiences in technology-based CTE courses. Moustakas (1994) explains that the researcher and the participants of the research can be classified as co-researchers in a study. I developed discussion board questions that allowed for individual feedback and internal responses within the group. The responses from all participants were then copied into a database, and I developed codes and themes based upon the interactions, answers, and commentary from within the discussion board.

Lastly, participants submitted a photo essay of 12 images, with captions, that described their experience in the technology-based CTE POS. The photo essay was independently submitted by participants, and they were not able to view the submissions of the other participants. While viewing the photo essays I developed codes and themes based upon the content of the images and the participants’ captioned descriptions.

**The Researcher's Role**

As the primary research instrument in the study, I was responsible for (a) identifying sources as well as recording, collecting, and organizing data, (b) reducing data to focus on meaningful patterns and themes, and (c) utilizing multiple data collection methods to triangulate
and verify data. Per Moustakas (1994), in order to “set aside all preconceived experiences to best understand the experiences of the participants in the study” (p. 22), I identified and monitored my biases. Moustakas (1994) suggested establishing an epoche, during which time the researcher determinedly employs strategies to identify and bracket their own presuppositions to avoid invalidating the research. As a CTE educator conducting qualitative research using a phenomenological approach, I attempted to identify the nature of reality in the shared experiences of the participants from multiple points of view, while acknowledging and bracketing out my own presuppositions. Therefore, I engaged in a reflective process (Husserl, 1931) in which I created a table of interview questions and listed my presuppositions regarding each one. I also maintained a reflective journal after each interview and session, reviewing interview and discussion board content to bracket out (Moustakas, 1994) my own suppositions and objectively examine the experiences of the participants.

I am currently employed as a computer systems technology teacher at a career and technical center in Central Virginia. I have been a teacher for 28 years, including five years at the elementary level (all subjects), eight years at the middle school level (primarily science), four years as a technology resource teacher (training and supporting other teachers), and 11 years at the high school level (teaching computer systems technology). I have a bachelor’s degree in Elementary Education, a master’s degree in Christian Leadership, an Educational Specialist degree in Curriculum & Instruction, and I am pursuing an Educational Doctorate degree in Curriculum & Instruction. Additionally, I have served as an athletic director, a coach, a department chair, and have taught a variety of courses online.

At one time I owned my own technology consulting business, focusing on network design, deployment, and troubleshooting. I did not hire employees, but rather worked as a free-
lance network and technology consultant. In this capacity, I advised small businesses, large companies, major corporations, state and national educational agencies, and local school districts in various IT capacities.

Moustakas (1994) refers to the term epoche to describe a situation in which the researcher consciously suppresses his or her own thoughts, experiences, and perceptions regarding the phenomenon being studied. Tufford and Newman (2010) emphasize that researchers must bracket their preconceptions, explaining that “one method of bracketing can take the form of writing memos throughout the data collection and analysis as a means of examining and reflecting upon the engagement of the data” (p. 86). Given that I have spent my career teaching students in the area of STEM at all grade levels, I needed to bracket my own ideas, impressions, and perceptions prior to and after facilitating the interviews and discussion board forums.

I used the four-step bracketing method described by Chan, Fung, and Chien (2013) to: (a) put aside all personal knowledge and impressions throughout the entire process, (b) use the literature review to set the guidelines of this study in order to gain a better understanding of the research questions that drive the study, (c) develop a predetermined set of questions for the face-to-face interviews, and (d) use the verbatim narratives from the literal transcripts of in-depth interviews as a guide for the data analysis, in order to enhance the trustworthiness of the study. As the researcher, it was my responsibility to remove my expectations of and assumptions about the participants’ responses and conduct the analyses according to the themes and codes that emerge from the transcribed data collected from the interviews, discussion board responses, and photo essay content.

**Data Collection**

In this study, I sought to learn about the experiences of female students who earned
completer status in a technology-based CTE POS. Data collection followed upon the inquiry process described by Moustakas (1994, pp. 103-104) and included data gathered and evaluated from: (a) individual face-to-face interviews, (b) an online discussion board, and (c) photo essays submitted by the participants. The data collected during the interviews was used to improve upon and expand the inquiry process of the discussion board contributions to formulate a composite textural description (Moustakas, 1994), and the photo essays were used to triangulate the study data (Creswell, 2013). Triangulation of a study requires the use of multiple sources, methods, and theories to corroborate the evidence (Creswell, 2013), to increase validity of the findings and the likelihood that the phenomenon is described from various points of view (Ary et al., 2006).

**Interviews**

The interview process was designed to gain a deeper understanding of the experience (Van Manen, 1990). Individual, face-to-face interviews with 12 participants were conducted in a location of the participant’s choosing, such as a coffee house or café local to the participant. Some participants chose to conduct the interview at their school. While the interviews followed the interview guide’s pre-established questions, follow-up questions were inserted according to the unique direction of each interview. According to Polkinghorne (2005), “access to one’s experiences is not straightforward; it often requires assistance and probing to discover and explore areas of the experience that did not emerge initially” (p. 143). Therefore, the questions were designed to first build a level of rapport with the participants (Siedman, 2013), to probe the participants’ social and educational perceptions, and establish the context of the participants’ worldview.

**Interview Questions:**

1. Tell me about yourself – where you are from, where you’ve been.
Prompts if needed:

a. How would you describe the community/neighborhood where you grew up?

b. Where do you live now? Where have you lived in between? Describe those places.

2. Tell me about your educational history.

a. Where did you go to school?

b. What was high school like?

c. What kind of activities were you involved in during high school?

3. What are your first memories of using technology?

4. Think back over all the years that you have participated in technology use, and describe your fondest memory. (The most enjoyable memory.)

5. How often and when do you use technology during a typical day?

6. What was your CTE Center experience like when you first arrived?

a. Describe any visits you made to the CTE center before classes began.

b. What was your first impression?

c. Who were your friends? When and how did you make friends?

d. What was it like to navigate this new environment?

7. How did you feel about being there?

a. About being in a CTE Center in general?

b. About being away from your home school for a portion of the school day?

c. About the experience of traveling to and from the CTE Center from your home school?

8. How would you describe your high school experiences outside of Career and Technical Education?
a. Describe your participation in any extracurricular activities.

b. Tell me about your experiences with these groups and/or organizations.

9. How would you describe your experiences within the CTE program?

10. What motivated you to participate in your selected CTE Program of Study?

11. What specific guidance were you provided prior to and during high school?

12. What activities did you participate in prior to and during high school that encouraged you to select your chosen program of study?

13. Which courses did you find the most challenging in your program of study?

14. How would you describe the importance of your participation in a CTE program of study on your career plans?

15. Who do you believe technology-based CTE courses are designed to serve?

16. How would you describe the importance of CTE programs in secondary education?

17. How did concentrating in a technology-based program of study better prepare you for your college and career goals?

18. Why do you think so few female students participate a technology-based program of study?

19. What could be done to alter that decision for others?

20. Considering your academic and career history, how would you compare the CTE environment to the environment in which you took your core curriculum classes such as math or language arts?

21. How would you describe the challenges you faced in your CTE program of study?

22. What is your proudest and/or most defining moment in your CTE experience?

23. What did you do after high school?
a. Describe how prepared you felt to take that next step?

b. What types of formal/informal networks were made available to you post-graduation?

24. How much of the success you have had in your current job (or education program, if still in college) would contribute to your CTE POS experience?

25. What else do you wish to share about your experience in CTE?

Per Seidman (2013), the questions were designed to establish the context of the participants’ experiences, then to allow participants to describe the details of their experience, and finally to reflect on the meaning and implications of their experience. The structure of this set of questions was designed to address the study’s central research question and sub-questions. Questions one through three are knowledge questions and were intended to be relatively straightforward and non-threatening and served to help develop rapport between the participant and me (Patton, 2015).

Questions three through 10 focus on how participants described the social environment and participants’ worldview. Self-efficacy is often tied to the assumptions a student makes about a training program or career choice as a function of their worldview (Bandura, 2012). When deciding on course selections in CTE Programs, Alfeid and Bhattacharya (2013) found parents and friends provided advice to students, and a student’s worldviews on social norms are formed and justified by these individuals (Manley & Zinser, 2012).

Questions 11 through 19 focus on how participants described the learning environment. Participants of CTE programs are often more engaged in school (Alfeid & Bhattacharya, 2013). The answers to these questions provided insight into the level of student engagement and helped to shed light on whether student perceptions varied from those described in CTE literature as a
function of gender. Brown (1990) asked, “What are the relationships among values, needs, aptitudes, and interests as they operate in concert to influence occupational choice making?” Social cognitive career theory (Lent, Brown, & Hackett, 1994) suggests self-efficacy beliefs impact occupational choice-making due to four factors: personal performance accomplishments, vicarious experiences, social persuasion, and physiological and emotional states. Within the self-efficacy theoretical construct, Bandura (1012) explained that a person’s self-efficacy can play a major role in how one approaches goals, tasks, and challenges. The relationship between a student’s perceptions of the learning environment and self-efficacy were significant when it came to answering this research sub-question.

The remaining questions address how participants described the education system’s support for their participation. Beyond society in general, the guidance system in secondary education is bound to certain pre-conceptions about the proper courses for female and male program enrollment (Ceci, Williams, Sumner, & Defraine, 2011). In the CTE realm, male students are disproportionately enrolled in carpentry, masonry, and automotive courses and females are disproportionately enrolled in cosmetology, nursing, early childhood development, and dental assisting programs. If the key to being welcomed through the door of the IT workplace is motivation, and one of the indicators of motivation is direction, the females who have expressed an interest in receiving training for careers in IT and have chosen this as their area of interest should be afforded adequate support from the guidance and instructional mechanisms in place within the CTE training environment (Lin, Shih, & Lu, 2013).

**Electronic Discussion Board**

Further, more reflective interviews took place within an electronic discussion board that allowed all participants to reply to the prompts without the researcher present, observe the
responses of other participants, and reply to those responses. All interview participants were asked to contribute to the reflective discussion board follow-up, which was brought online within two weeks of the conclusion of the first face-to-face interviews. The participants were advised that a random drawing for one fifty dollar Amazon Gift Card would take place at the end of the discussion board interaction, and all who contribute to prompts within the three board forums and submit a photo essay would qualify for the drawing. This electronic discussion board allowed me to collect a wide range of descriptions from participants about their shared experience in a short period of time, with inherent data accuracy built into the “continuously recorded” nature of the online discussion board environment. This allowed the research to comply with Gay’s (1996) suggestion that a small sample that is representative of the study phenomenon can provide a deep understanding. All communication took place via electronic discussion board query and response. This was partly intended to mitigate the impact of nonverbal decoding inaccuracies on the part of a novice researcher, particularly as these influences can be amplified in gender studies (Stewart & Shamdasani, 1990). Within each forum, participants were asked to consider and respond to all questions.

**Discussion Board Questions:**

**Forum I: Technology Use**

1. What are your first memories of using technology?

2. Think back over all the years that you have participated in technology use, and describe your fondest memory. (The most enjoyable memory.)

3. How often and when do you use technology during a typical day?

**Forum II: Experiences within a technology-based CTE program of study**

1. Describe, in detail, your overall experience in a technology-based CTE program of
2. Share an anecdote about the most memorable positive experience you had in your CTE program of study.

3. Share an anecdote about the most memorable negative experience you had in your CTE program of study.

Forum III: Technology-based program of study influences

3. Describe what influenced you to participate in a technology-based program of study.

4. What would you recommend to positively influence activities aimed at increasing female participation in a CTE POS? Why?

Per Seidman (2013), the questions were designed to establish the context of the participants’ experiences, to allow participants to describe the details of their experience, and finally to reflect on the meaning and implications of their experience. The structure of this set of questions was designed to address the study’s central research question and sub-questions.

Forum I questions are reflective questions and were intended to allow the participants to focus on the general subject of technology use from their unique personal experience (Patton, 2015).

Forum II questions focused on how participants describe the learning environment. Moustakas (1994) and Patton (1990) emphasize the importance of collecting data that allows the research to provide meaning within the context of a deep, rich description of the participants’ shared experiences. The answers to the questions in Forum II provided insight into the lived experiences of the participants and allowed the participants to provide a rich description of both a significant positive and negative event in their CTE POS.

The questions in Forum III focused on the participants’ motivation for participating in a technology-based CTE program of study and helped shed light on whether student perceptions
vary from those described in CTE literature, potentially as a function of gender. Social cognitive career theory (Lent, Brown, & Hackett, 1994) suggests self-efficacy beliefs impact occupational choice-making due to four factors: personal performance accomplishments, vicarious experiences, social persuasion, and physiological and emotional states. The relationship between a student’s perceptions of the learning environment and self-efficacy were significant (Bandura, 2012) in answering this research questions.

**Photo Essay**

Contributors to the discussion board were asked to create a 12-slide PowerPoint to describe their experience as a female in a technology-based CTE program of study and submit the file to the researcher via email. Submissions included a caption with each image to describe, explain, or provide dialogue and context for each slide. Given Patton’s (1990) emphasis that the purpose of qualitative interviewing is to understand how the participants “view the program and to capture the complexities of their individual perceptions and experiences” (p.290), a photo essay allowed the participants a visually-inspired means by which to describe and explain what it was like to learn within their CTE program of study. The instructions for what to include in the slide content will be as follows:

1. Slides 1-3 will contain pictures or images that represent your perception of the IT industry.
2. Slides 4-6 will contain pictures or images that represent your perception of the social environment in the CTE classroom.
3. Slides 7-9 will contain pictures or images that represent your perception of the educational environment in the CTE classroom.
4. Slides 10-12 will contain pictures or images that represent your perception of the
support structure you experienced during and after participating in your CTE POS.

Participants will not be able to see one another’s submissions, nor reply or comment. This will be perhaps the most significant means of providing an avenue through which participants can respond to an open-ended approach to inquiry, allowing the research to reflect a deeper understanding of the participants’ lived experience (Creswell, 2013).

**Data Analysis**

Data analysis procedures followed Moustakas’ (1994) recommendations for a transcendental phenomenological study. A central element of this method involves intentionality, requiring that “we be present to ourselves and to things in the world, that we recognize that self and world are inseparable components of meaning” (Moustakas, 1994, p. 28). Therefore, taking steps to ensure pre-suppositions on the part of the researcher are accounted for to minimize the impact of self in the data analysis is critical (Moustakas, 1994), the following procedures were used:

**Epoche/Bracketing**

To be clear about my experiences within the phenomenon and describe how my own experiences working in the CTE environment as an instructor in a technology-based program of study, I bracketed my experiences (Creswell, 2013) in order to attempt to set aside my own personal preconceptions. Guidelines for conducting a transcendental phenomenological study set by Moustakas (1994) were used for the collection and analysis of the interviews, discussion board, and photo essays. Moustakas identified the first step in the analysis of transcendental phenomenology data as epoche, and a bracketing process was implemented to set aside my personal, prior knowledge. For this step I engaged a reflective process (Husserl, 1931) in which I built a table of interview questions and discussion board prompts and listed my presuppositions...
regarding each one. I also maintained a reflective journal after each interview and session reviewing discussion board content to bracket out (Moustakas, 1994) my own suppositions and objectively examine the experiences of the participants.

