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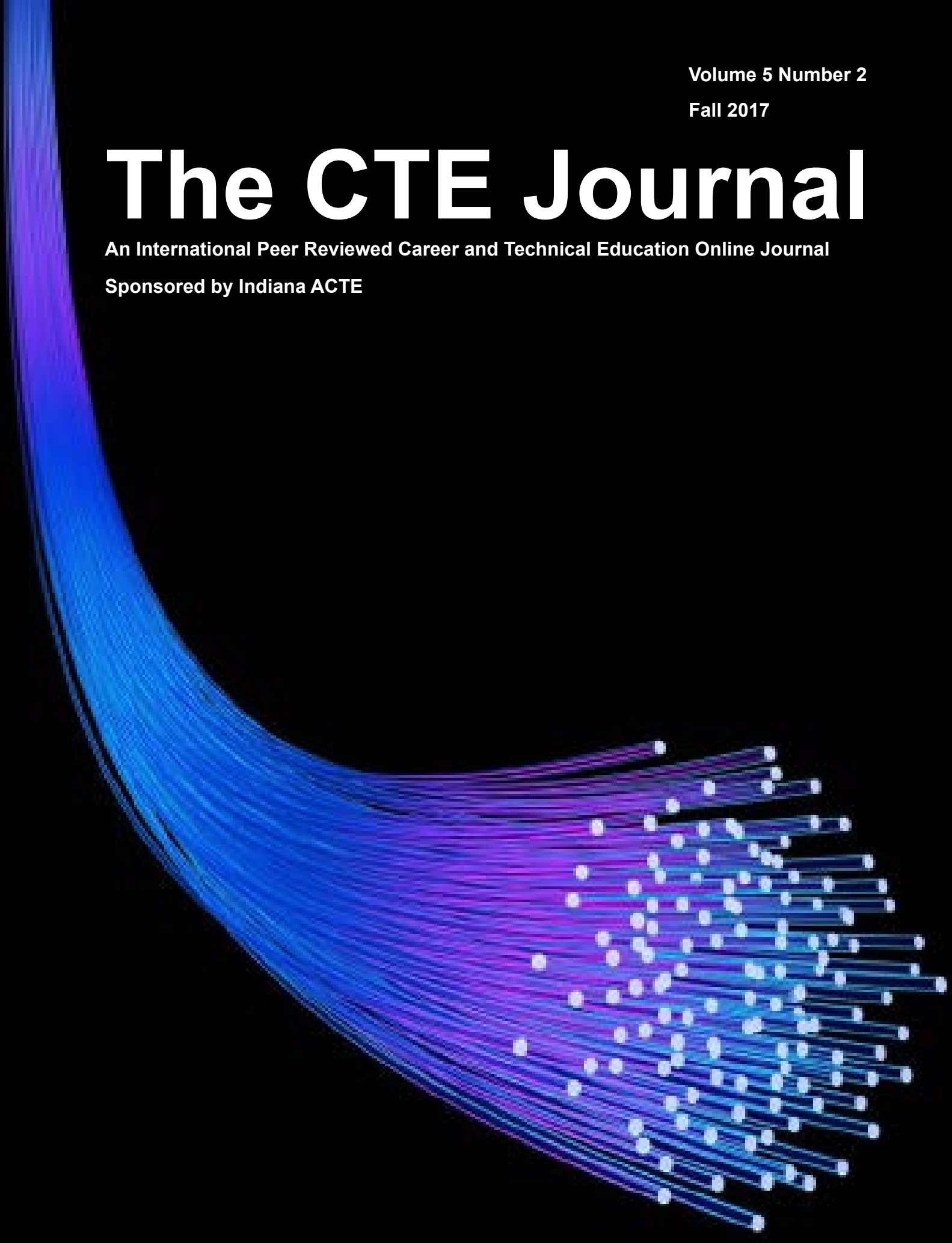

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Career and Technical Education: The solution for preparing today's youth for college and career

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Introduction

For some time, college and career pathways have operated as separate units; one pathway for students going to college and another for students entering the workforce, with both pathways focusing on the end-goal of high school graduation. However, in June 2010, the release of the Common Core Standards began a movement to prepare all students to be college- and career-ready. Nevertheless, according to an analysis of transcripts from the High School Longitudinal Study published by the Education Trust, only 8 percent of high school graduates completed a full college- and career-prep curriculum and nearly 50 percent of high school graduates did not complete either a college- or career-preparation curriculum (Bromberg & Theokas, 2016). After analyzing trends in the experiences and preparation of U.S. high school graduates, Bromberg and Theokas (2016) reported that, "instead of being prepared for college and career, many of our students turn out to have been prepared for neither" (p. 1).

Combining the separate college and career pathways, may be the solution for preparing today's youth to be college- and career-ready. Consistent with this perspective, in 2017, the Association for Career and Technical Education (ACTE) emphasized the need to prepare *all* high school students to achieve their long-term goals through equal development of core academic skills, employability skills and knowledge, and technical, job specific skills. This could be accomplished by further developing Career and Technical Education (CTE) curriculum to integrate career-ready pathways with college-ready curriculum.

Background

As far back as the late 1800's debates existed over the purpose of the American high school. Lee and Ready (2009) described, "the controversies centered on basic issues of what students should learn, whether all students should learn the same thing, and who should make decisions about such matters" (p. 137). In 1893, the Commission on Ten, a national commission formed by the National Education Association, studied the American high school and suggested the following recommendations: (1) students should be permitted little curricular choice, and (2) all high schools should offer a narrow academic curriculum that does not distinguish students heading for work from those heading to college (National Education Association, 1893). Twenty-five years later the Cardinal Principles of Secondary Education took the position that, "schools should offer a broad and diffuse curriculum, one that included a wide range of academic and

vocational offerings that varied not only in content but also in rigor" (Lee & Ready, 2009, p. 137). It was during the twentieth century that two distinct tracks were developed for students attending college and for students bound for work. Change occurred again during the 1960's where the shift moved towards student choice within a more flexible curriculum (Cusick, 1983). Known as the comprehensive curriculum (Lee & Ready, 2009), this academic structure remained in place until the 1980's when the National Commission on Excellence in Education published, *A Nation at Risk* with recommendations to move back to a common academic high school curriculum (Gardner, 1983). *A Nation at Risk* emphasized academic underachievement on a global level. Since this time education curricular reform has been influenced by national and state standards, education legislation, and increases in required graduation credits and courses (Lee & Ready, 2009); although students may have some flexibility in regard to course selection, there is still a disparity of cohesiveness between career-ready and college-ready curriculum (Bromberg & Theokas, 2016).

Career and Technical Education

The ACTE (2002) states that Career and Technical Education (CTE), "as we know it today has its roots in the founding of the United States" (para. 2). Apprenticeships are credited with being one of the earliest forms of vocational education along with "a strong knowledge base and skill set for citizens" (ACTE, 2002, para. 2). Over time, vocational education changed in name and intent adapting to the prevailing social needs.

Key educational legislation that has impacted CTE can be dated back to 1862 with the passing of the Morrill Act. The Morrill Act was the first legislation to support vocational education by providing land that states could sell to fund agricultural and mechanical colleges. Subsequent legislation such as the Second Morrill Act 1890, the Hatch Act, and the Adams Act of 1906 continued to support agricultural educational initiatives.

The 20th century brought significant change to vocational education. Growth in economic and industrial development, World War I, the Great Depression, and World War II all contributed to developing vocational education especially the training of women, youth, and veterans. The Smith-Hughes Act of 1917 provided the first federal investment in vocational education funding agriculture, home economics, and trade and industrial education. Other key legislation includes; The George-Deen Act of 1936 funding teacher education and marketing; The George-Barden Amendments of 1956 funding vocational centers, nursing, and fishery; The Vocational Education Amendments of 1969 funding for student specific population and postsecondary students; 1984 vocational education was renamed Carl D. Perkins Vocational Education Act of 1984; Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990 included accountability, secondary and postsecondary alignment, and business partnerships; and the School-to-Work Opportunities Act 1994 linked work-based and school-based learning expiring in 2001.

In the 21st century, the Carl D. Perkins Career and Technical Education Act of 2006 introduced programs of study and retired "vocational education". The Strengthening Career and Technical Education for the 21st Century Act (2016) provided states flexibility while promoting innovation and program alignment of administrative requirements. Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) has been instrumental in moving all students toward college- and career-readiness by promoting "a greater focus on academic rigor, career-focused programs of study, articulation between secondary and postsecondary education, and greater accountability" (Brand, Valent, & Browning, 2013, p. 2). Programs of Study (POS) are organized into 16 career clusters and provide students more than 79 career pathways. Schools that receive Perkins IV funding to support CTE programs must offer at least one program of study that:

- Incorporates secondary education and postsecondary education elements;
- Includes coherent and rigorous content aligned with challenging academic standards and relevant career and technical content in a coordinated, non-duplicative progression of courses that align secondary to postsecondary education;
- May include opportunity for secondary education students to gain postsecondary education credits through dual or concurrent enrollment programs or other means; and
- Leads to an industry-recognized credential or certificate at the postsecondary level or an associate or baccalaureate degree. (Carl D. Perkins CTE improvement act of 2006, 2006)

CTE programs are uniquely positioned to advance the necessary skills and knowledge of students to be successful by developing and implementing a comprehensive college- and career-ready curriculum within CTE programs. College-prep curriculum typically consists of four credits in English; three credits in math, science, and social studies; and two credits in the same foreign language (Bromberg & Theokas, 2016, p. 2). The college-prep curriculum is not a rigid track rather it is structured on student curricular choice. Lee and Ready (2009) explain, "many high schools permit students to select among three distinct levels of eleventh-grade U.S. history: regular, honors, and Advanced Placement" (p. 138). Honor courses are considered to be more academically challenging by entailing a, "more demanding college-preparatory coursework, and they were intended for the highest-achieving or most academically accelerated students in a school" (Abbott, 2016, para. 1). Another option for high-achieving high school students are Advanced Placement programs where unlike honors courses students can earn college credit or advanced placement of introductory college level courses.

The Advanced Placement program (AP), created by the College Board in 1952, is a popular high school academic program which exposes high-achieving high school students to advanced academic content (Warne, Larsen, Anderson, & Odasso, 2015). High school students can elect to take AP courses in which they learn college-level material in their high school course which culminates with a standardized exam at the end

of the course. Students who score well on the AP exam can earn college credit from the university and/or advance standing in introductory level college courses. The College Board (2013) in the *AP Report to the Nation* highlights the steady growth in the AP program over a ten-year period, nearly "doubling the number of students who have been given access to the opportunity of AP" (p. 6). However, the College Board also noted there are, "nearly 300,000 students in the class of 2013 with potential to succeed in AP graduated having never participated in a matched AP course" (p. 7); such as evident in the sciences where, black/African American, Hispanic/Latino, and American Indian/Alaska Native students who have the same AP readiness as their Asian/Asian American/Pacific Islander peers are significantly less likely to experience AP-level course work (p. 28). Traditionally, AP programs serve a select high school population with a focus on college-readiness and is working on advancing the opportunities for low-income students and students of color. Unfortunately, both honor courses and AP courses are not inclusive of providing opportunities to all students in preparing them for college-readiness.

