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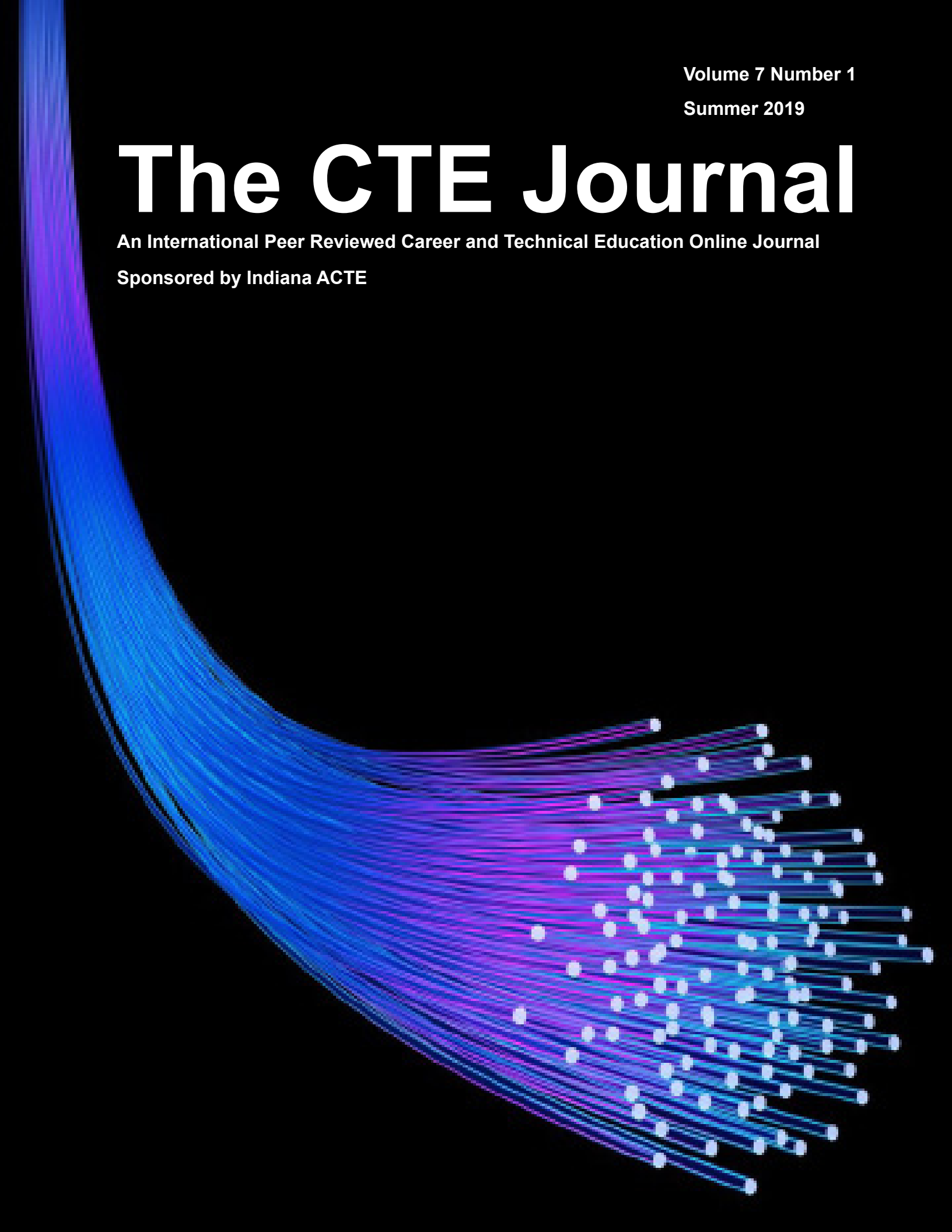
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Perception of Satisfaction in a CTE Teacher Preparation Program

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Abstract
Teacher Preparation Programs (TPP) are focused on preparing quality and effective classroom teachers and have long been regulated by federal and state governments. Most recently regulations dealing with program accountability have been developed to ensure gradates of TPP's have the skill and knowledge to increase student learning. This longitudinal study examined the perception teacher satisfaction of their Career and Technical Education (CTE) teacher preparation program after five or less years of teaching compared to their perception of their teacher preparation program before professional teaching experience. The findings of this study concluded that the satisfaction of program graduates and post-graduate program is there is not a statically significant difference. However, the high level of program satisfaction reported suggested graduates and post-graduates of this Career and Technical Education program area are satisfied with the quality of education. This study also investigated the relationship of graduates' perceptions of program quality to teacher retention and the findings revealed there was not a significant relation between the satisfactions of program completers that are employed to those not employed as a teacher. An important recommendation of this study supports the development of systematic evaluation procedures and the use of evidence-based evaluations to support program improvements.