**Horizontalization**

I utilized horizontalization practices (Creswell, 2013) by organizing the significant statements into segments of meaning and initially giving every significant statement equal value in considering its contribution to the overall description of the participants’ shared experience. Clusters of meaning emerged (Creswell, 2013), which establish preliminary themes. To eliminate overlapping of themes or repetitive statements the codes were clustered into meaning units and described texturally. Thus, to clarify trending data statements according to the “what” of the phenomenon, I wrote a description of the participants’ experience themes. Lastly, I looked for divergent perspectives and varying frames of reference about the phenomenon by writing a structural description of the emerging themes to clarify the “how” of the preliminary clusters of meaning (Moustakas, 1994). As per Moustakas (1994), the following overall method were employed:

1) I listed every expression relevant to the experience (Horizontalization)

2) I tested each expression thusly: (a) does it contain a moment of the experience that is a necessary and sufficient constituent for understanding it, and (b) is it possible to abstract and label it (This is the horizon).

3) I clustered the invariant constituents (meaning units) of the experience that were related into a thematic label. The resulting clustered and labeled constituents are the core themes of the experience.
4) I checked the invariant constituents and their accompanying themes against the complete record of the participants thusly: (a) are they expressed explicitly in the transcription, (b) are they compatible, if not explicitly expressed, and (c) if they are neither, they are not relevant to the experience and were deleted (reduction).

5) Using the relevant, validated themes, I constructed an individual structural description of the experience.

6) I then construct a textural-structural description of the meanings and essences of the experience, incorporating the invariant constituents and themes (Moustakas, 1994, pp. 120-121).

Moustakas references Casey (1977), who explains that within these steps the researcher “contemplates as many imagined objects or events as possible; existent or not” (Moustakas, 1994, p.99) relevant to the textural descriptions. Lastly, a process involving synthesis of meanings and essences was undertaken by the researcher to begin digging out what Keen (1984) refers to as the “final truth.”

**Thematic Portrayal**

The researcher then applied a process of reflection and imaginative variation in order to construct thematic portrayals of the participants’ experiences from the invariant constituents reflected within the images of the photo essays (Moustakas, 1994). As per Braun and Clark (2006), the following method for thematic analysis of the photo essays was employed:

1) **Familiarizing with data:** I watched and re-watch the PowerPoints, noting initial ideas.

2) **Generating initial codes:** I coded interesting features of the data systematically across the entire data set, collating data relevant to each code.

3) **Searching for themes:** I collated codes into potential themes, gathering all data
relevant to each potential theme.

4) Reviewing themes: I checked if the themes fit in relation to the coded extracts and the entire data set, generating a thematic map.

5) Defining and naming themes: Ongoing analysis for refining the specifics of each theme and the overall story that the analysis tells was be performed, generating clear definitions and names for each theme.

6) Producing the report: Selection of vivid, compelling extract examples, and final analysis of selected extracts were performed, relating the analysis back to the research questions and existing literature to produce a report of the thematic portrayal.

**Trustworthiness**

Trustworthiness and validity cannot be taken for granted (Ary et al., 2006), which is why the evidence was corroborated utilizing multiple methods of data collection. Mertens (1998) states that “authenticity refers to the presentation of a balanced view of all perspectives, values, and beliefs” (p. 184). Thus, Data analysis processes began with the bracketing of my own experiences to avoid significant influence from my internal presumptions. Further, the data analysis process involved multiple layers of statement analyses, theme clustering, and textural and structural description of statements to validate emerging trends within the data and phenomenological themes (Creswell, 2013).

**Credibility**

Bracketing, triangulation of data, member checking, and peer review methods were all employed in order to ensure credibility within the data collection and analysis process. To be clear about my experiences within the phenomenon and describe how working in the CTE environment as an instructor in a technology-based program of study may influence my data
analyses, I bracketed my experiences (Creswell, 2013) through an intentional reflection of my pre-suppositions about each interview question as well as maintaining a reflective journal. Creswell (2013) recommended triangulation because it is a “process that involves corroborating evidence from different sources” (p. 251). Gay (1996) and Patton (1990) explained that the use of multiple sources of data collection strengthens findings and generates a complete picture of the study. Triangulation for this study consisted of: (a) interviews, (b) a focus group, and (c) a photo essay.

**Dependability and Confirmability**

Member checking and external audits of the data via peer review helped to establish dependability of the data. This contributed to the trustworthiness of the study and ensured the necessary trust the participants must have in both the researcher and the research (Creswell, 2013). Member checking is a highly effective method to increase credibility of the data, because it allows the participants to continue to be involved as co-researchers, to correct errors in the text to be analyzed, and to guard against misrepresentation or misinterpretation by the researcher (Ary et al., 2006). Similarly, external audits and peer review moves beyond the involvement of those involved in the research who are closest to the process, providing an external check on the process to keep the researcher honest and “ask the hard questions about methods, meanings, and interpretations” (Creswell, 2013).

**Transferability**

Ary et al. (2006) explained that transferability is the degree to which findings of a study can be applied or generalized to other contexts or groups. The acquisition of rich and thick data ensures transferability (Creswell, 2013). Thick, rich descriptions of the data and making the survey and interview instruments available for peer review and the potential to replicate the
findings contribute to the transferability of the data. The similarity of the participants’ experiences as developed within the horizontalization and reduction processes helps to confirm transferability of the data as well (Moustakas, 1994).

**Ethical Considerations**

To protect the anonymity of the participants, pseudonyms were utilized for the site locations and the participants themselves. The computers on which the data is stored was password protected to ensure the security of the data. Patton (1990) advised that a complete ethical disclosure should be provided to each participant before the research study begins and that the researcher should express a willingness to share the results with the participants at the closure of the study. Therefore, all participants signed consent forms prior to participating in any phase of data collection and their contributions to the study were entirely voluntary. The consent forms were structured with simple, thorough language to make sure the participants understood the purpose of the research and the extent of their participation. Lastly, member checking and peer review as a means of external audit helped to ensure the accuracy of the data.

**Summary**

The purpose of this phenomenological study is to understand and describe the experiences of female students who earned completer status in a technology-based CTE POS. This effort to depict the lived experiences of a group (Van Manen, 1990) helps to understand the qualities and characteristics of females who persisted in their POS despite finding themselves in an arena of training for which a gender imbalance has been noted through previous quantitative research.

A triangulated approach to data collection was utilized to understand the participants’ shared experience. This approach consisted of confirming participant criterion and demographics
through use of a recruitment survey, conducting in-depth face-to-face interviews with 12 participants who fit the research criteria, and allowing discussion board participants to respond to discussion board prompts without any interaction or redirection by the researcher and communicate with one another within the interface. The descriptions from the discussion board were then enhanced and expanded through the sharing of a photo essay of their experience in order to help confirm emerging themes and establish a thick, rich pool of participant data (Creswell, 2013).

In this chapter, the setting and participants of the study were described. The study’s design and data collection methodology, along with data analysis processes, were presented. Additionally, the methods for establishing the trustworthiness and identification of ethical considerations were described in detail and these methods were aligned to accepted practices for conducting transcendental phenomenological research.
CHAPTER FOUR: FINDINGS

Overview

The purpose of this phenomenological study was to investigate how female high school students who earned Career and Technical Education (CTE) completer status in a technology-based program of study (POS) in Virginia described their experiences. Participants provided rich and descriptive data that described their perceptions of participating in a technology-based CTE POS. I used a transcendental phenomenological research design which involved the collection of information from all participants in a variety of technology-based programs of study to consider how the participants described their experiences as related to the phenomenon being studied. Data were reduced, categorized, coded, and analyzed following Moustakas’ (1994) steps.

The gap in the literature this research was designed to address was the lack of qualitative studies examining the experiences of female CTE students who have completed a technology-based CTE POS. Therefore, the focus of the research was to describe the characteristics of female students who persist in a technology-based POS while emphasizing their perceptions and experiences. This chapter presents the key findings from 12 in-depth interviews, a discussion board with 11 participants, and 8 photo essays. The research questions for this study were:

Central Research Question: How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS?

Sub-Question 1: How do participants describe the social environment as females participating in a technology-based POS?

Sub-Question 2: How do participants describe the learning environment as females participating in a technology-based POS?

Sub-Question 3: How do participants describe the education system’s support for their
participation in a technology-based POS?

**Participants**

A total of 12 females who earned completer status in a technology-based CTE program of study participated in this research. Polkinghorne (2005) suggested, “Researchers interview from 5 to 15 individuals who have all experienced the phenomenon” (as cited by Creswell, 2013, p. 81), and Gay (1996) confirmed that a small sample can produce “in-depth understanding” (p. 213) in a qualitative study. Included in this research were participants from six different high schools, who were instructed in a technology-based program of study by five different teachers, in four distinct programs of study identified by the Virginia Department of Education as eligible for both industry credentialing and completer status. Additionally, participants ranged in age and relation to the formal instruction itself by four years, from students who were in their final semester prior to high school graduation to students who had graduated from their program of study up to three years prior to participation in the study.

**Alice**

Alice (pseudonym) was a graduating senior at Blue High School (Pseudonym) in Central Virginia and attended the Blue Career and Technical Center (Pseudonym) for a two-year program of study focusing on radio and television broadcasting, in which she earned completer status. Alice was a very frank individual and was diagnosed as being on the autism spectrum for which she attended school programs designed to address her unique needs. She started the interview by mentioning that she had attended 18 different schools in central and northern Virginia. Alice was an active member of a variety of clubs throughout high school and mentioned these clubs and specific friends within the clubs multiple times. Alice does not intend to work in a field specifically related to her CTE program of study, and stated that she thought
CTE programs are “very useful as an edge tool and to let people realize whether or not they actually want to do it, but I haven't seen anyone actually go straight from the Blue CTE Center straight to actual work.” Alice mentioned the expense of the brand name equipment in her CTE classroom multiple times and described the editing work she does for part-time income as a “side hustle.” The high-income potential for STEM careers was a particular focus for her.

Katherine

Katherine (pseudonym) was a graduating senior at Orange High School (Pseudonym) in Central Virginia and had attended the Blue Career and Technical Center (Pseudonym) for a two-year program of study focusing on radio and television broadcasting, in which she earned completer status. She lived in the same suburban area all of her life, and was one of only two participants who did not comment about having taken any AP courses in high school, although she did say that she tried to take advanced courses whenever possible. Katherine was also one of only two participants who did not participate in many extracurricular activities, sports, or clubs, explaining:

During high school, I wasn't really in like school-oriented activities outside of school. I would make like videos and stuff. I used to have a YouTube channel. When I was younger, I would gather all my cousins around and we'd all make these like short films sort of things where we'd write it like 10 minutes before we started shooting it. And then I would go edit it and we'd have a showing for everyone in my family.

Katherine made it clear that she intentionally selected this program of study based on her passion for video and audio editing and that she planned to pursue more training in college in order to do similar work for a career. When asked to describe the importance of her participation in her CTE program of study to her college and career goals, she said “I think it's definitely just made my
plan solid. Like, now I know this is really what I want to do.” In fact, she was able to get a head start on putting what she learned in her CTE program of study into practice when she was asked to make a promotional video for a special event for her part-time employer.

**Betty**

Betty (pseudonym) graduated from Green High School (Pseudonym) in Central Virginia three years prior to the interview and was at the end of her third year at a four-year university. She earned completer status in a cybersecurity program that required the completion of a two-year sequence and took multiple Advanced Placement (AP) courses prior to graduating from high school. Although her instructor thought of Betty immediately as a candidate for this research, she certainly had the least amount of technology use in her background of all the participants. She explained that she had:

> A very different experience with technology just because I grew up in the Caribbean where we didn't really have a lot in general. We had a lot of water issues in St. Thomas, which is pretty poor, so we were dealing with water and the technology of how you get water versus computers.

She even explained that one of the motivating factors for her to choose a technology-based program of study was that her peers would tease her, good-naturedly, about her lack of computer knowledge. Betty was studying to become a doctor and had no plans to enter a field specific to the CTE course in which she earned her completer status, but stated that technology and computer use is a vital element in most current careers. While her CTE program experience was at her high school and not a Career and Technical Center, Betty did say that there were disproportionately more males in the class compared to any of her other classes. This caused her to question whether this was the right elective for her, but she stuck with it because she knew the
skills would help her in her chosen career.

**Chloe**

Chloe (pseudonym) graduated from Green High School (Pseudonym) in Central Virginia three years prior to the interview and was already able to complete her bachelor’s degree at a four-year university. At the time of the interview, she was working in a clerical office environment for her first job. She earned completer status in a cybersecurity program that required the completion of a two-year sequence. When asked to describe her first impression of the social environment in her technology-based CTE program of study she said “it's a boys club. Most of the classes I took were predominately young men. There's no diversity, of course. The school had no diversity within the STEM classes, mostly men and then no racial diversity.” Chloe took a lot of AP classes, which allowed her to finish her four-year degree in just two and a half years. She was highly motivated to succeed and had significant leadership roles in high school clubs and career and technical student organizations (CTSOs), such as Future Business Leaders of America (FBLA). When asked about her most enjoyable memory of using technology, Chloe explained that in the office where she worked she was more tech-savvy than her co-workers who were all older than forty “so they don't have a lot of technological expertise. It's not like I do anything totally crazy magic, I just go click something, it fixes the problem, and their mind is blown.”

**Jasmine**

Jasmine (pseudonym) was a graduating senior from Purple High School (Pseudonym) in Central Virginia. She earned completer status in a cybersecurity program that required the completion of a two-year sequence. Jasmine was a leader on her school’s golf team and was recruited to play golf at the university level, where she planned to major in computer science and
go on to work in the field of computer forensics. Her family lived in a rural area compared to the other participants, and she even commented that where she lives “you hear occasional gunshots because people are hunting.” She participated in her high school’s Girls Go Cyberstart program, which encouraged female students enrolled in technology-based CTE programs of study to display their skills in competitive settings that take place locally as well as on a state and national level. Jasmine is a very competitive and driven young woman, and stated that she is “ready for college,” and that “high school is stressful.” When pressed on this, she explained that she did not have a very close network of friends apart from the members of her golf team and the girls on the Go Cyberstart team. Indeed, multiple times during the interview she made comments about not having had many or any friends but did comment on how much she enjoyed the people with whom she competed in the Go Cyberstart team and the golf team. As was common among many of the participants, Jasmine was not able to point to any formal encouragement from guidance professionals within the school division in terms of selecting her program of study. When asked about what guidance she was given in choosing a technology-based program of study, she said “I don’t remember anyone like introducing me to that. I was just always into the forensics stuff. And then I was like, ‘I like computers.’”