Statistical evidence supports the need for development of pathways that focus on core academic skills, employability skills and knowledge, and technical, job specific skills of students. According to the Southern Regional Education Board (2012), 80 percent of students taking college preparatory courses and CTE courses meet college and career readiness goals, whereas only 63 percent of students meet college and career readiness goals when taking the same college preparatory courses without involvement with CTE courses. Further development of CTE program of studies with college preparatory courses can benefit students of all abilities and socio-economic status. Bromberg and Theokas (2016) stated that, "Students from disadvantaged backgrounds were 14 percentage points less likely to complete a college-prep or college- and career-prep course sequence than advantaged students" (p. 4). While the benefits to students are great, there are significant challenges that must be overcome to maximize the benefits for all students. The Independent Advisory Panel (IAP) of the National Assessment of Career and Technical Education (2014) identified three recommendations to strengthen the full potential of college- and career- readiness. First, integrate CTE with broader education reform; second, develop greater coherence between secondary and postsecondary CTE; and third, gather robust, actionable information about the implementation and outcomes of CTE. The IAP (2014) concluded,

> Continued federal investment in CTE is warranted, but today's CTE must make itself part of the repositioning of the broader landscape of K–12 and postsecondary education for the 21st century. It must embrace the new Common Core State Standards to support student academic achievement as well as students' long-term success. CTE must reposition itself not just as a vocational alternative to college prep but as a pathway into postsecondary programs that links degrees and credentials to occupations. (p. ES-2)

Conclusion

Historically, CTE has been adapting to meet the demands of the American work force, the needs of advancing technologies and has often been the answer to meet the challenges influencing our nation's economy. With a strong backing of federal funding, CTE is in a positioned to be the solution to preparing all students for college- and career-readiness through further development of comprehensive curriculum aligned with core academics, employability skills, and technical, job specific skills. In order to maximize the full potential of CTE, it must position itself in a larger scope of K-12 education reform as a cohesive pathway preparing students for both entry into the workforce and postsecondary education. CTE can provide the leadership that will prepare students to be successful in today's globally competitive high-skills, high-demand work force.

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CTE Students' Perceptions of Preparedness for Post-Secondary Opportunities

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Abstract
The recent passing of House Bill 5 (HB5) in Texas has renewed interest in CTE programs and in the importance of preparing students for college and careers. Research indicates that CTE programs are effective in decreasing dropout rates, increasing attendance, increasing student grades, and encouraging students to pursue careers and post-secondary education. This study was conducted using quantitative analysis to determine if there is a relationship between the perceptions of the student's preparedness for college or university, trade school, or a career, and five factors of the CTE endorsement area. The five factors researched were curriculum, extracurricular activities, facilities, teacher knowledge, and administrator support. The study utilized a survey research instrument that was administered to high school seniors enrolled in a CTE course at one of two south central Texas high schools. Analysis of data determined that there are significant differences in specific endorsement areas on student's perceptions of preparedness. Results can be utilized by educators and administrators to implement components of House Bill 5 and to strengthen CTE programs across south central Texas.

Introduction

Research indicates that Career and Technical Education (CTE) programs are effective in decreasing dropout rates, increasing attendance, increasing student grades, and encouraging students to pursue careers and post-secondary education. The purpose of this study was to determine CTE students' perceptions of preparedness for post-secondary opportunities. This study was conducted using quantitative analysis to determine if there is a relationship between the perceptions of the student's preparedness for college or university, trade school, or a career, and five factors of the CTE endorsement area. The five factors researched were curriculum, extracurricular activities, facilities, teacher knowledge, and administrator support. It was determined that there is a significant difference between the Public Service and Business and Industry Endorsement area on students' perceptions of preparedness for higher education in the areas of facilities and curriculum. There is a significant difference between the Public Service and Business and Industry Endorsement area on students' perceptions of preparedness for careers in the

area of teacher knowledge. Lastly, there is a significant difference between the Public Service and Business and Industry Endorsement area on students' perceptions of preparedness for vocational or trade schools in the areas of facilities and teacher knowledge. Data collected from this study can be utilized to strengthen CTE programs.

Texas school leaders in Career and Technical Education (CTE) have continuously been at the forefront of educational reform. CTE programs have strived to provide students with the tools needed to become talented and skilled employees. Recent movements have led CTE leaders and government officials to call for increased rigor and relevance in CTE courses. These leaders have promoted the benefits of Career and Technical Education and aimed to evaluate and make progress towards improving CTE programs. While it is well known that CTE courses prepare students for college and careers (Lakes, 2007; Haniford, 2008), it is unknown if the students enrolled in these courses perceive themselves as ready to enter the workforce, traditional higher education, or vocational schools.

The purpose of this study was to determine senior students' perceptions of preparedness for post-secondary education or the workforce, in their CTE field of study. A ten point Likert Scale survey was administered to high school seniors who were enrolled in a CTE course to determine their perceptions of preparedness in five post-secondary goal areas. The five areas students were surveyed on are curriculum, extracurricular activities, facilities, knowledge of the teacher, and administrator support. Certifications and hands-on experience are integral and required portions of CTE curriculum, and provide students with real life applications for the curriculum. Gutek (2004) explains that education is not merely about metaphysics and curriculum, but it should also encompass epistemology, the relationships between humans, culture, and society. CTE programs give students the opportunity to gain the skills necessary to interact in the real world. This is why it is essential to determine whether high school seniors enrolled in CTE courses perceive themselves as prepared for their post-secondary goals.

Review of Literature

Numerous studies have been conducted to determine the effectiveness of CTE programs on student success. A study conducted by Smith indicated that providing a rigorous curriculum to all CTE students is essential to their success regardless of their postsecondary plans (2012). According to Smith, CTE is an essential tool to allow students the opportunity to "explore career options, remain engaged in school, gain skills that are broadly useful in the labor market, and prepare for further study" (2012, p.15). Haniford, (2008) indicated that while, 67% of CTE instructors stated students need to make real life connections that relate to their career goals, only 45% of college preparatory teachers saw this as important. Kwong (2010), concluded that students enrolled in career academies are more likely to experience greater success on standardized mathematics tests, higher grade point averages and feel more like a family than students who are not enrolled in career academies. Alonzo (2011) determined that CTE programs have a beneficial impact on student graduation rates. Research indicated that students who were listed as low socioeconomic status or who were enrolled in

limited English proficiency, English as a second language, and parenting education programs along with a CTE program had higher graduation rates than students enrolled in these programs without CTE program participation (Alonzo, 2011, p. 110).

Connecting education to real life has long been a focus in educational research and reform. Dewey first indicated a need to connect these two integral parts of education in 1938. Roberts describes Dewey's theories of experiential learning as "people living in a world surrounded by people and other things that are a result of previous human experiences, these experiences construct knowledge, as we know it" (2003, p. 4). Further research suggests that linking curriculum to real life student experiences increases the student's desire to learn and enhances their level of engagement (Loera, Nakamoto, Joo Oh, & Rueda, 2013). CTE programs offer curriculum based on real world experiences, combined with the needs of local industries, which allow for the creation of programs customized to the current needs of the local area (Rhodes, 2014).

This is more likely to peak their interest, causing greater engagement and retention of information. In fact, research conducted by Alonzo (2011) indicates that students who were listed as low socioeconomic status or who were enrolled in limited English proficiency, English as a second language, or parenting education along with CTE had higher graduation rates than students enrolled in these programs without CTE participation. The sub populations listed above are typically considered hard to reach or at risk students.

Other studies indicate a link between students enrolled in CTE courses and lower high school dropout rates. The two leading reasons why students drop out of high school are lack of interest and lack of support for education (Bloomfield, Foster, Hodes, Konopnicki & Pritz, 2013). According to the Association of Career and Technical Education (ACTE), the national completion rate for students enrolled in CTE courses is 90.81% of students (2014). This should be compared to the national completion rate for high school students of 74.9% (ACTE, 2014). Bloomfield et. al. (2013) describe the factors that decrease dropout rates as including a strong relationship between student and teacher, personalized instruction, and mentoring, all of which are characteristics of quality CTE programs. A study on student perceptions of CTE programs noted that, of the respondents enrolled in CTE programs, only 10% had ever considered dropping out of high school at some point (StGene, 2010). Research suggests that a combination of one CTE course for every two academic courses will decrease a student's likelihood of dropping out of high school (Plank, DeLuca, & Estacion, 2008). This is due to the combination of emotional, behavioral and cognitive engagement that a student experiences when combining CTE programs with academic programs (Plank, DeLuca, & Estacion, 2008).

While the majority of American high school students indicate they have a strong desire to continue their education through college, the reality is that many students do not attend college, making their high school training even more essential. StGene (2010) indicated that 32% of students surveyed who were enrolled in CTE courses had perceived CTE

programs to be for students who do not plan on attending college, but rather plan on going straight to the workforce. Of these same students, 54% of them indicated they planned to attend a 2-year college after graduation from high school (St Jean, 2010). According to Schwartz (2014), 90% of CTE students indicate a desire to pursue a postsecondary education and 70% of students will actually enroll in college level coursework. The numbers, however, are far less favorable for completion. Of the 70% of students who enroll in college level coursework, only 32% will have completed a four-year degree by their mid-20's, and only another 10% will ever complete a two-year degree (Schwartz, 2014). CTE courses provide students with hands-on education while meeting the individualized needs of each student. This increases student engagement which, in turn, significantly decreases dropout rates (Closs, 2010). Providing students with a rigorous academic setting, paired with a valuable CTE certification can equip students for success.

While many opponents criticize the decreased rigor of math, many proponents applaud the efforts to recognize students who are interested in both college and career readiness. The ability of students to choose a pathway of interest, and of schools to offer CTE programming to replace traditional core courses has many excited about the opportunities that exist for students. According to Smith (2012), CTE is an essential tool allowing students the opportunity to "explore career options, remain engaged in school, gain skills that are broadly useful in the labor market, and prepare for further study" (p. 15). Research indicates that integration of academic curriculum and CTE curriculum can increase student motivation and achievement, and help reduce dropout rates (Handy & Braley, 2012). Smith, (2013) indicates Carneval, the director of Georgetown University's Center on Education and the Workforce was quoted by Smith as stating "it is becoming a problem because we keep upping the ante and standards never get high enough… at some point no one is going to graduate from high school, except the two kids that are going to Harvard" (2013). Smith (2013) also quoted Stuart, an assistant superintendent of Nacogdoches Independent School District, as she testified to the State Board of Education, stating "to require these courses in high school is to deny many students the opportunity to graduate high school because they have not mastered a sequence of math courses they will never need" (2013). Wang and King (2008) indicate that allowing students to choose from a variety of course options is essential as it creates a democratic like scenario for students to participate in. Montgomery (2013) noted that the failure of Texas to place emphasis on career and technical training in the past has led to an unprepared workforce in the state.

Research has indicated that a need is present for CTE curriculum to be integrated into the core curriculum. Further, superintendents are more supportive of CTE programs and professional development that integrate core curriculum. This is seen as a method of reinforcing academic curriculum (Cannon, Kitchel, & Tenuto, 2013). It should be noted that mean test scores for core subjects of students enrolled in CTE courses were higher than non-CTE students (Snowe & Okojie, 2013). One main point of support for this bill,

according to the House research Organization, is that the bill will "maintain rigor while providing students flexibility to pursue college or career interests" (2013, p. 9).

Students seem to favor course choice as well. Research conducted by Closs (2010), indicated that students felt as though a large variety of CTE course availability would lead to increased grades on report cards. This same research also stated that larger varieties of options for CTE courses could lead to less interest in students dropping out of high school before receiving their diploma (Closs, 2010). Students enrolled in CTE courses have the opportunity to participate in hands-on training and learning that relates to experience in the workforce. Gordon (2014) notes that when education is provided through a real world, hands-on setting, students are more likely to retain the knowledge.

Traditionally, the vocational school path that students choose has been frowned upon and viewed as less than ideal and undesirable (Dare, 2006). According to Mupinga and Livesay (2004) vocational schools are no longer for the non-college bound students, dropouts, students with special needs, or those unable to cope with traditional college. Salopek (2007) indicates more than 9,400 institutions are offering post-secondary education in the form of community colleges, technical programs, skill centers, and other opportunities related to CTE. Similar to the success CTE courses provide students in high school, research has indicated CTE courses effectively prepare students for post-secondary education and careers. The East Valley Institute of Technology (EVIT) considers itself to be a college prep academy for vocational education (Todd, 2015). The campus is an innovative school that offers students the opportunity to earn college credits in CTE courses while still enrolled in high school. According to Todd (2015) two out of three students enrolled in EVIT over the last nine years have continued to a four-year university. Stipovanvic, Lewis, and Stringfield (2012) indicated that students enrolled in a CTE Program of Study (POS) transitioned easier to postsecondary education, were required to enroll in fewer remedial courses, were more likely to have post-secondary plans, and were as likely to be awarded admission to four-year universities as students not enrolled in CTE. Students enrolled in a POS had earned more credits than their peers who did not make a transition from high school to college through a POS (Stipovanvic et al., 2012). Various post-secondary education incentive programs, such as Project Lead the Way (PLTW), POS, and EVIT have been implemented nationwide, bridging the gap between traditional CTE courses and post-secondary education attendance and completion (Dare, 2006). Dare (2006) notes that PLTW has a 90% success rate for the completion of the first year of college for students, coming from CTE programs, with 75% of the student continuing to a two or four-year degree in engineering or engineering technology. Research indicates that more that 65% of students enrolled in CTE tech prep programs in Idaho enrolled in post-secondary education within three years of graduation (Ball, 2005). CTE students who attempt post-secondary educational opportunities tend to experience more success today, than ever, as CTE programs implement more rigorous coursework into the curriculum.

Methodology

Research Design

This research was conducted using an ex-post facto design. Students chosen to participate in this study were asked to complete a 10-point, Likert scale survey. The purpose of the survey was to collect data regarding the student's perceptions of preparedness for post-secondary opportunities in their CTE field. The survey was divided into four major categories:

1. Preparedness for higher education (2-year community college, or 4-year university)
2. Preparedness for a career in the field of the student's CTE coursework
3. Preparedness for trade of vocational school
4. Demographics

Population and Sample

The population utilized for this study included 770 twelfth grade students enrolled in a CTE endorsement program in one south central Texas school district. A convenience sample of 76 twelfth grade high school seniors enrolled in a CTE endorsement program at two 6A south central Texas high schools was utilized. The students who chose to participate range in age from 16 years old to 19 years old, were enrolled in CTE courses and have chosen an endorsement area offered in their school.

Student participants were chosen based upon the following criteria:

1. The student was a senior
2. The student was enrolled in an upper level CTE course
3. The parents completed the participation informed consent
4. The student completed the participation informed assent

Instrumentation

This survey was constructed utilizing information provided by M. D. Gall, Gall, and Borg (2007). Data on preparedness was collected in five different areas:

1. Curriculum – the information prepared for the students and presented by the teachers throughout the student's time in CTE courses.
2. Extracurricular Activities – Career and Technical Student organization opportunities provided in the CTE endorsement program.
3. Facilities – The facilities available to students throughout their time in the CTE Endorsement program.
4. Teacher Knowledge – The knowledge of the teachers in the CTE endorsement program in regards to their area of expertise.
5. Administrator Support – The amount of support provided by the administration for students to be able to pursue this opportunity.

A definition of terms for each answer is listed on the survey. Students were asked to rate their level of preparedness in each of these areas on a scale of 1 to 10, ranging from 1) highly unprepared, to 10) highly prepared.

Data was collected regarding three of the five possible endorsement areas. The schools that were surveyed offer each of the five endorsement areas, Business and

Industry, STEM, Public Service, Arts and Humanities, and Multidisciplinary. Only two of these endorsement areas include courses and focus areas from CTE; therefore, only students enrolled in the Business and Industry, and Public Service endorsement areas were surveyed. For the purpose of this study, endorsement areas are broken into more specific focus areas utilizing labels as assigned by the local campuses. The Business and Industry endorsement included courses from the Agriculture, Food, and Natural Resources; Audio/ Video; Hospitality and Tourism; Information Technology; and Architecture and Construction focus areas. The Public Service endorsement included courses from the Law, Corrections, and Security; Health Science; and Education and Training focus areas.

Data Analysis

A univariate analysis of variance (ANOVA) was employed to determine if there was a significant difference between the students' endorsement area, and the perception of preparedness for post-secondary opportunities in any of the five areas; curriculum, extracurricular activities, facilities, teacher knowledge, and administrator support. The ANOVA was utilized to determine the relationship between each independent variable and the student's perception of preparedness.

Results

Pilot Study

The research instrument was created by the researcher. In order to ensure reliability, a pilot study was conducted on 18 junior level students (n=18) at one 6A high school in south central Texas. The students were selected using the following criteria:

1. The student was a junior
2. The student was enrolled in an upper level CTE course
3. The parents completed the participation informed consent if the student was under 18 years of age.
4. The student completed the participation informed assent

A Cronbach's Alpha was utilized to calculate the reliability of the survey. The area of curriculum had a high level of internal consistency, at .873, as did extra-curricular with a level of .926, facilities at a level of .928, teacher knowledge at a level of .917, and administrative support at a level of .968, as indicated by a Chronbach's Alpha.

Descriptive Statistics

Table 1 depicts the number of courses each student had taken in CTE, and depicts the frequencies for demographics of the participants.

Table 1
Demographic Information on Participants, N=76

Variable		*n*	Percentage
Age			
	15	0	0%
	16	1	1.33%
	17	22	29.33%
	18	48	64%
	19	4	5.33%
	Missing	1	
Gender			
	Male	32	42.67%
	Female	43	57.33%
	Missing	1	
Ethnicity			
	White	36	48%
	Hispanic	20	26.67%
	Black	11	14.67%
	Asian	3	4%
	Other	5	6.67%
	Missing	1	
Number of CTE Courses			
	1	15	20%
	2	13	17.33%
	3	20	26.67%
	4	7	9.33%
	More than 4	20	26.67%

Students who completed the survey were asked to indicate which endorsement area they had chosen. The students' responses indicated that thirty-one students or 40.78% of the sample had chosen two endorsement focus areas. This increased the number of responses from 76 to 107 for this particular question. Of the 107 responses, 13.08% fell into the Science, Technology, Engineering, and Mathematics (STEM) endorsement. These responses were not included in the inferential data, as the hypotheses were not evaluating students enrolled in the STEM endorsement. The remainder of the students indicated they were enrolled in Business and Industry (B&I) 41.11 %, and 45.78% were enrolled in the Public Service (PS) endorsement. Each endorsement area is broken into respective focus areas. Students were given the options in a format that represented their school's endorsement options. The local campuses offered nine focus areas that fell into three CTE endorsement areas. Table 2 depicts the frequencies of choices for the students' endorsement area and focus area.

Table 2
Frequencies of Choices for Endorsement Area and Focus Area, N=107

Variable	*n*	Percentage
Endorsement Area		
Business and Industry	44	41.11%
STEM	14	13.08%
Public Service	49	45.78%
Focus Area		
Ag, Food, and Natural Resources	14	13.08%
Hospitality and Tourism	8	7.48%
Education and Training	7	6.54%
Arts, A.V., Technology	12	11.12%
Law, Public Safety	9	8.41%
STEM	14	13.08%
Architecture	9	8.41%
Marketing	9	8.41%
Health Science	25	23.36%

Means did indicate that students enrolled in the PS endorsement area perceived themselves to be slightly more prepared for higher education in the areas of facilities (*M*=8.0, *SD*= 2.45), and teacher knowledge (*M*=8.35, *SD*= 2.19), while students who were enrolled in the B&I endorsement area perceived themselves to be slightly more prepared for higher education in the areas of extra-curricular activities (*M*= 7.13, *SD*= 2.90), and teacher knowledge (*M* =7.3, *SD*=2.61). When evaluating their perceived preparedness for careers, students in the PS endorsement area appear to feel better prepared based off of teacher knowledge (*M*=8.42, *SD*=1.94). Students in the B&I endorsement area did not appear to perceive themselves as more prepared for careers based off of any of the five areas. Students who declared the B&I endorsement area appear to perceive themselves as more prepared to enter vocational and trade schools based off of their extracurricular activities (*M*=7.2, *SD*=2.52) as opposed to the other areas. Students in the PS endorsement area did not appear to feel considerably more prepared for trade and vocational schools based off of all five areas (Table 3).

Table 3
Means and Standard Deviations for Endorsement Area

	B&I		PS	
Variable	M	SD	M	SD
Higher Education				
Curriculum	6.6	2.27	**7.88**	2.37
Extra-Curricular	7.13	2.90	**7.84**	2.41
Facilities	6.53	3.04	**8.0**	2.45
Teacher Knowledge	7.3	2.61	**8.35**	2.19
Admin. Support	6.27	2.08	**7.58**	2.40
Career				
Curriculum	6.43	2.87	**7.77**	2.61
Extra-Curricular	7.3	2.65	**7.50**	2.45
Facilities	6.63	2.62	**7.73**	2.60
Teacher Knowledge	7.13	2.56	**8.42**	1.94
Admin. Support	6.63	2.58	**7.77**	2.64
Voc Schools				
Curriculum	6.53	2.75	**7.65**	2.59
Extra-Curricular	7.2	2.52	**7.70**	2.59
Facilities	6.50	2.61	**7.92**	2.37
Teacher Knowledge	6.00	2.96	**8.00**	2.42
Admin. Support	6.5	2.83	**7.81**	2.35

Inferential Statistics

A simple Analysis of Variance (ANOVA) was conducted. There is a significant difference between the B&I and PS endorsement areas on senior student perception of preparedness for higher education in the area of curriculum $F(1,54) = 4.28$, $p = .04$, $p\eta^2 = .07$. The public service endorsement area ($M = 7.89$, $SD = .45$) mean is significantly greater than the business and industry endorsement area ($M = 6.60$, $SD = .42$). There is a significant difference between the business and industry endorsement area and the public service endorsement areas on senior student perceptions of preparedness for higher education in the area of facilities $F(1,54) = 4.11$, $p = .05$, $p\eta^2 = .07$. The public service endorsement ($M = 8.00$, $SD = 2.24$) mean is significantly greater than the B&I endorsement area ($M = 6.53$, $SD = 3.04$). In both cases, 7% of the variance is attributed to the endorsement area. This is considered a medium effect size (Green & Salkind, 2011). No other significant differences were found (Table 4).

Table 4
Univariate Effects of Endorsement Areas on Student Perception of Preparedness for Higher Education

Variables	d_f	F	Significance	$p\eta^2$
Curriculum	1,54	4.28	.04	.07
Extracurricular Activities	1,54	.98	.33	.02
Facilities	1,54	4.11	.05	.07
Teacher Knowledge	1,54	2.59	.11	.05
Administrative Support	1,54	3.47	.07	.06

A simple Analysis of Variance (ANOVA) was conducted. There is a significant difference between the B&I and PS endorsement areas on senior student perceptions of preparedness for careers in the area of teacher knowledge $F(1,54)=4.41$, $p=.04$, $p\eta^2=.075$. The public service endorsement ($M=8.43$, $SD=.45$) is significantly greater than the B&I endorsement area ($M=7.13$, $SD=.42$). In this case, 7.5% of the variance is attributed to the endorsement area. This is considered a medium effect size (Green & Salkind, 2011). No other significant differences were found (Table 5).