Darwin

Darwin (pseudonym) graduated from Red High School (Pseudonym) in Central Virginia three years prior to the interview and was working on a bachelor’s degree in Biology at a four-year university, after which she hoped to become a veterinarian. She earned completer status in a drafting program that required the completion of a four-year sequence. Darwin took advanced placement courses throughout high school as a participant in Virginia’s Commonwealth Governor’s School program. As testament to her very focused approach to academics, when
asked about the challenges she faced in her technology-based CTE program of study, she said:

For me, it was really easy. I just found it really easy to navigate among work-minded people because it's an atmosphere that you know you're there to get work done. And so, you just sit down and work, and people will come up and ask you questions, and you go and ask them questions. It's a really easy collaboration experience for everyone in our program.

Darwin was very involved in dance throughout her childhood and through high school, which was very time-consuming, and yet she was able to excel in her academics and serve in leadership roles and as a model to others through her participation with SkillsUSA, which was her high school’s CTSO. Even when responding to questions that focused on the topic of low female enrollment in technology-based programs of study, Darwin’s answers always focused on the type of students who were likely to succeed and the importance of the instructor to student success, as well as the benefits of developing skills that are sought after in the work environment. To make some money while in college, she did part-time work in drafting but did not plan to pursue it as a career.

**Elouise**

Elouise (pseudonym) was a graduating senior at Red High School (Pseudonym) in Central Virginia and was planning to attend a four-year university. She earned completer status in a drafting program that required the completion of a four-year sequence. Elouise took advanced placement courses throughout high school as a participant in Virginia’s Commonwealth Governor’s School program. She participated in the school’s marching band and jazz ensemble and was active in her church’s youth group. Elouise earned multiple trips to compete at the national level in SkillsUSA for Additive Manufacturing (3D Printing), and spoke
a great deal about enjoying not just the challenge presented by problem-solving within the CTE classroom and the importance of having hands-on experiences but also was very fulfilled by the level of creativity required to tackle class projects. She got very excited when she would talk about how when different individuals or groups were assigned to design a building with some very specific features that “you have to be really creative with it and in the end no two people’s houses are exactly the same.” Elouise was planning to begin college in a general studies program but had no specific plan to work in the drafting or architecture field. Instead, she was interested in being trained to be a nurse. In the process of interviewing Elouise and reading her discussion board contributions, I found her responses to be very much focused on the relationships she had with family members who had taken the course before her and the friends she made while participating in the course and in SkillsUSA. Despite the challenges that she encountered in learning to use the technology and problem solve, she was especially proud of how she learned to work with her SkillsUSA event partner, emphasizing repeatedly how “we communicate well and we always have fun with each other.”

**Frankie**

Frankie (pseudonym) was a graduating senior at Red High School (pseudonym) in Central Virginia and was planning to attend a four-year university. She earned completer status in a drafting program that required the completion of a four-year sequence. Frankie attended a Montessori school through kindergarten and had been in public schools since. She took advanced placement courses throughout high school and participated in her school division’s gifted program from first grade on. She played soccer, was a part of the school’s marching band and Jazz club, was a member of the National Honor Society, and she and her partner, Elouise, represented her school at the national level in additive manufacturing through SkillsUSA.
Although she was not planning to pursue drafting or architecture as a career, stating instead that she was interested in law enforcement, Frankie commented more than once in the interview and discussion board about the benefit of having a class that allowed for hands-on involvement, and was “designed for people that are willing to work hard and who are interested in learning new technology and new ways of applying their knowledge from other previous classes, like math and science.” While she observed that more males took technology-based CTE programs of study than females, just as females tended to be more likely to take programs of study that followed traditional western gender roles, when asked if she thought anything could be done to change those trends, she said “I don't think so. I don’t think the CTE classes should be changed just to accommodate more women. I think the women taking STEM courses are trying to do what they want to do. They'll be more noticed.”

Gwen

Gwen (pseudonym) was a graduating senior at Green High School (Pseudonym) in Central Virginia and attended the Blue Career and Technical Center (Pseudonym) for a two-year program of study focusing on Mechanical and Architectural Drafting, in which she earned completer status. She is from Maryland, but lived with her mother, who was a teacher in the same school division she attended. Her father passed away when Gwen was in the ninth grade. Although she was officially enrolled at Blue High School, she attended the school division’s alternative school due to the depression and anxiety she experienced after her father’s death. She was on the honor roll during her Junior and Senior years and enrolled in multiple advanced placement classes in addition to her CTE program of study. Not only did she work part time as an assistant manager at a restaurant, but she also volunteered in a child support program for those with parents in hospice, explaining she did so “because I know when I was going through it, it
was hard for an adult to talk to me about it because, like they can't know how I feel if they’re forty or something.” The Career and Technical Center where she attended had extensive auto service and building trades programs, and in describing her first impression upon arriving for her program of study she stated that she “was nervous because of my social anxiety. And the first thing I noticed when I came here was a lot of redneck men.” Gwen was unique among the other participants in that she clarified she does not like social media. Her grandfather was an architectural engineer by trade, and she shared that “he was always mad because he had three girls. He never had any boys and back then, the guys do this kind of thing, when I told him I was interested in drafting, he was like, ‘Ah, finally!’”

**Heather**

Heather (pseudonym) was a graduating senior at Yellow High School (Pseudonym) in Central Virginia and attended the Blue Career and Technical Center (Pseudonym) for a two-year program of study focusing on Mechanical and Architectural Drafting, in which she earned completer status. She was in the school’s marching band all four years of high school and stated that most of her close friends were those she had known throughout high school and also participated in band. Heather mentioned that she had a leadership position in band, and that she also was on her school’s swim team. Heather was the only female in the class at the beginning of her first year, and when asked why she thought so few female students participated in technology-based programs of study she said “I don't know if a lot of females are interested in those types of things. I feel like that, and maybe it's just the stereotypical person would not be a female, so it deters them I guess.” As a confirmation that a passion for drafting and architecture played a role in her selecting to follow that path in CTE, Heather was one of only a few participants who planned to pursue an interior architecture or computer-aided design program at
the college level. These are programs that aligned with her CTE training and would allow her to get a head start as a result of the credential she earned in the course.

Isabella

Isabella (pseudonym) was a graduating senior at Blue High School (Pseudonym) in Central Virginia and attended the Blue Career and Technical Center (Pseudonym) for just one year. Yet, in that time she was able to finish a two-year program of study focusing on Mechanical and Architectural Drafting, in which she earned completer status. Isabella was enrolled in the division’s Commonwealth Governor’s School program during her freshman year but left the program after the first year, although she continued to excel in both honors and advanced placement courses. She was on the school soccer and swim team all four years of high school, and was in the National Honor Society, National Technical Honor Society, Math Honor Society, Science Honor Society, History Honor Society, and English Honor Society. While Isabella excelled in several pursuits both academically and in extracurricular activities, when asked to describe her fondest memory of technology use, she replied:

I'd probably say it had to be this year when I learned how to use AutoCAD because it's the first time I really felt like I'm good at something. I can really do this. I fit in here. I'm just a really good fit and I understood everything we were doing. I really enjoyed it. It's the first time I've actually been excited to do something on the computer.

She described herself as being very shy and introverted but was excited to share the extent to which she and the drafting instructor went in order to convince her mother to allow her to take the CTE program of study. The drafting instructor’s wife was Isabella’s teacher at Blue High School, and after meeting her at an open house, the drafting instructor recruited her to take the course and provided her the encouragement and resources to earn completer status and an
AutoCAD credential in just one year. Drafting and architecture were definitely a part of her college and career plans.

Lyra

Lyra (pseudonym) was a graduating senior at Orange High School (Pseudonym) in Central Virginia and attended the Blue Career and Technical Center (Pseudonym) for a two-year program of study focusing on Mechanical and Architectural Drafting, in which she earned completer status. She was born in Hawaii, and lived in Japan for seven years, in Texas, and Central Virginia, and explained the moving was due to being in a “military family.” Having spent most of her early school years in Japan, when she moved to the United States she took some English remediation courses in order to catch up on grammar, but was then enrolled in advanced and advanced placement courses throughout her high school years. Lyra played soccer for her school all four years, was in the school orchestra and spirit club, and took two drafting courses at Orange High School before taking the credentialing CTE courses at the Career and Technical Center. She stated that she hoped to pursue a career in interior design and planned to take college courses related to architectural drawing and interior design. She was very insightful in terms of how CTE training both built upon skills learned prior to program enrollment and helped develop skills that would be needed for college and a career, explaining:

In my sophomore year, I got AutoCAD certified, and then I learned to use AutoCAD here. So, my first year at the Career & Technical Center we re-learned everything that I already learned, but it was more in-depth. There were things that I already knew, but at the same time, there were things that I was still learning, like corporate standards, and just everything you would expect in a career on a day-to-day basis.
Table 1

**Summary of Participant Demographics**

<table>
<thead>
<tr>
<th>Participant</th>
<th>High School (Year)</th>
<th>CTE Center?</th>
<th>Completer?</th>
<th>Program of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alice</td>
<td>Blue (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Radio/TV Broadcasting</td>
</tr>
<tr>
<td>Katherine</td>
<td>Orange (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Radio/TV Broadcasting</td>
</tr>
<tr>
<td>Betty</td>
<td>Green (Grad, 3yrs)</td>
<td>No</td>
<td>Yes</td>
<td>Cyber/IT Fundamentals</td>
</tr>
<tr>
<td>Chloe</td>
<td>Green (Grad, 3yrs)</td>
<td>No</td>
<td>Yes</td>
<td>Cyber/IT Fundamentals</td>
</tr>
<tr>
<td>Jasmine</td>
<td>Purple (Senior)</td>
<td>No</td>
<td>Yes</td>
<td>Cyber/IT Fundamentals</td>
</tr>
<tr>
<td>Darwin</td>
<td>Red (Grad, 3yrs)</td>
<td>No</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Elouise</td>
<td>Red (Senior)</td>
<td>No</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Frankie</td>
<td>Red (Senior)</td>
<td>No</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Gwen</td>
<td>Green (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Heather</td>
<td>Yellow (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Isabella</td>
<td>Blue (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
<tr>
<td>Lyra</td>
<td>Orange (Senior)</td>
<td>Yes</td>
<td>Yes</td>
<td>Drafting/CAD</td>
</tr>
</tbody>
</table>

**Results**

The purpose of this phenomenological study was to understand and describe the experiences of female students who earned completer status in a technology-based CTE program of study in Central Virginia. Results were derived after an in-depth analysis of the transcribed text from face-to-face interviews with 12 participants, the content within the electronic discussion board responses from 11 of the original 12 participants, and the images and caption text analyzed in photo essay submissions from 8 of the original 12 participants.

I utilized horizontalization practices (Creswell, 2013) by organizing the significant statements from all three research instruments into segments of meaning and initially giving every significant statement equal value in considering its contribution to the overall description of the participants’ shared experience. Clusters of meaning emerged (Creswell, 2013), which established preliminary themes. The preliminary themes were confirmed by triangulation of the data from across all three research instruments utilizing NVivo coding software to establish overlapping codes that had been derived from interview statement, discussion board responses,
and the images and accompanying captions from the photo essays submitted by the research participants.

**Themes**

The three overarching themes that emerged regarding the experiences of female students who earned completer status in a technology-based CTE program of study in Central Virginia are as follows: (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual. These three themes describe the shared experiences of females who persisted in a technology-based CTE program of study and earned completer status in Central Virginia.

Theme development was a process involving the use of a qualitative research software program called NVivo, which allowed me to go through every transcript, discussion board post, and photo essay image and select phrases and comments that represented a deep, rich portrayal of participant experiences. These were then summarized with codes, such as those that are listed in the horizontalization section of Table 2 on the following page. More than 50 codes were initially assigned to a collection of 1,055 descriptions, and the horizontalization process revealed the 22 codes in the table to be highly significant. This significance was determined utilizing Braun and Clark’s (2006) six-step process for horizontalization. Specifically, these 22 codes could be observed to apply to multiple participants in multiple instruments or they were shared by any individual research participant while also occurring in all three research instruments. Codes, clusters, and themes in table 2 on the following page have been listed in no particular order.
Table 2

*Analysis of Raw Data from Interviews, Discussion Board, and Photo Essays*

**Overarching Themes**

Instructor influence on program and participant goals  
The impact of collaboration  
Guidance and support focused on the individual

**Clusters of Meaning**

<table>
<thead>
<tr>
<th>Environment - school</th>
<th>CTE Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment - friends</td>
<td>Few females</td>
</tr>
<tr>
<td>Environment - home and family</td>
<td>Guidance and recruitment</td>
</tr>
<tr>
<td>Career or college prep</td>
<td>Technology Tools</td>
</tr>
<tr>
<td>Collaboration and support</td>
<td>Instructor Impact</td>
</tr>
</tbody>
</table>

**Code horizontalization of the Interviews, Discussion Board, and Photo Essays**

<table>
<thead>
<tr>
<th>Career prep</th>
<th>CTE importance</th>
<th>Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>College prep</td>
<td>POS Guidance</td>
<td>Games/gaming</td>
</tr>
<tr>
<td>Collaborate</td>
<td>Few or only female</td>
<td>Frequency of use</td>
</tr>
<tr>
<td>Support or encouragement</td>
<td>Technology use</td>
<td>Hands-on learning</td>
</tr>
<tr>
<td>School environment</td>
<td>Passion for the topic</td>
<td>Age of use</td>
</tr>
<tr>
<td>Instructor importance</td>
<td>Communication</td>
<td>Creativity/problem solving</td>
</tr>
<tr>
<td>Friends</td>
<td>Hard work</td>
<td></td>
</tr>
<tr>
<td>Home and family</td>
<td>Reputation of gender roles</td>
<td></td>
</tr>
</tbody>
</table>

**Instructor Influence on Program and Participant Goals**

This was the first theme that I identified in this study, and it provided answers to the central research question and each of the three sub-questions. Compelling commentary from participant responses related to the instructor’s influence on program and participant goals was noted in interview responses, discussion board posts, and within the imagery and captions from photo essays submitted by the participants. This influence in many cases began before the participants even experienced their first day of instruction, with many commenting on how the instructors either made an impact on them during open houses or other recruitment outreach programs. Isabella shared how she met her instructor, who was the spouse of one of her high school teachers, at an open house where the instructor listened to her speak about the things she
enjoyed doing and based on their discussion he effectively recruited her into the program:

I was still trying to convince [my mother] to let me come [to the Career and Technical Center]. Her mother told her “You don't need to do this. This is not gonna help you at all.” She insisted, “No, I really want to do it. I really wanted to [take this class].” But then [the instructor] talked to my mom and I when we came to open house, and she finally got on board.