Table 5
Univariate Effects of Endorsement Areas on Student Perception of Preparedness for Careers

Variables	d_f	F	Significance	$p\eta^2$
Curriculum	1,54	3.12	.08	.06
Extracurricular Activities	1,54	.09	.77	.00
Facilities	1,54	2.46	.12	.04
Teacher Knowledge	1,54	4.41	.04	.08
Administrative Support	1,54	2.64	.11	.05

A simple Analysis of Variance (ANOVA) was conducted to determine the relationship between Career and Technical Education (CTE) Endorsement Areas, specifically the Science, Technology, Engineering, and Mathematics (STEM), business and industry, and public services endorsement, on senior student perception of preparedness for vocational

schools in south central Texas in the areas of curriculum, extracurricular activities, facilities, teacher knowledge, and administrator support. There is a significant difference between the B&I and PS endorsement areas on senior student perceptions of preparedness for vocational and trade schools in the area of facilities $F(1,54)=4.15$, $p=.04$, $p\eta^2=.077$. The public service endorsement ($M=7.92$, $SD=2.37$) is significantly greater than the B&I endorsement area ($M=6.5$, $SD=2.61$). Eight percent of the variance is attributed to the endorsement area. This is considered a medium effect size. There is a significant difference between the B&I and PS endorsement areas on senior student perceptions of preparedness for vocational and trade schools in the area of teacher knowledge $F(1,54)=7.52$, $p=.00$, $p\eta^2=.12$. The public service endorsement ($M=8.0$, $SD=2.42$) is significantly greater than the B&I endorsement area ($M=6.0$, $SD=2.96$). In this case, 12% of the variance is attributed to the endorsement area. This is considered a medium effect size (Green & Salkind, 2011). No other significant differences were found (Table 6).

Table 6
Univariate Effects of Endorsement Areas on Student Perception of Preparedness for Vocational or Trade Schools

Variables	d_f	F	Significance	$p\eta^2$
Curriculum	1,54	2.44	.12	.04
Extracurricular Activities	1,54	.52	.48	.01
Facilities	1,54	4.52	.04	.08
Teacher Knowledge	1,54	7.52	.01	.12
Administrative Support	1,54	3.48	.07	.06

Discussion

The statistical evidence provided indicates that students enrolled in the PS endorsement area feel better prepared to enter higher education and careers based upon the knowledge of their teacher. This could be due to additional credentialing the Texas Education Agency requires of most teachers employed under the PS endorsement area, health science, law, and education and training. Approximately 25 respondents, an overwhelming majority of the PS endorsement area respondents, indicated they were intending on earning a health science focus. According to TEA Administrative Code 233.14 (2006), health science teachers require additional industry based certifications and time in the career field, before educator credentialing can be awarded. TEA Administrative Code 233.14 (2006) indicates that teachers who seek a health science teacher certification must meet the requirements for years of qualified work experience and preparation for their skill area in order to be awarded a teaching certification by the

State Board for Educator Certification. The PS students' perceptions of preparedness to enter higher education based off of curriculum could also be attributed to the credentialing requirements. CTE courses have a wide range of curriculum that may be offered to students in order to satisfy the Texas Essential Knowledge and Skills (TEKS) requirements. The PS endorsement area has the opportunity to offer a variety of industry based and industry validated certifications to students, such as Emergency Medical Technician (EMT), Pharmacology, Certified Nursing Assistant (CNA), Medical Billing and Coding, and more. It is possible that the significant difference between the PS endorsement area and B&I endorsement area in regards to students' perception of preparedness for careers based on curriculum, lies in the certification offerings that prepare students for careers immediately out of high school.

Conclusions

It can be concluded that there is a significant difference between the Business and Industry (B&I) and Public Service (PS) endorsement areas on senior student perception of preparedness for higher education in the area of curriculum and facilities. This difference could be attributed to the certification offerings at the two south central Texas high schools to PS endorsement area students. The certification offerings require a specific facility as well as specific set of curriculum designed for the certification process. In some cases, the certification programs may require field experience in the profession before credentialing will be awarded to the student.

It was determined that there is a significant difference between the B&I and PS endorsement areas on senior student perceptions of preparedness for careers in the area of teacher knowledge. This is likely attributed to the teacher credentialing requirements of the Texas Administrative Code, which requires more extensive real-world experience for the educator. The majority of focus areas in the PS endorsement area require teachers to hold industry based certifications and licensures, along with a minimum requirement for years of practice before educator certification is awarded to the teacher.

Lastly, it was determined that there is a significant difference between the B&I and PS endorsement areas on senior student perceptions of preparedness for vocational and trade schools in the areas of facilities and teacher knowledge. The specific nature of facilities vital to meet the requirements of student certifications lends itself to students feeling more prepared to enter trade or vocational schools. Students enrolled in the PS endorsement area often end their endorsement area with a capstone course involving a practicum or clinical experience.

This study aimed to bridge the gap in literature regarding students' perceptions of preparedness. Current research indicates that students who are enrolled in a Career and Technical Education (CTE) program have higher graduation rates, higher levels of motivation, are more interested in their curriculum, and are more engaged in their learning (Reese, 2011; Smith, 2012; Alonzo, 2011; Handy & Braley, 2012

The House Research Organization (2013) reinforces the importance of curriculum by noting that academic rigor is essential when considering the preparation of students for postsecondary opportunities. Maintaining the rigor of the coursework along with allowing students to explore postsecondary opportunities is an integral part of the high school experience (House Research Organization, 2013). Teachers who are knowledgeable in their field, and have real-world experiences, have a unique opportunity to share these experiences with their students, which leads to higher engagement and interest. The ability to share real-world experiences with students increases the teachers' ability to build meaningful relationships with their students. Research indicates that strong teacher-student relationships and personalized instruction are two leading factors that can decrease dropout rates among high school students (Bloomfield, Foster, Hodes, Konopnicki, & Pritz, 2013). Studies also correlate higher graduation rates for at risk students, than those who are at risk and not enrolled in CTE courses (Alonzo, 2011). Exposure to higher education opportunities happens frequently through Career and Technical Student Organizations (CTSO) participation, which may lead to an increased desire to attend colleges and universities. While CTSO's provide hands on experiences, prepare students for the workforce, and focus on skills and trades, it should be noted that students also perceive CTSO's as an opportunity to prepare for college, careers, and vocational or trades schools. These activities aim to build a student's ability to utilize public speaking, reasoning and judgement, exercise their hands on skill, and build specific career skills. For this reason, it is likely that students feel more prepared for careers and trade or vocational schools.

A deep understanding of what areas students perceive as preparing them for post-secondary opportunities, and which endorsement areas seem more beneficial, will allow the LEA and school to improve upon areas that score lower on the perceptions.

The purpose of this study was to determine senior students' perceptions of preparedness for post-secondary education or the workforce, in their CTE field of study. This data can be utilized by the school district to implement changes that are integral to the success of the CTE program, as well as the success of the individual student as they pursue postsecondary opportunities.

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Importance of Integrating Cryptography, Steganography, and Digital Watermarking for Undergraduate Curriculum

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Abstract
Cryptography is the art of obscuring information by scrambling the content of a file. Steganography, the art of information concealing information, embeds secret information into an unsuspicious carrier document without revealing its presence. Watermarking, a subarea under steganography, embeds copyright information into a document. The goal of both cryptography and steganography is to protect a message from falling into the hands of unintended third parties. The goal of watermarking is to assert copyright to protect intellectual property.

All of these technologies are advancing rapidly. Scientists and researchers are developing more secure and efficient ways to achieve its goals. At the same time, hackers, malvertisers (web advertisers that have hidden and mischievous malwares), and criminals are continuing their efforts to exploit the capabilities of cryptography and steganography for criminal intent. Criminals increasingly use these technologies for information stealing, leaking, malvertising, and intellectual rights violations.

The shortage of trained professionals has resulted in a surge in the demand for people with these skills. The issue is that academic institutions provide limited training in the field. The course content may only contain a few paragraphs or chapters. This paper presents the importance of these technologies and the need for it to be its own course. A whole course would promote a deeper understanding of these technologies needed for careers in cybersecurity.

Introduction

The rapid growth of the Internet by industry, government, researchers, and the public has generated vast amounts of data exchanged for things like communications, data sharing, and storage. While this data exchange traverses the Internet, it needs to be protected from unauthorized access. This may only be possible by concealing it either explicitly or implicitly by using innocuous carrier information.

Concealing it explicitly requires it to be transformed into unreadable and garbled content using encryption methods before transmitting data online. Once it reaches its destination, it needs to be converted back into a readable format using decryption. The process of encryption and decryption is called cryptography. An encrypted file is considered to be concealing its information explicitly because the content of the file cannot be read by

anyone who does not have the encryption key needed to decrypt, or unscramble, the file. However, obtaining encryption key from any other means other than the original encrypting or authorized body is exploitation of weak encryption method.

Alternatively, information can be implicitly concealed by hiding it within an otherwise readable or viewable file. The information is transformed in such a way that it is unexposed and invisible during its transmission, which is possible only if it is carried inside another regular message called a carrier message. The intent of implicitly concealing information is to avoid the notice or suspicion of unintended parties by embedding the information in an otherwise innocuous file. Commonly used carrier messages include image, audio, video, and text files. Two methods that use carrier messages, also called cover medium, to conceal data are called steganography and digital watermarking. These strategies for data hiding can be categorized as follows:

a) Implicit Data Hiding
    i) Steganography and
    ii) Digital Watermarking
b) Explicit Data Hiding
    i) Cryptography

Steganography techniques are based on information hiding that embeds secret messages in another cover medium without revealing its existence. Only the sender and receiver of the file are aware of the presence of the data hidden within the file. For example, an individual trying to arrange a covert meeting may hide a text-based message within an image file of the Grand Canyon. In watermarking, data is hidden to convey some information about the cover medium, such as ownership and copyright. Cryptography techniques are based on rendering the content of a message unreadable to unauthorized people. Figure 1 exhibits the differences and similarities between steganography, watermarking and cryptography (Djebbar, Ayad, Meraim, & Hamam, 2012).

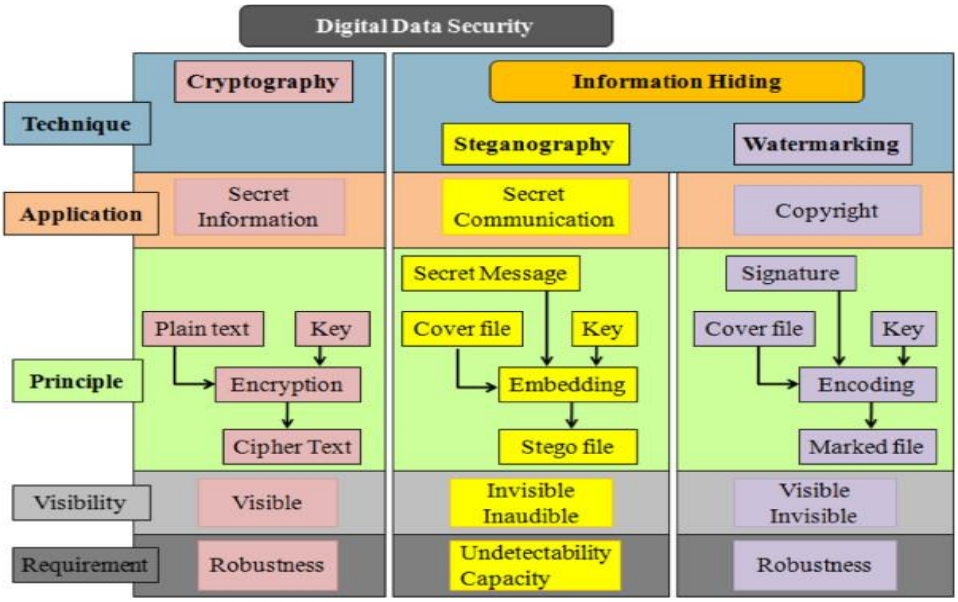

Figure 1: Digital Data Security Disciplines (Djebbar et al., 2012)

Steganography and Watermarking

Steganography is the ancient art of embedding private messages in seemingly innocuous messages in such a way that prevents the detection of the secret messages by a third party. In other words, steganography means establishing covert channels. A covert channel is a secret communication channel used for transmitting information. The other major area of steganography is copyright marking. This is when the message to be inserted is used to assert copyright over a document. This can be further divided into watermarking and fingerprinting. As shown in Figure 2, two general directions can be distinguished within steganography: protection against detection and protection against removal (Popa, 1998).

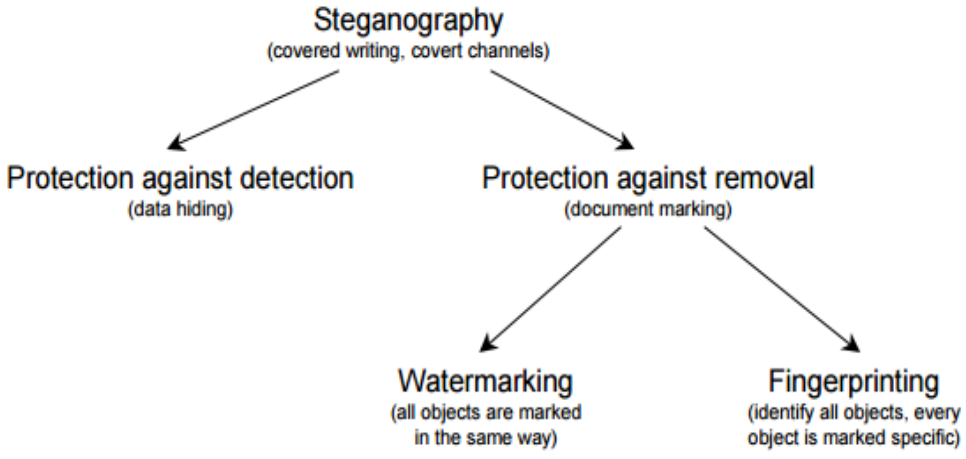

Figure 2: Directions within Steganography (Popa, 1998)

Integrating Cryptography, Steganography and Watermarking

Background
There are various approaches to teach these courses for undergraduates. These three disciplines of data hiding can be integrated together as a single course. Each of this discipline can be a separate course. These disciplines can also be integrated into other courses like programming, database, or algorithm courses.

Integration of Steganography and Cryptography
Steganography is a technique used for hiding data in an array of media such as text, voice, image, and video. Cryptography re-arranges the message/data so that it cannot be interpreted (Johnson & Jajodia, 1998). Steganography can be briefly described as hiding information in plain sight while cryptography lets everyone know that the data is hidden in an unreadable message. The two concepts have multiple commonalities: secret data, computer security, computer science, and cryptography. The use of the two concepts will only increase as people use them for sharing of sensitive, private, classified, and even potentially dangerous data.

Undergraduate and graduate computer curricula should include steganography and cryptography. Such programs and courses in which the two are taught include, but not limited to, information systems, computer science, computer information systems, and computer forensics. The question to be examined is how best to incorporate the concepts into academic curricula in a way that is understandable and allows for more research and adaptation as knowledge within the field of cybersecurity.

Integrating Watermarking with Database Course
Pournaghshband, Movafaghi, Chan, and Collins (2009) briefly discussed the addition of watermarking to a database systems course in order to increase knowledge of database security. The course introduced watermarking that covered relational databases as a set of tools and techniques for protecting the ownership of relational data. The inclusion of such content would increase awareness of database ownership and protection of digital data in an era where digital information is still new and vulnerable to attack. Their database course introduced database ownership, the concept of watermarking, implementation of watermarking techniques, and discussion of future protective techniques for information technology.

Integrating Cryptography and Steganography in Introductory Programming Course
Kortsarts and Harver (2007) had a successful experience integrating cryptography into a computer forensics course for non-majors. Kortsarts and Kempner (2010) included a public-key cryptography component into a programming course. Kortsarts and Kempner (2014) embedded cryptography and steganography concepts into freshman year introductory programming courses. These courses taught Python and C without use of any image processing and graphics libraries to emphasize the merit of cryptography and

steganography in programming assignments. It was noted that this created an enjoyable programming experience, sparked students' interest, and increased their engagement in the course. Students showed great interest in discovering and decrypting hidden messages. They became highly motivated in algorithmic implementation of various steganography and cryptography techniques (Kortsarts & Kempner, 2014).

Cryptography, Steganography and Digital Watermarking Curriculum

Numerous degrees, such as computer science, information technology, computer technology, information systems, cyber security, and digital forensics, offer courses that include cryptography, steganography, and watermarking. This is due to the significant increase in demand in the job market for those with these skill sets (U.S. Bureau of Labor Statistics, 2015). However, these courses vary in their objectives and goals, due to their degree programs, majors, minors, academic institutions, and faculties. Such course offerings are on theoretical aspects, programming aspects, applied concepts, algorithmic aspects, mastering operating system specific tools or online tools, and on computer forensics. The prerequisite courses may also vary. Such prerequisites may include mathematics, programming languages such as C, python, Java, Windows or Linux Operating Systems, and image processing.

Undergraduate degrees with security concentrations can offer these courses differently. Data hiding topics may be covered in individual three credit hour courses devoted to cryptography, steganography, and watermarking. The alternative is to cover a combination of two or more of these data hiding disciplines into a single three credit hour course. Some undergraduate course offerings may be limited to selected topics or a single chapter within other courses.

Data hiding technologies are delivered in various course titles such as:

a) Cryptography
b) Steganography
c) Cryptography and Steganography
d) Steganography and Digital Watermarking
e) Information Hiding Techniques, Technologies, and Investigation
f) Computer Security
g) Network Security

Importance of Cryptography, Steganography and Watermarking

The domain of cyber security is expanding almost every day. It has become a multi-disciplinary operation. The number of cyber incidents is on the rise. Several security firms have detected multiple updates to exploit kits which have recently started using steganography as a main component of their operations as they employ steganography as a way to hide exploits and malware payloads as PNG files (Cimpanu, 2016). The Stegano exploits kit (also known as Astrum) is used to transfer different malicious code via PNG banner ads. Once a web browser hits such websites, JavaScript will extract the code from the PNG file and redirect the user to a different website that will infect the computer with

malware. This newly updated exploit kit was used by multiple malvertising campaigns to distribute malware. The most affected countries were Japan, Canada, and France, though Japanese users accounted for more than 30% of the total target (Paganini, 2016).

Steganography has been beneficial in protecting media copyrights (via digital watermarks). Unfortunately, there might be more downsides than benefits. On the extreme end, terrorist organizations almost completely rely on steganography as their means of communication. It is used to pass secret messages without anyone but the intended recipients being aware of it (Wall Street Pit, 2017). For example, what appears to be a family photo may surreptitiously contain the plans for a planned terrorist attack.

Unfortunately, steganography is also providing opportunities for cybercriminals. There are many steganography tools currently available ranging from opensource to commercial products. These tools give plenty of options for cybercriminals. To combat this problem, there is a need for individuals who know how to detect and decrypt this hidden data. Only a few academic institutions offer these courses that specialize in these technological areas. These technologies should not be confined to only a few paragraphs or chapters in existing courses. They should be offered as separate courses in cryptography, steganography, and watermarking.

The goal of these three technologies is the same, to secure communications to only the intended sender and receiver. These courses should be offered in a coordinated sequence that builds a comprehensive understanding of the concept, theory, and application of cryptography, steganography, and watermarking. The ability to crack encrypted files and discover messages hidden through steganography will prepare students as they enter a world in which cyber warfare has become the norm. This will serve as a gateway to more specific, specialized courses leading them to careers in steganalysis, cryptography, cryptology, digital media (audio, video, and images) forensics, and digital criminal investigation.

Conclusion

In this paper, digital data security disciplines of cryptography, steganography, and watermarking are discussed. Examples of how these technologies have been incorporated into programming courses and database courses were presented. The importance of offering integrated digital data security was discussed.

The demand for data hiding expertise and skillsets is on the rise. Academic institutions need to offer courses that address the three major digital data security disciplines. This will help students understand the fundamental knowledge of digital data security disciplines, their differences, and similarities. Students will understand these technologies as separate fields of study and lead them to careers such as digital media (image, audio, video) forensics, steganography, and cryptography.

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Strategies for Increasing Female Participation in Technology-Based CTE Courses

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Abstract
This paper details the history of female participation in science, technology, engineering, and mathematics (STEM) related career and technical education (CTE) courses, and reviews relevant peer-reviewed literature on the subject of increasing female participation at the secondary level. Despite females enrolling in STEM-focused college programs and securing STEM-based employment in ever-increasing numbers over the previous two decades, female enrollment in secondary CTE programs remains high primarily in cosmetology, nursing, dental assisting, and early childhood education programs. This research considers why this trend continues, whether females in middle school are interested in pursuing STEM-based careers, and what strategies might be implemented in guidance, recruiting, and instructional practices to reverse the trend.

Introduction

The issue of diversity within the evolving demographics of modern education spans concerns over student achievement to needs for special services to the goal establishing equitable balances for course enrollment and career preparation. 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. This article focuses on the problem of female enrollment in career and technical education (CTE) programs centered around science, technology, engineering, and mathematics (STEM).

In particular, the 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. 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).

If 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, it may well be worth investigating reasons why secondary CTE programs have not seen a similar increase in female enrollment for technology-based CTE programs (Lester, 2010). CTE recruitment strategies, high school guidance counselor training and expectations, and instructional methods currently used in CTE programs in general are three areas worthy of reflection and review.

Word of mouth can be one of the most effective recruitment strategies resulting in program growth, whether it be for a given strand of instruction or increasing interest in an athletics program. This "buzz" can be the result of exceptional program effectiveness, awards or public acknowledgement of a program's achievement, or simply participants who enjoy a program leader's methods or program content spreading the word to their peers with similar interests. This strategy may just not be enough, however, if one factors in the influence of gender-based preconceptions. Thus, CTE centers may need to engage in a strategy of targeted program recruitment.

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). Guidance 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 assisting.

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 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 particular profession or industry. 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).

Literature Review

Before identifying strategies for increasing female participation in technology-based CTE courses, it is important to confirm that a need exists. This need can be confirmed through first assessing that females have an interest and aptitude for enrolling in the courses, and then consulting enrollment statistics to evaluate whether an impropriety exists. Emine Demiray 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 (MSN, 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).

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. Likewise, 34% of female respondents owned a laptop, which was 13% less than the males. 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.

Knowing what trends exist in female ownership and use of consumer information technology (IT) products can be a valid predictor of female interest in IT in general (Sexton, et al, 1999). This interest and aptitude with IT is the same indicator that is used by guidance counselors and others involved in the process of selecting programs of study for CTE placement. It is therefore important to know what kinds of technologies are owned and utilized by females, as well as their perceptions of this usage, in order to determine strategies for steering females into technology-based CTE programs of study.

Based upon data collected through interviews with adult women gamers in the UK, and female teenage participants in digital media workshops organized by the BBC, Thornham and McFarlane researched what it means to claim to be technologically competent in relation to gender (2011). More intimate in its research design than Demiray's 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.

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.

While stereotypes suggest that certain technology is for men, 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. Most female participants also indicated a desire to problem-solve and troubleshoot technology by applying resources such as online forums, message boards, and embedded technical support rather than merely 'consulting the nearest male to find a solution.' 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.

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, et al, 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.