Isabella went on to explain how the hands-on nature of the course and the applicability of a career-training course to career skills was all tied to the guidance and support provided by the instructor, saying:

It's a lot more real-life. Say in math, I sit down at a desk all day and we listen to the teacher and we take notes. In CTE, we're actually making or doing something and it's more like a workplace. We aren't confined to just sit at our desk. We don't just have to sit down the whole time. We're allowed to go and interact with our peers and get their opinion on what we're making and do. Every day my instructor shakes our hand when we walk in the door. He's always getting us ready to do things that we're actually going to have to do in life. We won't just walk into a room and be quiet, we're going to walk into a room, greet someone, say hello, and see our peers.

Frankie agreed that her instructor was the key to her enrolling in her program of study, sharing “That is where I heard about the program, from [my instructor]. And going into open house, I got to talk to [the instructor] and learned that he had actually graduated with my dad.” Jasmine commented on how she was attending an open house and one of the instructors for an embedded technology-based CTE program approached her and she “knew that [the instructor] wanted me to do it because after she introduced herself and talked to me a little bit she was like ‘Yeah, you
should do this,’ and so she sort of recruited me for it.” Once in the class, Jasmine had even more specific commentary on the impact of her instructor, saying:

My overall experience in my CTE program has been awesome. The teacher has really taught us a lot of things and helped us a lot to prepare for our certifications. We do a lot of fun games and activities. My teacher has also done a lot of promoting for girls in the cyber field.

In this particular program, the instructor is part of a network of teachers across the division who oversee a program called Girls Go Cyberstart, which not only is intended to develop cybersecurity skills but also to allow the participants to showcase those skills in a competitive environment that has local, state, regional, and national contests. These instructors are not paid to oversee the program, and a tremendous amount of time outside of school hours is required by both the instructor-sponsor and the participants.

Darwin, Elouise, Frankie, and Isabella also shared anecdotes related to instructors being willing to work to not only make the program as relevant and meaningful as possible, but to go above and beyond to make sure students had every resource and opportunity to succeed. Isabella, who managed to complete a two-year POS in just one year, said:

I felt the CTE teachers were a bit more invested in their students’ success. Right from the beginning I got the one-on-one help I needed to succeed, and my teacher was even willing to stay after school and spend his own personal time to help me catch up. [My instructor] was always there. So, if I didn’t want peace and quiet, then I had him to talk to. It was an area to work, and that was really nice. I’ve told a lot of my peers that my drafting experience was always my favorite because the rest of my high school experience felt like busywork. It wasn't actually getting me somewhere and it required
working on things I didn't enjoy and things I didn't want to do. But the CTE classroom is things that I could see the results of. Your job is going to be like a CTE classroom. And so, I found that very beneficial to my experience.

The overall intent of CTE is to teach a specific set of skills that translate into workplace readiness right out of high school, and also includes soft skills such as customer service, etiquette and proper speech, and a host of other professionalism and job skills sought after in industry. Be that as it may, many of the participants had no intention of pursuing careers in their specific area of CTE training. They were nonetheless impressed by the lengths to which their instructors would go to impart those essential elements of professionalism. Elouise explained:

Drafting has taught me about the importance of deadlines and that it is okay to check with the instructor (or employer) about how I am doing on the assignment and that I do not need to be afraid to ask questions about how to do something if I am confused. Me and my teacher and some of my classmates went to volunteer at this home builders’ association event, and we all had a lot of fun together and became better friends. We also learned more about the different careers available to us because of the class we take.

When Chloe, who had graduated from her program 3 years prior to the interview and similarly described her former instructor as both a friend and peer, was asked how much of her success in her current job she would contribute to her CTE program of study, she replied “If I were to quantify, I’d say maybe 80%. Just the soft skills, learning how to do a handshake, how to interview with people, just the job readiness skills that they prepared, that they teach.”

This theme of instructor influence on program and participant goals through developing professionalism and communication skills was echoed by Gwen, who also mentioned that her instructor specifically encouraged that critical transfer from instructor dependence to peer
collaboration. She explained it this way:

[My instructor] communicates with everyone well enough so that everyone is included and everyone just - we have to talk to each other. Really. I mean, sometimes he'll leave the lab on purpose and go to his office and be like, ‘If you have any questions, ask someone else.’

Photo essays submitted by participants were flooded with images related to instructor encouragement and development of professionalism, as can be seen in Figure 1, below.

Figure 1
*Images Taken from Participant Photo Essay Submissions*

<table>
<thead>
<tr>
<th>Lyra</th>
<th>Chloe</th>
<th>Isabellia</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Provided me with teachers that truly cared and still do care about how I'm doing and where I'm going.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Katherine</th>
<th>Jasmine</th>
<th>Heather</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Darwin</th>
<th>Elouise</th>
<th>Katherine</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Captions added by the participants bolstered the idea of instructor influence on program and participant goals, but in many cases the images chosen by the participants spoke for themselves.
While many of the participants stated that they had no plan to enter the field for which they were being specifically trained in their program of study, others definitely plan to pursue their chosen CTE career path. Lyra explained:

In my sophomore year, I got AutoCAD certified, and then I learned to use AutoCAD here. So yeah, my first year at [the CTE Center], we re-learned everything that I already learned, but it was more in-depth. There were things that I already knew, but at the same time, there were things that I was still learning, that [the instructor] made sure we were all familiar with, like corporate standards, and just everything you would expect in a career. She also commented on how her instructor focused on developing those baseline professionalism skills, and also pushed her to collaborate in order to experience success. She said:

When you actually hear the assignment, the challenge at first, it's kind of like, “Wait, what are we doing?” But then once you actually do it, and you have the teacher helping you, and someone else helping you because they might understand more than you, it's pretty easy. And it's never like, “Oh, you did it wrong, you failed!” You have chances to redeem yourself and get better at that challenge and complete it to the best of your ability.

More than 50 codes were drawn from the participant data, and these were grouped into 10 clusters of meaning. From those clusters, the instructor influence on program and participant goals theme can be tied to the school environment itself, the implicit college and career prep that is a goal of every CTE program and program instructor, modeling and encouraging collaboration and providing support for students within and beyond the program of study, the importance of CTE as a resource for high school students, addressing the disproportionately low number of females participating in technology-based CTE programs of study, guidance and recruitment, and the use and application of technology tools. With that said, one of the most poignant
elements of an instructors’ influence on program and participant goals is something that extends far beyond classroom instruction, and even beyond supporting and sponsoring extracurricular activities which may or may not involve extra pay. The fact that after students have completed their programs of study they maintain relationships with their instructors is very telling in terms of the life impact these programs and instructors have on CTE students. Darwin, who graduated from her program three years prior to participating in this research, said:

I kind of bonded with more of my peers as we were growing in our track, so I would bond with all those students who are more interested in the topic. But, I also bonded a lot with my instructor. We now consider ourselves to be really best friends for four years.

The Impact of Collaboration

Another theme which emerged from analysis of the data in this study involved the participant’s perception of the impact of collaboration in their CTE learning environment. Data related to this theme spanned codes and clusters of meaning that will help to answer to the central research question, and each of the 3 sub-questions. Participant responses related to the impact of collaboration was found in the participants’ interview responses, discussion board posts, and within the imagery and captions from the photo essays.

As I listened to the interviews and poured through the transcriptions and discussion board posts, I was struck by just how frequently the participants used the word “friend” and how frequently the word “with” was applied, even and especially to examples of game participation. Regardless of whether it was an educational game or for recreation, the participants’ descriptions of the activity were often phrased in terms that emphasized a connection or collaboration of some sort. For instance, Jasmine described her first memory of using technology as “I would always play video games with my older sister,” and when Lyra discussed how often and when
she used technology during a typical day, she said “I use technology to find information, write, draw, entertain myself when I spend hours inside, and to connect with the people in my life that I care about.” Indeed, the PowerPoints shared by the participants in their photo essays are filled with collaborative imagery, as can be observed in Figure 2, below.

Figure 2
Images Taken from Participant Photo Essay Submissions

<table>
<thead>
<tr>
<th>Isabella</th>
<th>Chloe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perception of the Professional Environment in the CTE Classroom</strong>&lt;br&gt;I included this picture of a group of people working together because teamwork was big part of our professional environment. Although we of course had our instructor to help us out when needed, collaboration was always encouraged so we could learn to solve problems amongst ourselves and our peers before going higher up.</td>
<td>The students that are serious are super serious</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elouise</th>
<th>Lyra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Students help one another when they are confused or lost</strong></td>
<td><strong>Social Environment</strong>&lt;br&gt;The social environment connects me to other places. This small class we have still brought together people from so many different places.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Katherine</th>
<th>Heather</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sometimes you will work better on your own, with your own ideas and opinions.</strong>&lt;br&gt;Sharing ideas and questions with teammates can also be a big help.</td>
<td>Cooperation and group work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Darwin</th>
<th>Jasmine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Someone laughing (friendly) at their isolated booth</strong>&lt;br&gt;The poor sap who missed a lecture class</td>
<td><strong>Someone actually trying to help</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jasmine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The poor sap who missed a lecture class</strong></td>
</tr>
</tbody>
</table>
Not only do the slides from the photo essays depict people in collaborative environments, but the captions are distinct in pointing out the positive impact of collaborative activity. Darwin’s image goes so far as to specify that while one peer is laughing at the lopsided house in her colleague’s CAD design, her intent is still “friendly,” and Darwin chose an image that reflected her sentiment. Chloe’s image focuses on the professionalism inherent in a collaborative environment, highlighting the idea that “the students that are serious are super serious,” and Lyra’s image points to the idea that while students in her program came from different places, connections were still able to be made.

Phrases such as “working together,” “solve problems amongst ourselves,” “help one another,” “sharing ideas and questions,” and “cooperation and group work” which can be found in the participant captions emphasize the impact of this collaboration theme. Still, the interviews and discussion board posts are chocked full of even more examples. For instance, Isabella shared that her fondest memory of technology usage was “playing MMO’s with my friends,” and MMO is an acronym that is used to describe a Massively Multiplayer Online game. Isabella explained I use technology daily. Like many of my peers I wake up every morning and use my phone to check various types of social media. Before this weird pandemic stage of life I used to use technology every day at school from AutoCAD to emailing teachers. It helped me keep in touch with my school family even when I wasn’t with them. I also use my phone daily to keep in contact with friends. Many of my friends have graduated from high school already so my phone through Facetime and iMessage is essential for me to keep in contact with them and keep those relationships strong (which keeps me happy). That positive feeling which is derived from working with and helping others was shared by more than one other participant. Katherine tied the benefits of collaboration and the importance of her
CTE program of study directly together when she said “I am very thankful for the knowledge I have obtained in both of my CTE classes. I am all the time helping co-workers with their computer/network issues at work, and it makes me feel good about myself.” Alice took the same program of study as Katherine, and she reflected how she “got really close with the video production kids. I'm still planning to hang out with them after we graduate.” Alice also observed “if you put enough people in a room together and tell them to make stuff, they're basically going to become friends. That's just how people work. If you work together, you generally develop some sense of camaraderie.” Later in the interview, she excitedly shared how fulfilling it was to be a part of that collaborative support structure in her CTE course:

It's a thing you can do in Premiere or multi-camera. I don't even remember what it's called, but I figured it out, and then people would just come ask me how to do it, and it was extremely satisfying because I'm like, “Oh, yeah!” And then I just clicked three buttons, and it's like, “Here's how you do it.” And they're like, “Oh, thanks!”

Working collaboratively to come up with solutions to a problem is not something that comes naturally to everyone, but the benefit of learning to work collaboratively can show rewards long after a CTE program of study has ended. Betty shared her experience with this, saying:

I like structure a lot and I feel like all these computer projects had no structure but that's how it supposed to be if I'm not thinking about it wrong but in general it's a struggle for me whenever I get any creativity, artsy projects where I have zero instructions so I just had to work with the other students in class to come up with a solution. That was for me the hardest but I think that experience has been something I took with me to college and into my job. I don't think that was a bad thing for me to experience at all.

Teamwork can also be a benefit in competitive environments. Elouise shared:
Since my best friend and I compete as partners in additive manufacturing for SkillsUSA, we get the opportunity to use our creativity to come up with original designs for problems given in the competitions and then get to see the 3-D modeled part 3-D printed and functional as we intended it to be, which is very satisfactory and very fun.

The result of competitive collaboration is the sort of thing in industry that allows for companies to secure contracts, but in the high school CTE environment, Career and Technical Student Organizations (CTSOs) such as SkillsUSA and Future Business Leaders of America (FBLA) allow CTE students to hone their competitive edge, while working with others to reach their goals. Elouise’s SkillsUSA partner, Frankie, expounded on her partner’s point of view with this anecdote:

Last year, at our district competition, we had three weeks to complete our design or decide what we wanted to do but neither of us could do it in the first two weeks. So, on the third week, we came in every morning at six o’clock and did not go home until 5:00 PM. And we worked on it all week and we did everything we wanted to do with it. We only printed about two times and the last print was perfect. Everything we wanted from it, we had to sand it a little bit and we won first place at Districts. It all just worked very well, like, both of us working together and being able to do this within the time we were given. Drafting has taught me about the importance of deadlines and that it is okay to check with the instructor (or employer) about how I am doing on the assignment and that I do not need to be afraid to ask questions about how to do something if I am confused.

So, this pair proved that the impact of collaboration for them drew them closer together as friends and peers and allowed them to reach a mutual goal, while meeting a critical deadline.

Being in a class with other people who have a real interest in the topic is another benefit
of the CTE environment which can help to motivate students to work together. Succinctly, drafting student Gwen summed that up in saying “just being in the classrooms where we're all focused on doing the same thing.” Darwin, a graduate from a drafting program at a different school with a different instructor, was struck by how beneficial it was to be a part of such a focused learning environment. She explained:

It was there that I saw the extent of cooperation that humans are truly capable of. Older students would help younger students, people would be screaming at monitors while others are making a print order to follow. It was beautifully controlled chaos that brought me a lot of joy at the end of the year. I found it really easy to navigate among work-minded people because it's an atmosphere that you know you're there to get work done. And so, you just sit down and work, and people will come up and ask you questions, and you go and ask them questions. It's a really easy collaboration experience for everyone in our program. Yes, it was just really easy to navigate that.

When asked to give a specific example of her most defining moment from her CTE program of study, Darwin said:

I worked on a project to build an amphitheater. It was a challenge and working on that project is probably my proudest accomplishment because it's actually built now. So, I'm super excited about it. I had to draw on the things I had learned in class with my instructor and my friends, and then I had to work with people in the industry. I had to work with these contractors, all of that. So, I really got a full experience. And I think that is probably my proudest moment in the CTE program is building working on a project in the community that actually got built.

All the participants shared anecdotes, included photo essay imagery, or mentioned something
about their CTE program experience that involved collaboration and working with others. The impact of collaboration theme was woven through clusters of meaning that dealt with the school environment, friends, home and family, career and college preparation, CTE importance, and instructor impact. By working with their program instructors and class peers, the CTE program participants in this study gained invaluable experience on how to work with others to meet goals and develop collaborative relationships even within a competitive setting. Darwin explained how this was an experience that was unique to her CTE program of study in comparison to her core classes at her high school:

A lot of times it feels like something will challenge you in math, and you'll think it's like, "Oh, my goodness, this is impossible. I’m never going to be able to do this!” But in drafting there seems to always be another way to come at it. The instructor? Well, he can help you. Your classmates can help you. A lot of the times in other environments, it's only the one teacher that can help you and students just aren't going to be able to teach you. But [in CTE] I think that happens a lot.

This section started with my observation of how I was struck by just how frequently the participants used the word “friend” and how frequently the word “with” could be found in the data from all three research instruments. An answer from Lyra that I found to be frustratingly brief at the time really sums it all up in terms of the participants’ perception of the impact of collaboration in a CTE program of study. When she was asked to tell me about her fondest memory from her CTE experience, she simply replied “the two years that I spent with my friends in my CTE class.”

**Guidance and Support focused on the Individual**

One of the unique aspects of CTE is that it falls into a category called elective courses, as
opposed to the core classes of math, science, history, and language arts. This means students are
given the chance to consider what really interests them when signing up for a CTE program of
study. The participants of this study made it clear that, while each agree that there were far fewer
females in their technology-based program of study, they enjoyed their course and appreciated
the content because it was relevant to them as an individual. Therefore, the theme that guidance
and support focused on the individual was one that emerged from the interviews, discussion
board responses, and very powerfully from the imagery and captions in the photo essays. Data
proving this theme provides answers to the central research question, as well as the sub-questions
related to the participants’ experience with a technology-based program of studies’ social and
learning environments.

Getting the lock cylinder of learning to engage is a process which requires finding a key
to align all the tumblers that are unique to every learner. There is no master key for passion in
learning. Gwen graduated with completer status in architectural and mechanical drafting, and on
the discussion board she recalled the first time she saw the drafting lab during an open house
tour:

I'll play Tetris on my 1988 Game Boy until three in the morning. Just shapes always kind
of got my attention, and when you brought me in that classroom, I understood what was
going on. I was like, "Shaaaapes." I love shapes!"

Katherine, who started making videos when she was 10 years old expressed feeling lucky that
she knew what she wanted to do with her life, and she said:

Before the summer of eighth grade when you do all your freshman orientation stuff I
came to this open house and I came in and I was - I had been interested in video
production stuff. I think that's the only class I looked at and I thought it was pretty cool.
When I first walked in I was like, "Wow, I get to use like all this equipment and stuff." I wanted to do something in the film industry and being able to take a class in school about that was exciting. These programs of study aligned with each participant’s unique skills or interests, and that was an impetus for success. Lyra commented:

I've always been into designing buildings, and how a building would look like, “Oh, that's a really cool building. How did they think of that? How did they make that work to where it looks beautiful and it's functional at the same time?” I guess that's always been something that I've been interested in, and abstract and geometric shapes have always been my favorite, so just finding that career path, and then going into this was a great fit. Frankie emphasized how great a fit drafting was for her as well, and reflected:

I took Drafting One my freshman year. In Drafting One, I really liked it. I guess, I am a really detailed oriented person, so doing drafting is hands-on-manual, like drafting on the drawing board. I really liked the attention-to-detail and how specific. Where the lines needed to be? How dark they needed to be? And, how detailed they needed to be in order to be a good drawing? I like doing that. And my dad knew that I would be really good for this class because of what I like doing. I like drawing and visualizing things. Yeah.

When the participants of this study found themselves in a course that followed the line of their own interests, and were surrounded by others with similar interests, it was a life-changing event for many of them. Darwin, a participant who had been out of high school for three years, very simply recalled “that was one part I liked. It was people who wanted to be there. In math and language arts classes, it’s a lot of people who don’t want to be there but they’re taking it because it’s a requirement.” The idea that making technology-based programs of study a requirement like
math or history just to increase female enrollment did not sit well with Radio and Television Broadcasting completer Alice. She said:

Women going into a STEM field to just to have more women does not benefit herself. She is the one who has to stand up and declare her value to people who are certain she does not have it. She is the one who has to claw herself up every mountain. She is the one who will have to stand in a room full of men, every day, for 40 years. The only way it can benefit herself is if she genuinely enjoys the work. If you want more women to work in a field, expose as many women as possible to that work, and some of them will have a passion for it.

Given the importance of ensuring that guidance and support focus on the individual, and considering that all of the participants expressed that their programs of study were impactful because they were related to their unique skills and interests, I was curious to find out what suggestions they might have for increasing female participation in technology-based programs of study. When Elouise was asked what specific guidance she was given prior to enrolling in drafting, she admitted “I don't really know if I had guidance to take the course. For me it was just something that sounded enjoyable.” She suggested:

More representation of females in CTE programs will help to increase participation. If other females see females engaging in trades such as masonry or drafting, they might think to themselves “that person can do that trade and I think that trade looks interesting, so maybe I will give it a try.” Females are so often stereotyped as the type of people who would only be in cosmetology, or culinary, but I am a female in drafting and I am enjoying it a lot. My best friend is also in drafting and she and I excel greatly in the class because of our determination to do our work correctly and efficiently. We both competed
in additive manufacturing (3-D Printing) last year as well as this year and we were the youngest team in additive manufacturing to make it to nationals from our school, and we were an all-girl team. So overall, I just think that increasing female participation can come from setting an example of greatness and success in the class to draw more students in wishing to discover passions they did not know they had.

Isabella disagreed, and suggested that perhaps having at least an introductory technology-based course that was required for all students could be the answer:

I think that high schools should have a basic technology class as a requirement for graduation, or at least for an advanced diploma. I wasn’t all that interested in learning more about computers until the topic was introduced in my programming class, so I think if people are required to be introduced to it, more students, including females, would be interested in learning more by taking a CTE class. I honestly don’t think that, in this day and age, there are many women in our country who are deterred from a career field or a program of study just because it’s male-dominated. If they’re truly interested in something, they will pursue it. In my opinion, the issue isn’t showing girls ‘they can do whatever a boy can do!’ It’s simply helping people of any gender realize what they’re interested in at a younger age, especially since technology might not be something many girls initially think of.

This type of requirement has been tried in many school divisions and has been met with mixed success. Cybersecurity program graduate Chloe shared the following:

When I was in middle school, there was a big push for girls to join STEM and so the school made classes (co-ed, to be clear) go during the free period of the day. The “free period” was about 40 minutes, maybe more, in the day where students would have a
study hall for part of the time then go to "CORE" where a teacher of one of the core subjects would do some enrichment activities or projects with students outside of lecturing. CORE time was sometimes spent with IT staff as well as math and science teachers for a STEM day. During this time, students would build robots with Lego pieces and try to program the robots to do things like clean up oil spills or move blocks. These tasks were usually supposed to simulate natural disasters or things impacting environmental changes. I found programming incredibly challenging - frustrating might be a better word here since it has a negative connotation - and building the robots boring, so in high school I thought I wouldn't like computer classes. I figured we'd be doing the same things and I didn't like it then, so I wouldn't like it later. The experience has made me biased against STEM encouragements because I wasn't interested in it, but I know now that that is not all that STEM is. I think if a variety of activities showing how broad the field is could be made, it might be better.

In the end then, perhaps a “STEM Activity Day” is not the way to go. Open house events at high schools and career and technical centers have been a common method of getting potential participants and their parents to see what kind of programs are available. During these open houses, teachers often get just a few minutes to share a little bit about what their course has to offer. More than one participant offered the idea that these events could be put to better use by having the instructor step back. Katherine suggested “talking to females who took STEM courses and how they helped them in past or current jobs. Talk about the skills they have learned and how those skills have helped them or could help them in future careers.”

Drafting and CAD senior, Heather, commented:

When the schools present and talk about CTE for the first time it might be beneficial if a
female student or one of the female administrators could be there to talk about it and make sure it's clear that women are accepted in any class by all the teachers.

Frankie agreed, explaining:

It may promote more girls to see that they can do whatever they set their minds to and persuade them to try something they may not have been previously considering. In addition, if while a certain class is being promoted, it might be a good influence to share previous successful women in that field to show that it is possible for women to do just as well, if not better, than men to do the same jobs.

She then brought the conversation right back to the imperative that any such guidance and support for a program would only be effective if it struck a chord with the individual student herself, adding:

I like the idea and pride in being able to work my way to being the best, having the same fair opportunities. While events like that may persuade some to join the classes, would it be for the wrong reasons? They might join for the benefits, not for their passion in that field.

Turning to the photo essays, I was interested to see just what the imagery reflected in terms of the participants’ perception of the support structure they experienced while participating in their CTE program of study. Each of the participants earned completer status in their program of study, and therefore they had each experienced success. Indeed, 10 of the 12 participants had taken advanced courses or attended the Commonwealth Governor’s School, so from this pool of exceptional students did the images and captions in the photo essays confirm the theme that guidance and support focused on the individual to be effective? See Figure 3 on the following page.
Chloe’s image focuses at once on the previous theme of collaboration, while also hitting on that critical element of the individual, and Isabella tied the instructor influence theme into her
support structure imagery while also indicating that the support structure addressed her unique needs. Heather specifically focused on how the program supported her by allowing her to be creative, and Darwin just flat out shares her perception that her independence was key.

It is unclear just what kind of recruitment program is most effective when it comes to increasing female participation in technology-based programs of study. Some participants had a prior relationship with the instructor, and some were directly recruited based on known skillsets that were relevant to the course. Some came upon the course during an open house, seeing the potential for a fit with something they enjoyed doing or were interested in as a career, and some knew it was a program of study they were going to pursue all along. What is clear is that the participants in this study value their independence, and attribute their successes in the courses and beyond to the relationships they built with their instructors, the collaboration they experienced with friends and peers in the course, and the perception that the guidance and support they received was targeted to their individual goals and skills.

**Research Question Responses**

The research questions were answered through one or more of the three themes identified through analysis of participant responses in face-to-face interviews, discussion board responses, and the captions and imagery depicted in photo essays. The three overarching themes that emerged regarding the experiences of female students who earned completer status in a technology-based CTE program of study in Central Virginia are as follows: (a) instructor influence on program and participant goals; (b) the impact of collaboration, and (c) guidance and support focused on the individual. The following research questions were explored:

**Central Research Question:** How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS?
**Sub-Question 1:** How do participants describe the social environment as females participating in a technology-based POS?

**Sub-Question 2:** How do participants describe the learning environment as females participating in a technology-based POS?

**Sub-Question 3:** How do participants describe the education system’s support for their participation in a technology-based POS?

The Central Research Question explored the experiences of female high school students who earned completer status in Virginia in a technology-based POS. This question was answered by all the themes which emerged in the study. All participants were influenced by their instructor in ways that allowed them to experience success in their program of study. Isabella was not the only participant who sensed she was part of a program focused on meaningful learning, and she:

Felt the CTE teachers were a bit more invested in their students’ success. Right from the beginning I got the one-on-one help I needed to succeed, and my teacher was even willing to stay after school and spend his own personal time to help me catch up.

Not only did the participants describe a connection with their instructor, but the impact of peer collaboration was highlighted in interview responses, discussion board posts, and powerfully illustrated in the photo essays. These participants experienced success because they felt they were part of something. Each participant also sensed the something they were a part of included a system of guidance and support that acknowledged their individual skills and goals.

Sub-question one focused on how the participants described the social environment as females participating in a technology-based program of study. While all of the participants commented on being either the only female in their class or one of only a few females, their description of the social environment focused largely on the sense of collaboration they
experienced working with students who had similar goals and interests. Phrases such as “working together,” “solve problems amongst ourselves,” “help one another,” “sharing ideas and questions,” and “cooperation and group work” can be found in the photo essay captions, which emphasize the impact of collaboration theme. Many of the participants developed relationships with their instructors that rose to the level of friendship, and participants who have graduated all commented that they maintained contact with their instructor three years after graduation, and considered them to be friends and peers. The instructor influence on program and participant goals also impacted the social environment in the programs of study through encouraging collaboration and making it clear that individual skills were critical elements for group success. It was this concern for the individual that nurtured an environment in which the participants felt safe, experienced growth, and settled into an environment of social professionalism which is the true intent of the career and technical education: Learning skills that prepare students for work and life.

Sub-question two considered how the participants described the learning environment as females participating in a technology-based program of study. Here, too, all three themes are relevant to answering this question. Drafting program completer Frankie commented:

I took Drafting One my freshman year. In Drafting One, I really liked it. I guess, I am a really detailed oriented person, so doing drafting is hands-on-manual, like drafting on the drawing board. I really liked the attention-to-detail and how specific. Where the lines needed to be? How dark they needed to be? And, how detailed they needed to be in order to be a good drawing? I like doing that.

As with the other participants in this study, Frankie described her learning environment as something that focused on her individual goals and skills. The participants were unanimous in
identifying the collaborative, hands-on learning environment in their programs of study as being integral to their individual success. However, none of this would have been possible were it not for instructors who valued the importance of developing relationships which allowed for individual students to thrive, while also contributing to a collaborative environment in which specific program of study skills and characteristics of professionalism were both prioritized.

Sub-question three concentrated on how participants described the education system’s support for their participation in a technology-based POS. In answer to this question the guidance and support focused on the individual theme was the most directly related and the participants all used their photo essays to emphasize how important the individual was in a CTE learning environment. Face-to-face interviews and discussion board posts also served to emphasize that these participants persisted in their program of study because it was related to a specific skill or interest they had. There can be no better form of support than that which impacts students well beyond the walls of the classroom itself. The fact that the participants placed so much value in their instructor’s influence proves that these women were encouraged and supported by their teachers and this played a significant role in their persisting to earn completer status in a technology-based program of study. Darwin was not the only participant to comment on how her instructor’s support influenced her classroom experience and beyond, but her words poignantly describe a lasting impact: “I also bonded a lot with my instructor. We now consider ourselves to be really best friends for four years.”

Summary

This chapter described the lived experiences of 12 females who earned completer status in a technology-based program of study. The analysis of responses to questions posed in face-to-face interviews, an electronic discussion board, and photo essay prompts was used to describe
the participants’ experiences. Three overarching themes emerged regarding the experiences of female students who earned completer status in a technology-based CTE program of study in Central Virginia are as follows: (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual.