CTE administrators have sought data on gender equity within certain occupations and occupational training opportunities for at least the last fifty years (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. With all of this data available to confirm the value of female enrollment in

technology-based CTE programs, could it be that school counselors are reluctant to place females in such programs? The dissertation titled *School Counselors' Perceptions about Female Participation in Non-traditional Secondary Career and Technical Education Programs* (Malik, 2005) attempts to answer that question. This research focused on the following questions (Malik, 2005):

1. What are the high school counselors' perceptions toward female participation in nontraditional secondary CTE programs?
2. What are some of the underlying beliefs that affect school counselors' perceptions toward female participation in nontraditional secondary CTE programs?
3. Does difference in gender, age, level of education, years of experience in education, years of experience in counseling and school size affect school counselors' perception of female participation in nontraditional CTE programs? (pp. 8-9)

280 Counselors across the state of Michigan responded to a 25-item quantitative survey, including questions related to demographics, counselors' beliefs about counseling female students into CTE programs, and counselors' beliefs about female participation in non-traditional CTE programs. Survey feedback regarding female participation in non-traditional programs was positive, although 66.4% of the counselors who responded were female themselves. As an example, 63.1% of counselors in the study strongly disagreed with the statement "some [CTE] programs, like electronics technology, automotive, or manufacturing technology should primarily enroll males" (Malik, 2005). Counselors strongly agreed that career training opportunities should not be gender specific, and also that females should be allowed to enroll in any CTE programs in which they are interested and likely to complete (based upon course pre-requisites). Additional responses revealed conflicts in counselors' perceptions of job availability for females in IT and STEM-related careers, whether counselors ought to invest special efforts in directing females to non-traditional CTE courses, and whether funds ought to be available to specifically promote female participation in such courses.

Current Issues

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. Historically, men designed technologies in order to improve their lives and the lives of those around them at home, on campus, and in the workplace. 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).

Generations have passed, and there is a degree to which this is still occurring, regardless of whether the women of today have an aptitude or interest in getting their hands dirty

with the design, testing, production, maintenance, and utilization of emerging technologies in the workplace and in other practical applications. Despite this, 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, 2012). Many online learning opportunities are looking for basic qualifications to be met for acceptance. A formal interview and application process is not required. 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, 2013). The market place has been slow to catch on to this trend, particularly in management roles and for salaries in positions of comparable responsibility, but things are improving in these areas as well. A recent study indicated that while the percentage of female enrollees in dual enrollment and advanced STEM courses is roughly equivalent to the male-to-female population ratios in the United States in general, the top 20 technology corporations listed in *Forbes* for 2001-2010 employed women in management positions at a rate less than 20% that of the general population ratio (Watson, et al, 2011).

> "Women's opportunities of using recent information technologies are limited compared to men. Besides, if women use these technologies, they use them in order to do jobs that are considered suitable for their feminine roles, such as entering data and typing text. In short, computers are presented as advanced typewriters for women; in this way, the uses of a new technology are restrained" (Demiray, 2010, p.1)."

IT courses in the 1980s and early 90s were very general in their content and were generally taken as "exploratory" courses by most of the students at the middle and early high school level. 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 (Association for Career and Technical Education Website, 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. 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. 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," 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 18 students has just one or two females participating.

Social Perceptions

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 is bound to certain pre-conceptions about the proper courses for female and male program enrollment. 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. 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, but that there is frustration at the hurdles that stand in their way. "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.

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 (Harris, et al, 2009). 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. "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 it would seem that not only are decisions being made about female participation in technology-based training, IT college majors, and IT jobs as a result of outside influences in terms of societal perceptions, but internal influences as well in terms of how women view some training and work environments.

Best Practices

Social interaction in the workplace may be an element of the job environment sought by female IT professionals that distinguishes them from their male counterparts, but in order to make instruction as sound and effective as possible there needs to be some readjustment in the way the secondary system of education treats the recruitment, enrollment, and instruction of females in technology-based CTE courses (Saini, 2012).

To begin, in order to recruit females into IT courses there ought to be an effort on the part of current female participants who are enjoying success in these courses to communicate that to their peers. When recruitment activities are scheduled by CTE centers at local middle and high schools, both male and female students, instructors, and administrators might need to be present in order to grab the attention of female students who have expressed interest in the courses and to speak to them about whatever fear and reluctance they might have in pursuing IT-related programs of study. Some school systems have gone so far as to bring in female representatives from industry in order to specifically address the need for increasing female participation in the early stages of training (Obaidat & Alqatamin, 2011). Buy in from the guidance departments might be simpler to coordinate if there is an effort being made to put "boots on the ground" in terms of recruitment that can relate to qualified female candidates.

Often instructors in CTE centers are contracted beyond the standard ten-month contract of the core classroom teacher due to the hands-on nature of the instruction and the requirement to order and maintain a large inventory of very expensive equipment and emerging technologies. Training industry professionals who are making a transition to the classroom how to individualize instruction in order to meet the needs of students, while at the same time considering methods for delivering key content to large groups of students, can be a challenge. When you throw into the mix this need to present a learning environment absent of enmity towards any given sub-group, those extended contracts

provide an opportunity to deploy training in the most effective strategies for delivering instruction to a diverse population of learners.

In PBL environments, it is important to answers questions about how active participation looks for a male or female, exceptional learner or student with disabilities, student with a substantial background in utilizing technology or student who is taking courses in order to learn as much as possible about an area of interest that might include technologies they don't have the resources to afford at home (Mager, 1997). Some school divisions have gone so far as to implement female-only courses that focus on IT. Designed specifically to fit the most effective methods of instruction for a given sub-group, such teaching environments have proven to improve credentialing exam scores, increase class participation, and bolster post-course student evaluations (Parkay, Haas, & Anctil, 2010).

Strategies for Practical Application

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).

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. Such motivating factors are part of training that in experienced by guidance 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. 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, and involving female stakeholders in this process can provide representation with whom female candidates are more likely to relate.

Relevant, rigorous programs of study are the hallmark of well-respected CTE programs, and such programs also go a long ways towards training students about the nature of IT careers, which can involve intense troubleshooting and maintenance requirements. There are physical requirements and skills that must be mastered, such as installing and testing cable and devices, yet over the course of a given IT project the work can become monotonous and repetitive. Modeling the intensity of the IT work environment goes a long way towards training any CTE program participant to be ready for the rigors of their chosen career (Dick, Carey, & Carey, 2001).

The final element of motivation, persistence, is also inherent in the design of many CTE programs of study. Industry certifications require a broad range of skills and knowledge in order to pass written and practical credentialing exams. The preparation for such exams often involves redundant skills training and practice, and ultimately students who

are provided the opportunity to work in leading small teams and being assessed in that leadership role can add another level of rigor to the program. Online learning environments can infuse even more opportunity to develop a persistent attitude towards the work by allowing students to take work home with them. Electronic texts, discussion forums, technical support message boards, and the option to submit written work electronically can help to make the student feel as though the content of the course is becoming embedded in their day-to-day lives. While it is true that, just like in-person learning environments, "there are members of [online learning] groups who do not participate or are totally absent" (Capdeferro & Romero, 2012), there is an ability in the online learning environment for the instructors and participants both to be able to track student persistence and contributions to collaborative learning activities beyond what is typical for in-person learning experiences. Online learning and virtual learning environments also mesh well with technology-based programs of study.

Conclusion

The issue of diversity in modern education spans concerns over student achievement to needs for special services to the goal establishing equitable balances for course enrollment and career preparation. 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, leading to low female enrollment in technology-based CTE courses at the secondary level. Societal influences, such as preconceptions about gender roles within the CTE community, have an influence on program demographics, but current trends appear to stand at odds with areas of interest and aptitude that are observed in the middle school female population. Female 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 seeking opportunities for technology-based training prior to commencing college studies and securing entry-level jobs within their chosen careers (Garcea, et al, 2012).

Some strategies for increasing female enrollment in technology-based CTE programs involve recruitment, placement, and teacher training. Targeting recruitment in order to increase female participation can be as simple as involving female stakeholders, such as current and past students, instructors, and administrators. Past students who are employed in the IT field can not only serve as a model for women interested in enrolling in STEM courses, but can also serve as a resource for answering candidate's questions and allaying fears.

Once student interest is identified, guidance departments need to be willing to work with CTE centers to place students who have met minimum course qualifications and have expressed an interest in the relevant career fields, be it construction, cosmetology, computer networking, or HVAC installation. A student with aptitude and interest represents the first pages of a potential success story that can benefit both the student and the reputation of the CTE center. Finally, once the student has cleared the hurdles of

recruitment leading to valid candidacy and a guidance system willing to enroll the students for the program of study, instructors need to be prepared to deliver instruction to a diverse population through application of varied, robust, dynamic instruction that allows for hands-on and problem-based learning and collaboration on content in an environment that seeks to prepare technology-based CTE students for the realities of the IT workplace.

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Fire Inspector and Investigators Career Path Exploration

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Introduction

The motive of this article is to provide factual information to students interested in criminal justice and/or fire science who are debating whether or not to pursue the career path of fire inspector and investigator. It would be beneficial for students interested in criminal justice and/or fire science to examine the detailed information that will be described in this article to help the development of a deeper understanding of what it will be like to have a fire-related career as an investigator or an inspector. The details below for fire inspectors and investigators will be presented in the following order: responsibilities, how to become one, pay and benefits and job outlook.

Responsibilities of Fire Inspectors and Investigators

Fire inspectors and investigators work to ensure the public's safety from fire-related incidents. Inspectors examine structures such as buildings to determine if they meet the regulation of the fire codes and search to see if there are fire hazards present. They do this to ensure the safety of the public and reduce the likelihood of a fire occurring. Investigators are responsible for examining fires after they have occurred. They are responsible for searching for the origin and cause of fires (U.S. Department of Labor, 2015).

Fire inspectors work both in an office and out in the field. When working in the office, they are responsible for writing up detailed reports of buildings that they have examined for future use as a reference for the next inspection and/or for insurance companies. When the inspectors are out in the field, they must have an understanding of the fire codes and how to ensure that buildings meet these codes. This is done by the reviewing the blue prints and through examination of the fire alarms, sprinklers, and other equipment needed for protection against a fire (U.S. Department of Labor, 2015).

Like the inspectors, fire investigators also work in an office, usually a laboratory, and out in the field. Investigators are responsible for writing reports and protecting evidence of a fire for insurance companies or law enforcement. When they are not working in the office, investigators are out examining the damage that was created by fire. Investigators collect evidence and document it through photographs and through the collection of samples from the scene in which they are investigating. Through examination of the scene of the fire-related incident, they can determine the origin and cause of the fire (U.S Department of Labor, 2015).

Fire inspectors consult developers of buildings, so that the building may proceed with construction with the plans that are up to code. Fire investigators work with law enforcement to help create a case against a suspect if a fire was caused by suspicious means. Both occupations are relied upon or rely on other career fields to properly examine the fire safety or cause of the fire. Investigators also work with other specialists, such as chemists and engineers, to examine the evidence together and in more detail (Global Leaders in Fire Investigation, 2015). Both occupations work closely with insurance companies to either report neglect of the fire safety codes or to report the damage that has occurred due to a fire (U.S. Department of Labor, 2015).

Becoming a Fire Inspector or Investigator

Having at least a high school diploma is necessary in order to qualify for the job. Having job experience with law enforcement and the fire department is highly recommended. Some employers may look for a candidate with experience as well as some type of postsecondary school experience in chemistry, engineering or fire science (U.S Department of Labor, 2015). Fire science would be the most related option when in postsecondary school for a fire-related career and one can receive a certificate, Associate's degree, or a Bachelor's degree depending how long one wishes to be in school (Fire Science Degree, 2016). Most employers require inspectors to be U.S. citizens and to have a driver's license that isn't expired. When hired by an employer, employees will receive training both in a classroom setting and on the job with an experienced professional (U.S. Department of Labor, 2015).

Training is required to be able to become a fire inspector or investigator. The training can vary in intensity and length depending by the state. Classroom training is mainly set at a police or fire academy and takes several months to complete. There are an assortment of subjects and concepts covered. Subject material can include legal codes, protocols for handling dangerous materials and explosives, and the proper use of onsite and laboratory equipment.