The study revealed that participants were influenced by their instructor in ways that allowed them to experience success in their program of study. Not only did the participants describe a connection with their instructor, but the impact of peer collaboration was highlighted in responses from all three research instruments. Simply put, the participants experienced success because they felt they were part of something. Each participant commented about being either the only female in their class or one of only a few females, yet their description of the social and educational environments focused largely on the sense of collaboration they experienced working with students who had similar goals and interests. Phrases such as “working together,” “solve problems amongst ourselves,” “help one another,” “sharing ideas and questions,” and “cooperation and group work” can be found in the photo essay captions submitted by participants. Face-to-face interviews and discussion board posts also served to emphasize that these participants persisted in their program of study because it was related to a specific skill or interest they had. The fact that the participants placed so much value in their instructors’ influence, peer collaboration, and being encouraged and supported as individuals all played a significant role in their experience, allowing them to persist and earn completer status in a technology-based program of study.
CHAPTER FIVE: CONCLUSION

Overview

The purpose of this phenomenological study was to investigate how female high school students who earned Career and Technical Education (CTE) completer status in a technology-based program of study (POS) in Virginia describe their experiences. Low female enrollment in technology-based CTE courses as well as science, technology, engineering, and mathematics (STEM) courses in general is a concerning trend at the secondary level (Christensen, Knezek, & Tyler-Wood, 2014). CTE, which was referred to in the previous generation as vocational education, was typically populated by students who were not pursuing advanced diplomas or seeking formal college training. This is no longer the norm. In fact, the effectiveness of the hands-on nature of CTE training and problem-based learning (PBL) strategies which have been implemented into many CTE programs now generally map to entry-level industry training certifications and opportunities to bypass or secure dual enrollment credits for first-year college courses (Tillman & Tillman, 2008). Just as vocational training courses and programs were largely responsible for contributing to the skilled trades workforce in the previous generation (Wang & King, 2008), today’s CTE centers are being tapped by secondary education as models for providing rigorous, authentic, hands-on training for the digital native generation in STEM (Van Noy, Trimble, Jenkins, Barnett, & Wachen, 2016; Vilorio, 2014). However, these benefits require participants to persist in their POS through to the end.

Four research questions guided this study. This chapter presents a summary of the key findings followed by a discussion related to the empirical and theoretical literature and their implications. Finally, the delimitations of this study, limitations of this study, and recommendations for future research will be discussed.
Summary of Findings

A phenomenological approach was used to describe the lived experiences of 12 female high school students who earned completer status in a technology-based POS in Central Virginia. Results were derived after an in-depth analysis of the transcribed text from face-to-face interviews with 12 participants, the content within the electronic discussion board responses from 11 of the original 12 participants, and the images and caption text analyzed in photo essay submissions from 8 of the original 12 participants. The research questions for this study were:

Central Research Question: How do female high school students who earned CTE completer status in Virginia describe their experiences in a technology-based POS?

Sub-Question 1: How do participants describe the social environment as females participating in a technology-based POS?

Sub-Question 2: How do participants describe the learning environment as females participating in a technology-based POS?

Sub-Question 3: How do participants describe the education system’s support for their participation in a technology-based POS?

After analyzing the participants’ descriptions of their experience as communicated through the research instruments, three themes emerged. They were (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual. One or more of the three themes answered each of the research questions.

Central Research Question Findings

The central research question required the 12 participants to describe their overall experience in a technology-based POS. In the responses to the face-to-face interview questions,
the responses to the online discussion board posts, and in the imagery and caption text of the photo essays the participants made repeated reference to the instructor’s influence on their ability or willingness to persist in that program of study. The instructors’ shared passion for the topic, instructional strategies, modeling of professionalism, and willingness to go above and beyond made positive impacts on the participants. The participants also described collaboration as being not only something they sought, but in the end a characteristic of the learning environment that contributed to their success. Participants described program recruitment efforts, instructional delivery, and the support they received during and after their program of study as being focused on each participant as an individual, which was an affirming facet of their shared experience.

Sub-Question One Findings

Beyond merely describing the overall experience in a technology-based POS, this study sought insights into both the social and learning environments of females who persisted to earn completer status. Sub-question one was answered after analysis of all research instruments, and each of the themes which applied to the overall program of study experience was described by participant responses as relates to the social environment. More than one participant described developing a collegial or friendship relationship with the instructor, which contributed not only to the overall impact the instructor had on their social environment but also highlighted the instructors’ concern for the participants as individuals. Also, while it is true that descriptions of their experiences included commentary on being the only or one of only a few females in the class, there was a sense of collaboration that emerged for the participants as they worked to overcome project challenges and prepare for rigorous industry credentialing exams.

Sub-Question Two Findings

How the participants described the learning environment in a technology-based POS was
the focus of the second sub-question, and each of the three themes played a role in answering this question as well. As the primary model of professionalism and the individual responsible for class instruction, the influence of the instructor was clearly described in interview responses, discussion board posts, and through the imagery and captions of the photo essay submissions. PBL environments such as those which are encountered in a CTE classroom often depend upon a student’s ability to work as part of a team, and the study participants all valued the impact collaborative activities had on their success. Being a part of a well-functioning group is one thing; however, being encouraged to tap into your individual skills and interests can be a valuable catalyst as well. Research data proved that a focus on the individual was also a key element of the learning environment.

**Sub-Question Three Findings**

The last research question addressed how participants described the education system’s support for their involvement in a technology-based POS. Interview questions as well as discussion board and photo essay prompts attempted to get a feel for how the formal guidance programs in schools may have helped to recruit and encourage their participation, and yet very few of the participants had anything to say about guidance departments being involved in their deciding to pursue a technology-based POS. Instead, here too the participants described being recruited by, and encouraged by their instructors during and beyond their classroom experiences. More than one participant actually described experiences in which their guidance counselors attempted to convince them to follow a different path. The time the instructors spent getting to know these participants, and the opportunity they had to do so in classes that admittedly have smaller student populations, allowed professional relationships to develop in which participants’ individual strengths and interests were identified. Thus, the theme of guidance and support
needing to focus on the individual was something that became an organic part of the participants’ shared CTE learning experience.

**Discussion**

The purpose of this study was to understand how female high school students who earned completer status in a technology-based CTE POS in Central Virginia described their experiences. The theoretical framework of this study was based upon Bandura's (2012) self-efficacy theory, Eagly and Karau's (2002) role-congruity theory, and Lent, Brown, and Hackett's (1994) social cognitive career theory. After examining the shared experiences of female CTE completers in a technology-based POS, this study revealed themes which contribute to a greater understanding of the characteristics common to women who persist in such a program of study. This information may serve to also inform school counselors, administrators, and instructors on ways to address the challenges of female CTE recruitment, retention, and program completion.

**Application of Study Findings to the Theoretical Framework**

Learning is a process that requires the development of strategies for overcoming a great many obstacles. There are challenges that educators face every day in working to ensure that every student is afforded an opportunity to work towards college and career-readiness. In this generation of high-stakes, standardized testing, subgroup is a buzzword that represents categories of students with varied ethnicities or special needs in which low test score trends have been observed. However, within the specialized curriculum areas of career and technical education the trends for low scoring and program participation are often a function of family training and work history in many areas, and gender in most areas. This study was guided by three theories relevant to why people choose certain career paths, what intrinsic and extrinsic forces guide those decisions, and the motivation a student might have to achieve, or feel they have something
meaningful to contribute, within a given field of study or in their future employment. These theories are Bandura’s (2012) self-efficacy theory, Eagly and Karau’s (2002) role congruity theory, and Lent, Brown, and Hackett's (1994) social cognitive career theory.

**Self-Efficacy Theory**

Self-efficacy is one’s ability to succeed in specific situations or accomplish a task. Psychologist Albert Bandura, within the self-efficacy theoretical construct, suggests that a person’s self-efficacy can play a major role in how he/she approaches goals, tasks, and challenges (Bandura, 2012). Choices regarding behavior are shaped by the qualities of intrinsic motivation and impact academic productivity. Thus, self-efficacy theory is important within the field of education in general, and critical within the area of career and technical education (CTE) due to the impact these choices might have on a student’s career training and readiness for employment. Bandura (2012) identified four factors affecting self-efficacy: enactive attainment, which relates to the importance of experiencing success within a given environment; vicarious experience, which has to do with observing others who are experiencing success in that environment; social persuasion, which manifests from direct encouragement or discouragement from others; and physiological conditions, which has to do with how the body reacts to stressful environments.

Data from participants in this study was collected through face-to-face interviews with 12 females who had persisted in their CTE POS to earn completer status. Of those 12 participants, 11 responded to a series of prompts on an electronic discussion board, and eight submitted photo essays describing their perception of their experience. One of the themes that emerged from the study is the instructor’s influence on program and participant goals. This theme relates to all four factors Bandura identified. The participants described instructor relationships that encouraged
their success and the success of classmates, which contributes to enactive attainment and vicarious experience. The impact of collaboration theme is one of the primary reasons participants identified for experiencing success and is therefore directly relevant to enactive attainment. The very fact that collaboration involves the input of and need to work with others indicates an influence on both vicarious experience and social persuasion. Finally, the theme of guidance and support needing to focus on the individual was yet another factor participants identified as a reason for program success, and thus it directly addresses enactive attainment. Since the guidance and support theme requires the input from and encouragement of others, it benefits vicarious experience and social persuasion as well.

**Role-Congruity Theory**

Role-congruity theory proposes that a group will be positively evaluated when its characteristics are recognized as aligning with that group's typical social roles (Eagly & Deikman, 2005). While focused primarily on females in leadership roles, this theory has applicability to female participation in technology-based CTE programs of study for two reasons. First, participants in a CTE POS are generally striving for early career training because they have goals which involve leadership within a given career or industry (Tillman & Tillman, 2008). Also, the characteristics described by the role-congruity theory have a direct correlation that can be observed within the ranks of students who are receiving advanced training for industry credential certification. Two forms of prejudice have been identified by role-congruity theory. The first has to do with women having less-favorable potential for success in an area that is more stereotypical for participation by men than women (Eagly & Karau, 2002). The other prejudice in role-congruity theory suggests that women might receive less favorable evaluations than men specifically because the behaviors that are indicative of success are less desirable in a woman.
than in a man (Eagly & Karau, 2002).

The participants in this study expressed through the descriptions of their lived experience that they were encouraged and valued by their instructor and felt integral to the course itself, due to their contributions in collaborative projects and activities. Multiple participants shared anecdotes regarding being directly recruited for the program by their instructor mitigates the form of prejudice regarding women having less-favorable potential for success in an area that is more stereotypical for participation by men than women. There was simply no reason to doubt they were a fit for this program of study when they felt invited in by the instructor, and the encouragement the participants described from peers and instructors alike diminishes the impact of the other prejudice in role-congruity theory related to receiving less favorable evaluations as a function of gender. Here again, the instructor influence, impact of collaboration, and support focusing on the individual are themes which address the potential negative effects of Role-Congruity Theory.

**Social Cognitive Career Theory**

Social cognitive career theory (SCCT) incorporates elements of Bandura’s general social cognitive theory and combines it with such concepts as how interests, abilities, values, and environmental factors impact how a person goes about selecting and pursuing training for a given career (Lent, Brown, & Hackett, 1994). Brown (1990) asked, “What are the relationships among values, needs, aptitudes, and interests as they operate in concert to influence occupational choice making” (p. 346)? SCCT was designed to answer such questions, offering a unifying conceptual framework that might link these variables together. Therefore, SCCT highlights relevant experiential and learning processes, as well as ability-acquisition characteristics, and seeks to define the impact they might have on career development as a function of the bridge
between self-efficacy beliefs, outcome expectations, and personal learning goals (Lent, Brown, & Hackett, 1994).

While most of the participants did not plan to pursue careers specific to the trade skills developed within their CTE POS, all participants highlighted the value of developing soft skills such as customer service practices and better development of communication and professionalism in general. Four of the participants who do not plan to enter a field specific to their CTE POS made direct statements about the class content being something they had a passion for pursuing because of their individual interests and skills, which is a direct reflection on the tenets of SCCT. If a picture is worth a thousand words, a review of the caption text and imagery from the photo essays captures just how powerfully the participants’ experience as completers in their CTE POS, and how the instructor influence and focus on the individual addressed the concerns of SCCT, namely values, needs, aptitudes, and interests and how they influence occupational choice.

Three themes emerged from the analysis of data collected through face-to-face interviews, electronic discussion boards, and photo essay submissions: (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual. These themes dovetail nicely in confirming the effects of Bandura’s Self-efficacy theory, mitigating the concerns of Role-congruity theory, and tending to the elements of Social cognitive career theory which influence occupational choice.

Application of Study Findings to the Existing Literature

When the industrial age gave way to the information age it required western culture to adapt to new technologies, vocational competencies, workplace readiness characteristics, and the resulting training needs. The Smith-Hughes Act of 1917 saw its federal grant programs
perpetuated with the 1998 reauthorization of the 1984 Carl D. Perkins Vocational and Technical Education Act (Friedel, 2011). 21st Century CTE programs and specialized training centers expanded curricula to incorporate computer aided design, computer networking, advertising design, IT forensics, and a variety of other STEM-related content (Friedel, 2011). Existing programs in auto servicing, building trades, cosmetology, and nursing were forced to adapt to accommodate instruction related to emerging technologies.

**CTE Trends**

Because of the inherent hands-on nature of CTE instruction, employers and stakeholders in advanced training programs at community and four-year institutions were not only encouraged to observe these trends but sought to confirm that the benefits of vocational education translated to similar benefits in the burgeoning CTE-era of program development. Participants in this study were enrolled in radio and television broadcasting, IT fundamentals and general cybersecurity training, and drafting/computer aided design courses. Responses confirmed the value of hands-on training. Those planning to enter a field directly related to their CTE POS feel especially confident in the foundational skills they have developed, and those not planning to pursue careers that align with their specific CTE POS valued the development of soft skills and exposure to elements of professionalism.

Based on an analysis of the 1997 National Longitudinal Survey of Youth (NLSY) data set that examined high school graduates' occupational choices in 2006, findings reported by Fletcher (2012) indicated that CTE graduates were 2.7 times more likely to be employed in STEM fields, while college preparatory graduates were 1.8 times more likely to be employed in business, management, and administration occupations. In addition, gender was significantly related to all occupational choices. Implications of Fletcher’s study called for CTE teachers and leaders to find
new strategies to attract more diverse students, particularly females and minorities, into programs that have predominately white and/or male populations. The data describing the experiences of female high school students who earned completer status in a technology-based CTE POS indicate that one way to increase diversity is to provide opportunities for CTE instructors to speak directly to program candidates, and at least according to the experiences described within this study that schools must ensure that guidance and recruiting efforts focus on the unique interests and skills of the candidates.

**CTE Benefits**

General education students with CTE training are more likely to not only secure post high-school employment, but also more likely to find full-time employment in fields related to their CTE POS (Kim & Passmore, 2016). Not only are these findings significant, but indeed female and racial minority students who participate in career and technical education leadership programs realize improved high school grades, psychosocial, and achievement outcomes (Aragon et al., 2013). Ten of the participants in this study were enrolled in advanced placement courses or dual-enrollment courses, and 11 described having exceptional grade point averages and excellent college or career prospects. Therefore, the achievement outcomes for the participants of this study align with existing literature.

**Science, Technology, Engineering, and Mathematics Training Needs**

Beyond the core skills students learn in math, science, history, and language arts employers have a need for candidates who possess not only industry-specific skillsets that are available in CTE training programs, and the soft skills which are some of the most unique attributes inherent in CTE competencies (Falco, 2016). These soft skills include customer service skills, interpersonal and business communication abilities, problem-solving and critical thinking,
teamwork, and workplace discipline which can enable or interfere with success on the job (ACT, 2017). Participants in this study specifically addressed the value of their CTE POS in developing soft skills and improving problem-solving abilities.

**Research Related to Female Technology Use**

Demiray (2010) performed a study of 1100 individuals (550 males and 550 females between the ages of 16 and 64) in which the participants completed a 25-question survey about their use and perceptions of information technology. Residents of Turkey, the questionnaire's participants all had cell phones. Many also owned multimedia devices, digital cameras, and desktop and laptop computers. No significant difference was found between male and female ownership of technology products, according to the study. However, “women's computer use tended to be for communication (social networking, e-mail, chat), work purposes, research, surfing on the Net, and typing, while men used computers mostly for surfing on the Internet, communication (MSN, e-mail, chat), work purposes, playing computer games, and research” (Demiray, 2010, p.14). Participants in this study very directly supported the existing literature as it relates to technology saturation and use cases. All the participants regularly use technology, and their usage aligns with existing research.

**CTE Career Clusters and Pathways**

Existing literature from current research has confirmed that a gender and racial imbalance exists in secondary STEM and CTE enrollment (Aragon, Alfeld, & Hansen, 2013). Every participant in this study shared that they were the only female or one of few females in their technology-based POS. Studies have indicated there is an interest on the part of females to participate in technology-based CTE programs at the secondary level (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Thornham & McFarlane, 2011), but that there is frustration at the
hurdles that stand in their way (Wang & Degol, 2013). “As cultural, social, political and economic changes take place, the secondary or high school curriculum should reflect and respond to changing needs and aspirations of students” (Mativo, Womble, & Jones, 2013, p. 103). The data from this study confirms the literature regarding the benefits of CTE, and adds to the literature by describing exactly how females who experienced success in a technology-based program of study valued their instructors and the opportunity to work in a collaborative environment.

**Gender Imbalance**

Low female enrollment in technology-based CTE courses continues to be a trend at the secondary level. In fact, females "continue to be a disadvantaged group compared to their male peers" (Aldridge & Goldman, 2007, p. 40) in developing various interests and areas of giftedness that have been identified in primary and elementary school. Although societal influences, such as preconceptions about gender roles within the CTE community, have an influence on program demographics, current trends appear to stand at odds with areas of interest and aptitude that are observed in the middle school female population (Franklin, 2013). In other words, females within this generation of digital natives are not only more comfortable with emerging technologies that drive institutions of industry, commerce, medicine, education, and even recreation than those from previous generations, but they are in fact seeking opportunities for technology-based training prior to commencing college studies and securing entry-level jobs within their chosen careers. It has been suggested the simplest way to address the STEM gender imbalance is to make participation of all students a requirement (Garcea et al., 2012). However, the need for guidance and support to focus on the individual seems to argue against any suggestions that mass enrollments of females in STEM programs will be the answer in the long
run, but participants in this study felt that having an early exposure to a well-rounded STEM introduction would allow all students the opportunity to get a taste for what, if any, aspects of technology align with their unique skills and interests. From there, immersion in a dynamic, hands-on, rigorous CTE program of study in those individual’s areas of interest ought to be made available. The gap in the research this study intended to address, which called for qualitative data from females who persisted in a technology-based CTE program of study through to completion, proved to be valuable due to the themes which emerged: (a) instructor influence on program and participant goals; (b) the impact of collaboration; and (c) guidance and support focused on the individual.

Implications and Recommendations

The purpose of this phenomenological study was to understand and describe the experiences of female students who earned completer status in a technology-based CTE program of study (POS) in Central Virginia. The findings from this study could prove beneficial to stakeholders involved in the recruitment of CTE participants and course facilitation such as guidance counselors, administrators, and instructors. By examining the perception of female completers in a technology-based POS, the results of this study contribute to the existing literature related to the effectiveness of CTE and gender inequity in technology-based CTE enrollment and STEM.

Theoretical Implications and Recommendations

This study was guided by three theories relevant to why people choose certain career paths, what intrinsic and extrinsic forces guide those decisions, and the motivation a student might have to achieve, or feel they have something meaningful to contribute, within a given field of study or in their future employment. These theories are Bandura’s self-efficacy theory (2012),
Eagly and Karau’s role congruity theory (2002), and Lent, Brown, and Hackett's social cognitive career theory (1994). Each of the participants in this study had persisted in their technology-based CTE POS to earn completer status. Their descriptions were shared through face-to-face interviews, responses to online discussion boards, and submission of a photo essay. Themes that were derived as the essence of this study supported the guiding theories as well as extending the understanding of females who experienced success in a technology-based CTE POS despite being in the gender minority in terms of course enrollment.

In this study, three themes emerged from the analysis of data collected through face-to-face interviews, electronic discussion boards, and photo essay submissions. These themes confirmed the effects of Bandura’s self-efficacy theory (2012) and Lent, Brown, and Hackett's social cognitive career theory (1994), which suggests a focus on student interests, abilities, and values. One of the themes that emerged from the study is the instructor’s influence on program and participant goals, and participants described instructor relationships that encouraged their success and the success of classmates. Based on the findings of the study, it is recommended that learning environments which nurture professional instructor-student relationships be encouraged in order to increase the self-efficacy of the participants and address the elements of social cognitive career theory required for students to experience success.

Specifically, instructors should be encouraged to engage their students in activities through which they are able to observe and comment on student strengths and provide critique that focuses on specific skill development. However, it need not stop with the practice of instructors doling out grades. Encouraging self-assessment on the part of the students can help an instructor to get a picture of just how a student sees themselves, and peer assessment allows for team members to really drill down to which member has which strengths while also giving an
opportunity for the instructor to redirect the process in order to help the students tackle
challenging, multi-step problems requiring a variety of job skills. Additionally, it is
recommended that administrators and guidance personnel provide potential CTE candidates the
opportunity to choose a CTE POS that aligns with individual interests and goals in order to
bolster self-efficacy. What better way is there to prove a program has regard for a student’s
unique interests, abilities, and values?

Eagly and Karau’s role congruity theory (2002) suggests that gender-inequity diminishes
the contributions of females as a function of societal perceptions of gender roles. In this study,
the impact of collaboration emerged through student responses and perhaps most powerfully
through the imagery and captions from the photo essays, which used phrases such as “working
together,” “solve problems amongst ourselves,” “help one another,” “sharing ideas and
questions,” and “cooperation and group work.” Based on this data, I recommend instructors
encourage collaboration in projects and discussions to mitigate the negative impact of role-
congruity theory. Hands-on projects that involve all class participants allow learners to
contribute to their program of study in meaningful ways. Participants described activities in
which a team with well-defined roles that were subject to assessment from criteria within a
rubric as being particularly effective at eliminating the need to, as Isabella expressed it, “fight for
an opportunity to meaningfully participate.”

**Empirical Implications and Recommendations**

While research exists that quantitatively and qualitatively analyze the effectiveness of
CTE programs of study in general, no studies could be found that qualitatively considered the
experiences of students who have experienced success in their programs of study. The results of
this study add to the body of literature based on the experiences of females who earned
completer status in a technology-based program of study, which is a subset of CTE participation that has traditionally manifested a gender-inequity.

Students with CTE training are more likely to secure post high-school employment and to find full-time employment in fields related to their CTE POS (Kim & Passmore, 2016). Female and racial minority students who participate in career and technical education leadership programs realize improved high school grades, psychosocial, and achievement outcomes (Aragon et al., 2013). Ten of the participants in this study were enrolled in advanced placement courses or dual-enrollment courses, and 11 described having exceptional grade point averages and excellent college or career prospects. Therefore, the achievement outcomes for the participants of this study support existing research.

Fletcher’s (2012) research indicated that CTE graduates were 2.7 times more likely to be employed in STEM fields, while college preparatory graduates were 1.8 times more likely to be employed in business, management, and administration occupations. Gender was significantly related to all occupational choices. Implications of Fletcher’s study called for CTE teachers and leaders to find new strategies to attract more diverse students, particularly females and minorities, into programs that have predominately white and/or male enrollment. Based upon the finding in this study of the experiences of female high school students who earned completer status in a technology-based CTE POS, it is recommended that CTE instructors be afforded an opportunity to speak directly to program candidates. After all, the “C” in CTE stands for Career! The first step to enrolling in a CTE POS should be to sit down with the instructor for a skills assessment, or even a formal or informal interview. If that is not feasible for introductory courses, it should be considered before a student continues along an advanced track. It is critical to bear in mind the impact of the theoretical framework in the previous section, as the
effectiveness of all of this will be lost according to the experiences of the study participants if schools fail to ensure that guidance and recruiting efforts focus on the unique interests and skills of the candidates.

**Practical Implications and Recommendations**

The findings in this study can be used to develop recommendations for students who are considering any CTE program of study, as well as the instructors who facilitate the courses. The participants’ specific references to the value of teachers who were involved in their recruitment are very telling in terms of best practices for student enrollment. What follows are recommendations for students, instructors, administrators, and guidance personnel for increasing the effectiveness of recruitment, instruction, and support for females in technology-based programs of study. The implications and recommendations derived from participant data are supported by direct quotes from the study participants based upon their experiences.

**Recommendations for Students and Instructors**

Study participants spoke about the value of participating in a program of study that involves hands-on career training. Drafting/CAD student, Isabella, explained “In CTE, we're actually making or doing something and it's more like a workplace. We aren't confined to just sit at our desk.” Students who seek that type of value in their educational experience and want to get a leg up on others against whom they will one day be competing when it comes to college applications, internships, and careers should consider the benefits of a CTE program of study. However, based on the findings in this study it is recommended that students research the courses that are available and contact instructors directly if any questions remain. In a digital age, for students seeking training in a technology-based program of study, the internet should provide a bevy of resources to learn exactly what the state and school intends each course to be.
If a participant were to drill down to the instructor’s website or course description there may be additional information, recommended preparation activities, and most certainly an email address which will allow participants to make that direct contact. Be professional! CTE instructors take their courses very seriously and most have come directly from industry into the classroom and have real-life experience to share. However, the instructor is there to prepare students for a career, so putting that best foot forward is going to mean students must be professional, thorough, and clear in their research and communication.

Chloe, an IT Fundamentals graduate who went on to complete her bachelor’s degree in just three years, had an experience with a series of brief STEM projects in middle school, after which she said she was “biased against STEM encouragements because I wasn't interested in it.” Yet she went on to experience tremendous success in her program of study. Therefore, given that CTE programs can be the first step towards choosing and training for a career, it is important to not make a decision about what courses to take just by reading a paragraph in a course catalog or be dissuaded by one bad experience in the past. Students should ensure the course will align with their personal interests and goals. Here again, the school or instructor website may have videos from prior students and pictures of the CTE lab for the course.

Open house activities were discussed by participants as well. An event at which instructors have an opportunity to speak directly with potential program participants and their parents is common for many high schools and CTE centers already. Heather, who participated in Drafting/CAD, suggested the value of these events would be enhanced if instructors went a step further, saying “When the schools present and talk about CTE for the first time it might be beneficial if a female student or one of the female administrators could be there to talk about it.” Instructors ought to consider not merely handing out a pamphlet or being a talking head at a CTE
open house, but instead bring in a small yet diverse group of students to share their experiences in the class and possibly even show off ongoing projects and activities in the lab. Schools and individual instructors need a digital footprint, particularly for those facilitating a technology-based program of study. The participants all mentioned using technology extensively for communication and research. Therefore, instructors should consider preparing some video clips of what goes on in the classroom and in the lab. Instructors might wish to interview current students about what they enjoy in the class and what they wish they had done to prepare beforehand and post some clips on your course website. Interviewing former students who are now in college for commentary they might share about just how the course helped get them ready for university-level training or additional preparation they might recommend, and former students who are now in the workplace may provide helpful feedback to potential students. If the school division has a social media presence, consider at least a simple informational component describing the class on Facebook or Twitter. Take care to follow district guidelines and always be careful encouraging social media contact or participating in interactive social media contact that is not done through proper channels.

The implication of the impact of collaboration theme is that the participants benefitted from being involved in hands-on activities that required their active participation and collaborative input. Given that such experiences are a hallmark of CTE programs in general, it is recommended that instructors not only continue what they have been doing in terms of hands-on learning in class but also make sure projects and discussions encourage collaboration in ways that value the input of the entire class population. Many participants were a member of a career and technical student organization (CTSO) such as SkillsUSA or Future Business Leaders of America, and those participants who were members had great things to say about the leadership
and professionalism skills they developed within their CTSO. These CTSOs also sponsor local, state, and national contests and leadership conferences and it is worth investigating school, teacher, and student membership in such an organization. The findings in this study indicate the additional opportunities for hands-on learning, collaboration, and professional networking afforded by a CTSO are beneficial and long-lasting.

**Recommendations for Administrators and School Guidance**

Isabella, who completed her two-year CTE program of study in just one year, suggests “It’s simply helping people of any gender realize what they’re interested in at a younger age, especially since technology might not be something many girls initially think of.” Despite the fact that participants of this study ranged from high school seniors to college graduates, many commented on middle school activities that left an impression and impacted their decision to participate in a CTE program of study. These were not students from just one school who shared the same instructor and attended the same events, but instead represented six high schools, five instructors, and three different programs of study. These were not students who were placed in a class just to fill seats, but rather CTE participants who intentionally chose their program of study based on their unique interests and career goals. Some participants of this study received special services, while others were enrolled in the Commonwealth’s Governor’s School. Many took AP courses, dual-enrollment courses, participated in a variety of extracurricular activities, held leadership positions, and yet they spoke with a common voice about how much they valued having had an experience in a technology-based CTE program of study. Why? Phrases such as “working together,” “solve problems amongst ourselves,” “help one another,” “sharing ideas and questions,” and “cooperation and group work” were found in the data.