Even though there is no required educational achievement besides graduating from high school, there are licenses and certificates that are required in order for a fire inspector or investigator to be able to work. These licenses or certificates must be renewed once every year (U.S. Department of Labor, 2015). The National Fire Protection Association is responsible for creating the certification exams (Codes and Standards, 2016). There are other associations that offer more international or private certificates for fire investigators. One of these associations, the International Association of Arson Investigators (IAAI), is a more extensive certification program that further contributes to your resume as an investigator. Unlike the National Fire Association in which certification renewal occurs yearly, the International Association of Arson Investigators must renew their certification every five years (Global Leaders in Fire Investigation, 2015).

The work environment should be noted because there are some hazards in this particular career field. According to the U.S. Department of Labor (2015), "Fire inspectors and investigators have a higher rate of injury or illness than the national average" (Para. 4). It is dangerous for someone to walk along structures that were damaged from a fire and for someone to breathe in hazardous fumes in the air from a fire. As a result of the unsafe conditions in the field, protective clothing must be worn at all times. The one advantage of the working environment of fire inspectors is that they work during normal operating business hours. The downside of the working environment for an investigator is that you will have to wait for a fire to occur to be called into work (U.S Department of Labor, 2015).

Pay and Benefits for Fire Inspectors and Investigators

Salary and wage information can be accessed through the U.S Department of Labor (2015). It was observed in 2012 that the median annual payment for employees in all occupations was $34,750. However the observed median annual payment for fire inspectors and investigators in 2012 was $53,990. The range of salary for employees in this particular occupation was as low as $33,920 to as high as $87,400. According to Salary.com (2016) the average annual salary is $55,816. Salary.com (2016) also gives the range of the salary between $45,892 and $75,467. This source also gives information on the benefits and current job openings.

Job Outlook for Fire inspectors and investigators

Employment for fire inspectors and investigators is much lower than the average for all occupations, resulting in a highly competitive market for employment. There will be a projected increase of 11% of all occupations in the U.S Economy from 2012-2022, while the projected increase for fire inspectors and investigators is 6%. A census of employment in this field was taken in 2012 with 12,200 employees. The projected census of employment, considering the 6% increase, is estimated to be 13,000. That is only an outlook of 800 jobs becoming available within 10 years. However due to the nature of the occupations, there will always be a need for inspectors to examine buildings and investigators to determine the sources for fires and explosions. However, investigators may have a harder time finding employment because of the falling rate of fires in the United States due to technological advancements in fire safety (U.S Department of Labor, 2015).

Interview with Robert Mead at the Muncie Fire Department in Muncie, Indiana

Robert Mead is the chief fire investigator with the Muncie Fire Department in Muncie, Indiana. (**See Figure 1).** Robert Mead was interviewed by Dr. Edward J. Lazaros and Angela Gervais on January 19, 2016. To read more about the Muncie Fire Department, visit **http://www.cityofmuncie.com/fire-department-muncie.htm.** In the following section, you can read the questions that Robert was asked about his career and his responses:

Figure 1. Robert Mead by his work vehicle.

What do you like most about your job?
"I enjoy every aspect of my job, mostly the science behind it and trying to solve the puzzles of an investigation because there are no dull moments. The psychology of interviewing suspects is very interesting; you grasp a small understanding of a person's body language. Working with outside industries and the public is another enjoyable aspect of my job." (R. Mead, personal communication, January 19, 2016).

What is your daily routine like at this job?
"There is no daily routine, it depends on when an incident occurs and I check my MDT (mobile data terminal) which gives me an advantage of knowledge of the situation of an incident before I report to the scene. I am always on call; my shifts may start depending on when I am needed, many times I'm called in the middle of the night due to human error." (R. Mead, personal communication, January 19, 2016).

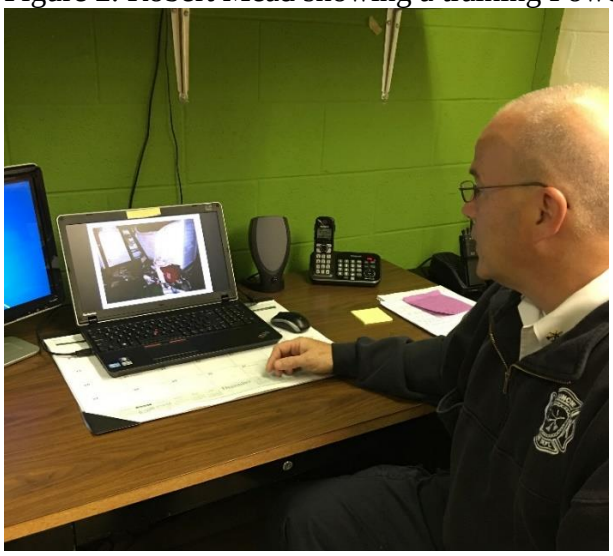
What would you say to someone who was looking to get into this type of career?
"This line of work isn't easy to get into, experience must be obtained into order to start. Every path towards this career isn't the same; even having a college education may not be enough to have the opportunity to have this type of career. Having experience is key, and having a career in criminal investigation either through the fire department or police department is important. Studying the literature of fire incidents and talking with other investigators is also important. Someone who is interested in this career should have an up to date knowledge of these materials beyond the high school level: fire science, fire chemistry, thermodynamics, thermometry, fire dynamics, explosion dynamics, computer fire modeling, fire investigation, fire analysis, hazardous materials, failure analysis and analytical tools, fire protection systems, evidence documentation, collection and

preservation, electricity and electrical systems". (R. Mead, personal communication, January 19, 2016).

What do many people not understand about this field?
"The biggest thing is that people don't understand about the science of this field, people don't need to tell me how the fire happened, I can discover the story the fire incident tells me, making me more of a scientist than a fire investigator. I develop a hypothesis when I look at a scene. I try to find the area where the fire started. I try to determine any and all ignition sources in that area. I look for anything that can cause the fire. This could be resistive heating or an ash tray, as examples. I develop a hypothesis of what may have occurred at the scene. I document this and back it up with science. At the end of my investigation, I determine the classification of the fire. There are four things that I use to classify a fire: 1. Accidental, 2. Natural, 3. Incendiary, 4. Undetermined". (R. Mead, personal communication, January 19, 2016).

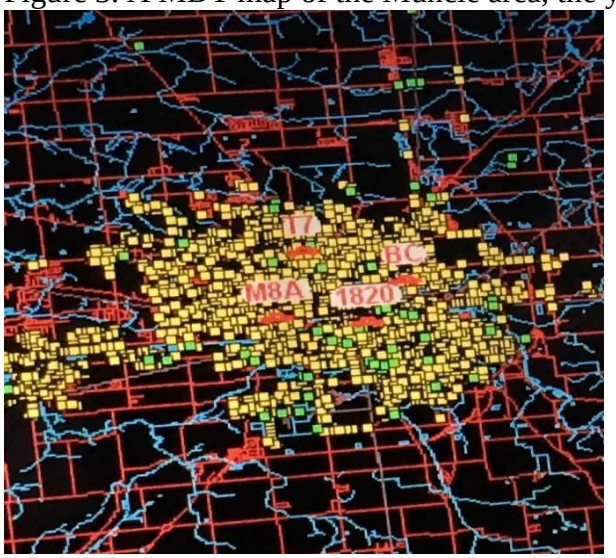
What kind of fun technology do you get to work with in this career?
"PowerPoint **(See Figure 2)** *is used in the fire department to train other firemen to understand the preservation of a scene and to gain an understanding of how an incident occurred. Pictures are embedded into the PowerPoints so the firemen have a visual representation of a variety incidents".* (R. Mead, personal communication, January 19, 2016).

Figure 2. Robert Mead showing a training PowerPoint.



"The MDT (Mobile Data Terminal) **(See Figure 3)** *allows real time communication between all emergency agencies. An aerial map on the MDT allows me to view fire hydrants and location of other emergency units".* (R. Mead, personal communication, January 19, 2016).

Figure 3. A MDT map of the Muncie area, the yellow dots are fire hydrants.



"Smartphones **(See Figure 4)** *allow me to take pictures of an incident and these pictures can help facilitate the process for me to write a narrative of my exploration of an incident".* (R. Mead, personal communication, January 19, 2016).

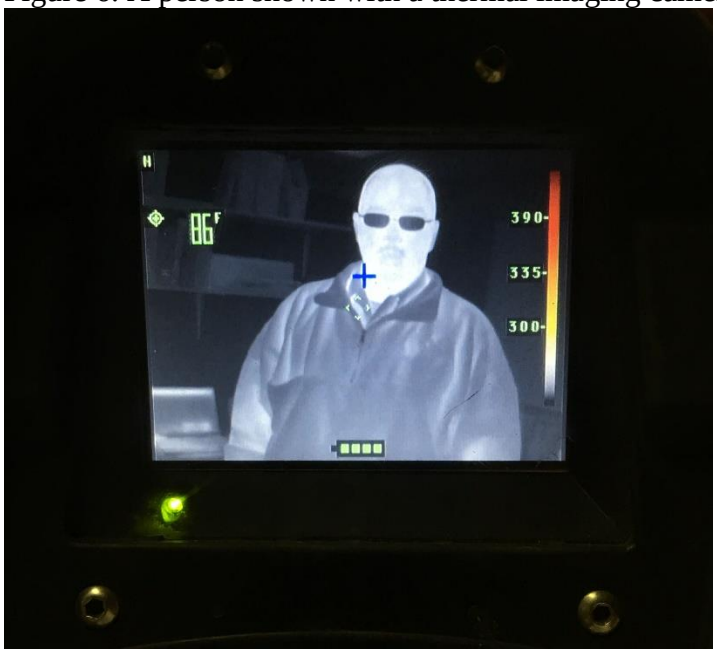
Figure 4. Robert Mead showing a picture of a gas line that started a fire on his smartphone.

"Element proof cameras and other digital cameras **(See Figure 5)** *are used for formal documentation for the proof evidence in the courtroom".* (R. Mead, personal communication, January 19, 2016).

Figure 5. Various cameras used for photographing a fire-related incident.

"Thermal imaging cameras **(See Figure 6)** *can be used to look for hidden fires and heat sources. They can be used in attic spaces or other spaces that can't be properly searched by firemen to ensure a fire has been properly stopped. They can also be used for a search and rescue mission".* (R. Mead, personal communication, January 19, 2016).

Figure 6. A person shown with a thermal imaging camera.



"Maps **(See Figure 7)** *are used to see accessible water mains within cities. Areas where there are current investigations are also noted on the map"*. (R. Mead, personal communication, January 19, 2016).

Figure 7. Robert Mead examining a map of Muncie.

Conclusion

Becoming a fire inspector or investigator may be the right career choice for those who are willing to invest several years in training after high school. Even though there isn't a large expected growth of jobs, this is an exciting career field which presents new adventures everyday. It is important to weigh the pros and cons before making the ultimate decision of choosing a career path. It may also be important to find people in this industry and to discuss with them their experience in order to discover what it is really like to have one of these careers.

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Automotive Body and Glass Repairer Career Exploration via a Hands-On Paint Scratch Repair Activity

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Introduction

Automotive body and glass repairers inspect damaged vehicles, remove damaged parts, repair metal car frames and chassis, use hand tools to hammer out dents or minor body damage, weld parts into place, grind, sand, and buff repaired surfaces, and apply new finishes to vehicles. The hands-on paint scratch repair activity described in this article is a great way to learn how to use some of the tools that an automotive body and glass repairer would use. This type of activity could help you to determine if this type of career would be for you.