Based on the analysis of the data in this research, it is recommended that administrators
plan career days and open houses early and often. If a school is going to participate in a CTSO, that will require the support of administration. It is important to encourage such participation, work with instructors to help them get the resources and training required to participate at the highest level, and make sure the school website has links that will allow students to see what really happens in each CTE lab. When all is said and done, there is not a single recommendation from these findings that applies to students or teachers that will not require the support and encouragement of a caring and involved administration. Participants also commented on how it might be valuable to see female and minority administrators participate in the open house itself. For schools that are blessed to have such diversity at the highest level, this presents an excellent opportunity to get involved, be seen, be heard, and be a model for the kind of achievement that is expected from students.

It was not uncommon for participants to reflect on middle school experiences influencing their POS selection. However, few participants described having their programs of study recommended by guidance counselors, and more than one participant described having to go out of their way to convince counselors and parents to allow them to enroll in the course. The high achievement of the females in this study is testimony to the fact that administrators and guidance personnel need not be concerned about the impact of CTE participation on college acceptance percentages or participation in specialized educational programs. If schools seek to increase female enrollment in technology-based CTE programs, they must meet with each student, listen, and allow the students’ interests, skills, and career goals to guide their path. One participant mentioned meeting with a vocational or career counselor who specialized in identifying which programs of study would be the best fit. Administrators and guidance departments ought to work together to ensure that at least each district, and if the resources are available each school has a
counselor trained to perform skills assessments, interest inventories, and ensure that these valuable CTE resources are being taken advantage of by those who will benefit from them the most. Leadership conferences for CTSOs at the state and national level have training programs embedded into these events, and this presents an excellent opportunity for administration and guidance to show support for students and instructors while at the same time engaging in training and gaining access to invaluable additional CTE resources. Finally, if an administrator is going to be an instructional leader or an employee is going to have the word guidance in their title how can either of these happen unless students and teachers see them in the classroom. Not just for observations that involve a critique, but to put on those safety glasses and get involved. Ask students and instructors questions, smile, engage, and show care and support for every significant school program in ways that can be seen and heard and felt. After all, it is not just students who are crying out for the opportunity to collaborate and be valued for their individual skills and interests.

**Delimitations and Limitations**

The participants for this study were drawn from a criterion sample (Patton, 1990) of female, high school students who earned completer status in a technology-based POS at CTE Centers and high schools in Central Virginia, from the Virginia Department of Education CTE Red Region. A total of 12 female CTE completers participated in this study. Initially the decision was made to only involve high school graduates to get a picture of the participants’ entire experience as a reflection exercise. However, a decision was made by the school division IRB to have the former teachers of the study candidates make the initial contact with them as this might be less awkward. In meeting multiple times with instructors of technology-based CTE instructors, I was advised that they each had quite a few graduating seniors who had already or
were about to earn their completer status and that getting in touch with students from prior years would be far more complicated.

I submitted a protocol revision to the Liberty University IRB, which was approved. The revised delimiting factors, and their rationale, are as follows: Females, because this was a gender-based study involving a phenomenon being experienced by females; High school students or graduates who were enrolled in a technology-based CTE POS, because this study focused on a phenomenon related to low female enrollment specifically in technology-based programs of study; if graduates were involved they must have graduated no more than three years prior to their participation, so the descriptions of their experiences would be based upon as recent a recollection as possible; those who had earned completer status, because the focus was to look at not merely the experiences of females who had taken a technology-based CTE POS, but had in fact persisted through to the end of the program.

The most significant limitation of the study was the requirement to involve prior teachers in the recruitment of participants because as it turned out the instructors selected students who had not only earned completer status but were some of the highest achievers in their programs, and also students and former students with whom the instructors had exceptional relationships. Given the most glaring theme involved instructor influence on program and participant goals there is a concern that this selection process amplified those descriptions. Additionally, ten of the 12 participants were enrolled in advanced placement classes, dual-enrollment classes, or participated in Virginia’s Commonwealth Governor’s School for exceptional/gifted leaners. This limiting factor may have impacted the analysis of the role of both self-efficacy theory and social cognitive career theory.
Recommendations for Future Research

This qualitative study focused on the experiences of female high school students who earned completer status in a technology-based CTE program of study in Central Virginia. The participants were enrolled in three different programs of study. Future studies could look at those who participated in a single program of study, or those who attended school in another geographic area or focus on other under-served student populations. There is a need for qualitative research in all these areas to understand learners’ experiences and identify recommendations for closing gaps. If a particularly successful program is identified, it presents a tremendous opportunity for a case study or quantitative analysis of characteristics that contribute to the program’s success. Correlational studies on a successful program may divulge characteristics that had not been previously considered. The focus here was on those who had persisted to completion in order to get a portrait of “the ideal candidate” for success. Additional phenomenological research might involve students who did not earn completer status, not consider completer status at all, or potentially focus on those students who actively participated in a CTSO.

Due to division IRB requirements, previous instructors of the study candidates hand-picked a group of 12 exceptional, and in many cases gifted, participants. A study that allows for a more random selection of participants might be revealing in terms of the impact on theme development. Absent that option, perhaps a case study of female completers from a particularly successful program would help to confirm the findings of this study and potentially uncover additional characteristics of successful programs, and successful program participants.

Summary

In this qualitative phenomenological study, I sought to examine the lived experiences of
12 female high school CTE participants who persisted in a technology-based program of study in Central Virginia and earned completer status. The goal of this study was to add to the existing literature on female participation in STEM training programs in order to increase understanding of what individual qualities made up the portrait of a completer, and the factors that contributed to their program success. The participants provided first-hand accounts of their experience through face-to-face interviews, participation in an electronic discussion board, and submission of a captioned photo essay. As a result, three themes emerged from the data. Instructors have an influence on program and participant goals, collaboration has a positive impact on learning in a CTE program of study, and guidance and support focused on the individual.

Lyra attended a high school in Central Virginia and was bussed to a CTE Center to participate in a mechanical/architectural drafting and computer aided design (CAD) program of study for which she earned completer status and an industry credential. Lyra was born in Hawaii and lived in Japan and Texas before coming to Virginia. Despite completing two CAD courses at her high school, she sought out an opportunity to go further and complete the credentialing program at her school division’s CTE Center. Lyra explained:

In my sophomore year, I got AutoCAD certified, and then I learned to use AutoCAD here. So, my first year at the Career & Technical Center we re-learned everything that I already learned, but it was more in-depth. There were things that I already knew, but at the same time, there were things that I was still learning, like corporate standards, and just everything you would expect in a career on a day-to-day basis.

Whether a student has a background in their technology-based program of study or not, there is simply no substitute for exposure to a dynamic, hands-on program of study with a highly qualified instructor who encourages collaboration and the participation of all class members, and
who places a value on supporting students as individuals. Moreover, gender ought not be a determining factor for who is or is not included in powerful learning opportunities that can determine the path of a person’s entire career.
REFERENCES


graduation rates of students in the commonwealth of Virginia. SAGE Open, 2(3), 215824401245543. doi:10.1177/2158244012455437


Daggett, B. (2013). *Begin with the End in Mind*. Keynote address presented at Model Schools Conference, Washington, D.C.


Farías, M., & Sevilla, M. P. (2015). Effectiveness of vocational high schools in students’ access


Gammill, D. M. (2015). Time to give CTE what it deserves--R-E-S-P-E-C-T: Changing our perception of career-technical education is one of the best things we can do for students and the profession. Phi Delta Kappan, 96(6), 17.


Goins, C. (2016). A phenomenological study examining the experiences of high school graduates


67-77. doi:10.1002/cc.20254


Smith, D. J. (2017). Implications for policy and practice: Summary of the volume and lessons for
the future of CTE programs and STEM. New Directions for Community Colleges, 2017(178), 91-95. doi:10.1002/cc.20256


Appendix A: Expected Interview Responses

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Researcher Pre-suppositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question #1. Tell me about yourself – where you are from, where you’ve been.</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>Question #2. Tell me about your educational history.</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>Question #3 (DB Forum I, Question #1). What are your first memories of using technology?</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>Question #4 (DB Forum I, Question #2). Think back over all the years that you have participated in technology use and describe your fondest memory.</td>
<td>Based on the review of literature and my personal knowledge of students in similar courses, I expect this memory will be related to computer games (Demiray, 2010)</td>
</tr>
<tr>
<td>Question #5 (DB Forum I, Question #3). How often and when do you use technology during a typical day?</td>
<td>Based on the review of literature and my personal knowledge, I expect most participants will state that they use technology all day long (Demiray, 2010)</td>
</tr>
<tr>
<td>Question #6. What was your CTE Center (or lab) experience like when you first arrived?</td>
<td>Based on the review of literature and my personal knowledge of CTE centers, I expect answers will focus on how the lab is set up to allow for hands-on training (Carver &amp; Kosloski, 2015).</td>
</tr>
<tr>
<td>Question #7. How did you feel about being there?</td>
<td>Based on the review of literature, I expect answers will focus on females immediately feeling they are a minority in the class population (Harris et al, 2009).</td>
</tr>
<tr>
<td>Question #8 (DB Forum II, Question #1). How would you describe your high school experiences outside of CTE?</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>Question #9. How would you describe your experiences within the CTE program?</td>
<td>Based on the review of literature, I expect answers will focus on the hands-on nature of the training (Carver &amp; Kosloski, 2015) and having overcome some social obstacles (Fletcher, 2012).</td>
</tr>
<tr>
<td>Question #10 (DB Forum III, Question #1). What motivated you to participate in your selected CTE Program of Study?</td>
<td>Based on the review of literature, I expect answers will focus on the influence of peers or parents (Franklin, 2013).</td>
</tr>
<tr>
<td>Question #11. What specific guidance were you provided prior to and during high school?</td>
<td>Based on the review of literature and my personal knowledge of guidance influence in course scheduling, I expect answers will focus on participants having to specifically ask to be placed in a course, if not outright convince someone to allow them in (Kim &amp; Passmore, 2016).</td>
</tr>
<tr>
<td>Question #12. What activities did you participate in prior to and during high school that encouraged you to select your program of study?</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Question #13. Which courses did you find the most challenging in your program of study?</td>
<td>Based on personal knowledge, I expect answers will focus on the “book learning” aspects of the coursework, such as terminology and jargon rather than hands-on experiences.</td>
</tr>
<tr>
<td>Question #14. How would you describe the importance of your participation in a CTE program of study on your career plans?</td>
<td>Based on the review of literature, I expect answers will focus on the importance of acquiring hands-on training in the lab (Van Noy, Trimble, Jenkins, Barnett, &amp; Wachen, 2016).</td>
</tr>
<tr>
<td>Question #15. Who do you believe technology-based CTE courses are designed to serve?</td>
<td>Based on the review of literature, I expect answers will focus on either personal career goals (Carver &amp; Kosloski, 2015), or gender roles within STEM-based career preparation programs (Negra, 2009).</td>
</tr>
<tr>
<td>Question #16. How would you describe the importance of CTE programs in secondary education?</td>
<td>Based on the review of literature, I expect answers will focus on the importance of acquiring hands-on training in the lab (Van</td>
</tr>
<tr>
<td>Question #17. How did concentrating in a technology-based program of study better prepare you for your college and career goals?</td>
<td>Based on the review of literature, I expect answers will focus on the importance of acquiring hands-on training in the lab (Van Noy, Trimble, Jenkins, Barnett, &amp; Wachen, 2016).</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Question #18. Why do you think so few female students participate a technology-based program of study?</td>
<td>Based on the review of literature, I expect answers will focus on societal perceptions of gender roles (Negra, 2009; Eardley &amp; Manvell, 2006).</td>
</tr>
<tr>
<td>Question #19 (DB Forum III, Question #2). What could be done to alter that decision for others?</td>
<td>I have no prior expectation for this question.</td>
</tr>
<tr>
<td>Question #20. Considering your academic and career history, how would you compare the CTE environment to the environment in which you took your core curriculum classes such as math or language arts?</td>
<td>Based on the review of literature, I expect answers will focus on the importance of acquiring hands-on training in the lab (Van Noy, Trimble, Jenkins, Barnett, &amp; Wachen, 2016).</td>
</tr>
<tr>
<td>Question #21. How would you describe the challenges you faced in your CTE program of study?</td>
<td>Based on the review of literature and personal knowledge, I expect answers will focus on the “book learning” aspects of the coursework,</td>
</tr>
</tbody>
</table>
such as terminology and jargon rather than hands-on experiences (Carver & Kosloski, 2015).

<table>
<thead>
<tr>
<th>Question #22</th>
<th>What is your proudest and/or most defining moment in your CTE experience?</th>
<th>I have no prior expectation for this question.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB Forum II, Question #2. Share an anecdote about the most memorable negative experience you had in your CTE POS.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question #23</th>
<th>What did you do after high school?</th>
<th>I have no prior expectation for this question.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Question #24</th>
<th>How much of the success you have had in your current job (or education program, if still in college) would contribute to your CTE POS experience?</th>
<th>Based on the review of literature, I expect answers will focus on the importance of acquiring hands-on training in the lab (Van Noy, Trimble, Jenkins, Barnett, &amp; Wachen, 2016).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question #25</th>
<th>What else do you wish to share about your experience in CTE?</th>
<th>I have no prior expectation for this question.</th>
</tr>
</thead>
</table>

| DB Forum I, Question #3. Share an anecdote about the most memorable negative experience you had in your CTE program of study. | Based on the review of literature, I expect answers will focus on gender roles within STEM-based career preparation programs (Negra, 2009). |
Appendix B: Sample Interview Journal Reflective Entry

<table>
<thead>
<tr>
<th>Individual Interview</th>
<th>My thoughts and feelings regarding the interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview #3 May 22, 2019 - Chloe</td>
<td>Chloe was the first participant to meet me at a public location other than a school conference room for an interview, which was scheduled for 3pm. I arrived five minutes early to find that Chloe was already there and had taken a seat. She had not ordered anything yet, and as agreed upon beforehand I paid for her drink, soup, and salad. When we first introduced ourselves and as she ordered, I began some casual conversation in order to try to build rapport. I described the purpose of the study in more detail and answered some simple questions she had about additional elements of the study and she told me about her current college program and some of her short-term goals. The interview itself lasted roughly twenty-five minutes, and Chloe was extremely thoughtful and yet deliberate in her responses. It seemed she had put some prior thought into how she might answer some of the more predictable questions, but her demeanor was very relaxed and she was enthusiastic about both her participation in her STEM program as well as participating in the research itself. One thing that really struck me about Chloe is that, despite being one of the participants who had been out of her program the longest she has very specific memories of her experiences in the</td>
</tr>
</tbody>
</table>
course and her interactions with the instruction. She seemed almost apologetic that she was not planning to enter a career field specific to her CTE program of study, but was able to identify many aspects of the course from organization and problem solving to some specific technologies themselves that would benefit her in any career she chose.

After the interview, I have to say that I am looking forward to her participation in both the discussion board and photo essay due to the clarity of her recollections about the program and her insight into the impact of guidance, the course content itself, and her instructor.