Responsibilities of Automotive Body and Glass Repairers

Automotive body and glass repairers are involved with fixing collision damage on vehicles so that the vehicles can look and operate as originally intended. Individuals in this career work with metal and often have to bend the frame of a vehicle after it has been deformed by a collision. Often, the metal frame must be manipulated back to the original specifications of the manufacturer. Equipment such as metal cutting guns, plasma cutters, and pneumatic devices are commonly used in this field. Many hand tools such as metal files, screwdrivers, hammers, and wrenches are also used. There are some instances where automotive body and glass repairers are involved with painting repaired parts; however, this is typically done by painting and coating workers who specialize in this area of work (U.S. Department of Labor, 2014).

Becoming an Automotive Body and Glass Repairer

It is possible to enter this career with the minimum of a high school diploma; however, most employers prefer to hire candidates who have formal training obtained through a technical school or community college program. These types of programs typically combine classroom instruction with hands-on training. Even after being hired, training must continue throughout the career. In fact, many employers send their employees to advanced training programs to continue refining their skills. Certifications are also encouraged which are often obtained from the National Institute for Automotive Service Excellence or the Inter-Industry Conference on Auto Collision Repair (U.S. Department of Labor, 2014).

Pay and Benefits for an Automotive Body and Glass Repairer

The U.S. Department of Labor (2014) provides details relating to compensation for this field as of 2012. The 2012 median annual pay is stated as $38,380 per year. Salary.com (2014) reports the median annual salary for an automotive glass installer/repairer as $48,715 or an hourly wage of $23.00 per hour. This source identifies additional benefits such as bonuses, 401k/403B, disability insurance, healthcare insurance, pension, and time off. This can bring the total compensation from $48,715 to $70,484 annually.

Job Outlook for an Automotive Body and Glass Repairer

The U.S. Department of Labor (2014) reports job outlook data current as of the year 2012 automotive body and glass repairers. The number of jobs in 2012 was stated as 172,200. The job outlook from 2012-2022 has a growth rate of 13%, which is as fast as the average when compared to all occupations. The employment change from 2012-2022 is estimated at 22,900.

Interview with Jason Hoskins an Automotive Body Shop Painter at the Ed Martin Collision 14 Center in Anderson, Indiana

Jason Hoskins is an automotive body shop painter at Ed Martin Collision Center at 5400 Scatterfield Road, Anderson, Indiana. This premier collision center is managed by Tony Francis. Jason Hoskins was interviewed by Dr. Edward J. Lazaros on December 8, 2014. To read more about the Ed Martin Automotive Group, visit www.edmartin.com To read more about the Ed Martin Collision Centers, visit, http://edmartin.com/collisioncenters in the following section, you can read the questions that Jason was asked about his career, and you can read his responses:

What do you like most about your job?
"It is satisfying to me to be able to please the customer by being able to repair their vehicle so that it is just as good as new" (J. Hoskins, personal communication, December 8, 2014).

What would you say to someone who was looking to get into this type of career?
"You should be someone who is open to learning new information and being able to use your hands". (J. Hoskins, personal communication, December 8, 2014).

What do many people not understand about this field?
"There is a lot of science and technology that goes into being able to repair a vehicle well. For example with paint, air temperature, humidity levels must be carefully monitored because it can influence dry time and cycle time. A lot of research goes into determining things such as the brand code, paint code, and paint variant to guarantee a perfect finish and match". (J. Hoskins, personal communication, December 8, 2014).

Paint Scratch Repair Activity
Materials and Equipment Required

- Electronic Mil Gauge
- Electric Buffer Machine
- Soft Shop Towel
- 3M Perfect-It EX Rubbing Compound
- 3M Perfect-It Wool Compounding Pad
- 3M Perfect-It Machine Polish
- 3M Perfect-It Foam Polishing Pad
- 3M Perfect-It Ultrafine Machine Polish
- 3M Perfect-It Ultrafine Foam Polishing Pad
- Microfiber Polishing Cloth

Activity Procedure

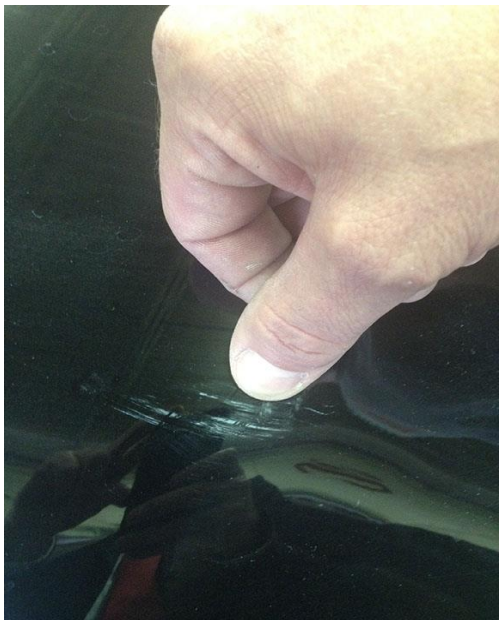
1. Safety glasses should be put on prior to starting the activity.

2. Determine if the paint on the vehicle is an OEM (Original Equipment Manufacturer) finish. This is important because it will determine how much paint material is on the metal panel. If it is not an OEM panel, the thickness of the paint material may vary from the original specifications. The thickness of paint material may influence how well a scratch can be repaired via buffing. To determine if the paint is OEM, an electronic mil gauge can be used. If the paint is an OEM finish, the electronic mil gauge should read 4.5-5.0. If it is not a factory finish, the gauge will be out of this range either positive or negative. If it is not a factory finish, proceed with caution because the thickness of the clear coat may not allow for the scratch to be easily buffed out. **See Figure 1.**

Figure 1.

3. Run your fingernail over the scratch to determine the depth. If your fingernail catches in the scratch, it may be too deep to repair by buffing. If your fingernail does not catch in the scratch, the repair can most likely be made via a buffing method. **See Figure 2.**

Figure 2.



4. Apply 3M Perfect-It EX Rubbing Compound to the painted surface. **See Figure 3.**

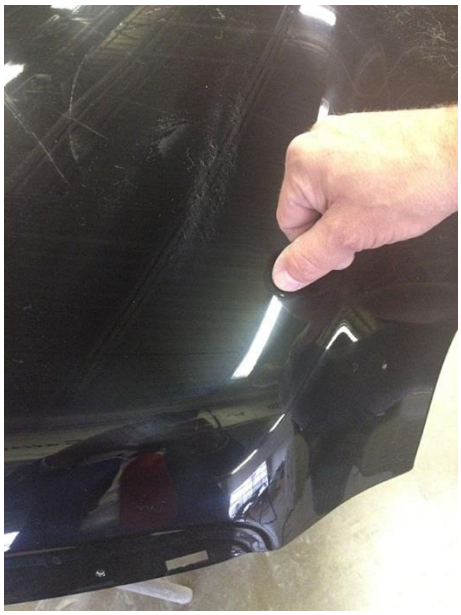
Figure 3.

5. Attach the 3M Perfect-It Wool Compounding Pad to the electric buffer machine and turn on the electric buffer machine and apply pressure as the buffer pad is rotating on the paint material. This may only take 30-60 seconds depending on the gravity of the damage to the painted surface. **See Figure 4.**

Figure 4.

6. Inspect the painted surface to make sure the damage was removed with the electric buffer machine and the 3M Perfect-It EX Rubbing Compound. Swirls will be evident in the paint from the buffer pad. **See Figure 5.**

Figure 5.

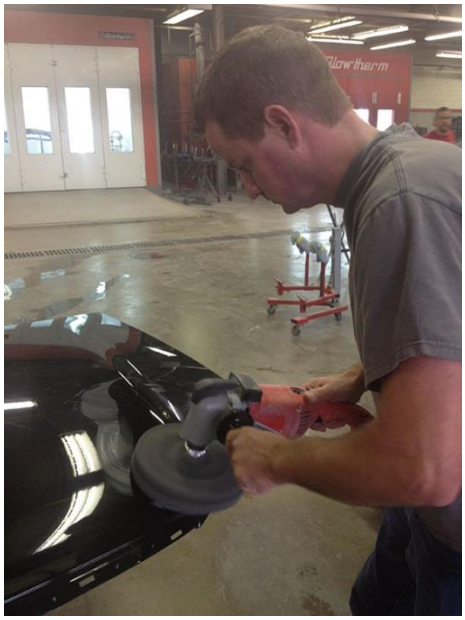


7. Apply 3M Perfect-It Machine Polish to the painted surface using a soft shop towel. **See Figure 6.**

Figure 6.

8. Attach the 3M Perfect-It Foam Polishing Pad to the electric buffer machine and turn on the electric buffer machine and apply pressure as the buffer pad is rotating on the paint material. This may only take 30-60 seconds depending on the gravity of the swirls in the painted surface. **See Figure 7.**

Figure 7.



9. Apply 3M Perfect-It Ultrafine Machine Polish to the painted surface using a soft shop towel. **See Figure 8.**

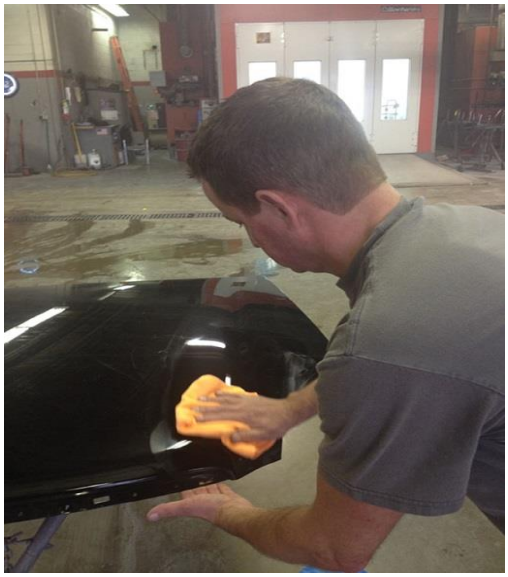
Figure 8.

10. Attach the 3M Perfect-It Ultrafine Foam Polishing Pad to the electric buffer machine. Turn on the electric buffer machine, and apply pressure as the buffer pad is rotating on the paint material. This may only take 30-60 seconds to eliminate fine scratches that may have been left by the rubbing compound and the machine polish. **See Figure 9.**

Figure 9.

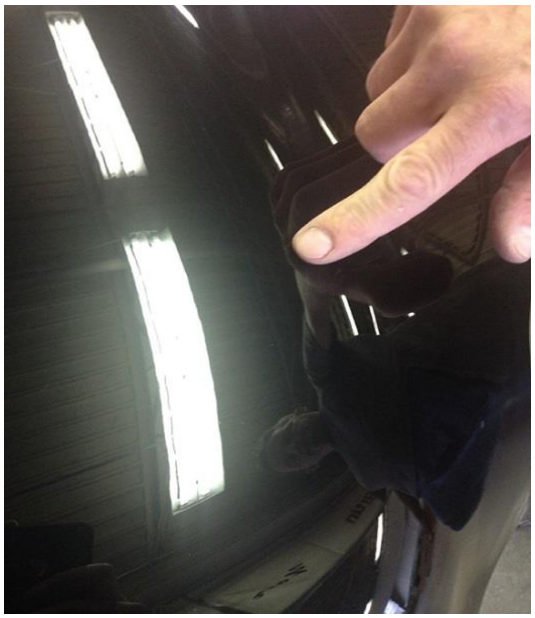
11. Use a microfiber polishing cloth to remove any machine polish from the painted surface. **See Figure 10.**

Figure 10.



12. Inspect the finished job to guarantee perfection. **See Figure 11.**

Figure 11.



Conclusion

Students who like using equipment and tools and have fun with this activity may want to consider a career as an automotive body and glass repairer. With a growth rate of 13% from 2012-2022 and a median annual salary ranging from $38,380 to $48,715 (depending on the source), this is a career field that may warrant further consideration.

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