Introduction
Teacher Preparation Programs (TPP) in the United States have a long historical presence dating back to 1823 when Samuel Read Hall started the first public normal school in Concord, VT which was aimed at preparing teachers with formal training in pedagogy. By 1850, there were seven normal schools in the United States spanning Massachusetts, New York, Pennsylvania, Connecticut, and Michigan (Wright, 1930). Then in the early twentieth century, normal schools began to transition into teacher colleges, then to state colleges, and finally to state universities. This transitional time was driven by the public's demand for more teachers and serves as an early indication of the struggle within the confines of the educational system between the quantity and quality of teachers (Labaree, 2008).

Few will argue about the importance of a quality classroom teacher and perhaps it can be the most important factor of student learning and growth. The release of *A Nation at Risk* by the National Commission on Excellence (1983) sounded the alarm regarding teacher quality fearing that "the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people" (p.

9). Key findings indicate, "not enough of the academically able students are being attracted to teaching; that teacher preparation programs need substantial improvement; that the professional working life of teachers is on the whole unacceptable; and that a serious shortage of teachers exists in key fields" (National Commission on Excellence, 1983, p. 20). Since this time, numerous accountability initiatives and programs have focused on improving the quality of teachers. Yet over two decades later teacher quality at all levels of education remains a major concern.

The challenge with preparing quality classroom teachers is further complicated with the growing teacher shortage. For the 2018-2019 school year, the teacher shortage is being described as "education in crisis" (Picchi, 2018). There has been a decline in high school graduates interested in the teaching profession (ACT, 2015, p. 3) and a decline in college students pursing a degree in teaching (U.S. Department of Education, 2015, p. 5). Looking at the teacher shortage on a national level, Startz (2015) surprisingly reported the number of bachelor and master degrees awarded in education are two or three times more than the number of new teacher hires (para. 3). Contradicting the national findings, many states have serious concerns about the teacher shortages affecting their school districts. There are varying factors that influence the teacher shortage within states. Aragon (2016) identified states with teacher shortages as having limitations governed by educational policies, having teacher shortages in certain subject areas, and having teacher shortages in urban, rural, and high-poverty, high-minority, and low achieving schools (p. 5).

Teacher preparation programs (TPP) are concerned with preparing quality and effective classroom teachers. All states require graduates of TPP's meet the minimum standards for certification and is one form of program accountability. Other accountability measures may include scores from standardized content tests or edTPA, among others. While teacher performance is the most popular measure of program accountability, there is also value in obtaining data from graduates' perception of program quality. Bastian, Sun and Lynn (2017) stated, "surveys of teacher preparation program graduates are becoming an important measure of quality for program evaluation, accreditation, and improvements" and "may be an important contributor to data-driven program accountability" (p. 1). This study surveyed TPP graduates' in one specialized area of Career and Technical Education. Career and Technical Education prepares all learners for the "world of work by introducing them to workplace competencies, and makes academic content accessible to students by providing it in a hands-on context" (Advance CTE, 2019, para. 1). This longitudinal study investigated the following research questions:
1. What is the perception of teacher satisfaction of their teacher preparation programs after five or less years of teaching compared to their perception of their teacher preparation program before teaching experience?
2. What is the relationship of graduates' perceptions of program quality to teacher retention?
The null hypothesis for research question 2 is that there is no relationship between graduates' perceptions of program quality and teacher retention.

Literature Review

There is an underlying connection between teacher preparation, quality teaching, and student success. Teachers in their first-year of teaching, experience a significant number of situations that contribute to their satisfaction with the quality of their teaching experience. Supporting this ideology, Carver-Thomas and Darling-Hammond (2017) specifically identified teachers that have taken 10 or more courses in teaching methods were more likely to report feeling well prepared or very well prepared to handle a variety of teaching responsibilities in their first year (p. 26). There is significant research on teacher satisfaction and outline a number of variables that can be of direct influenced. For example, Ingersoll (2012) identified, "that most of the studies that looked at the effect on teachers' job satisfaction, commitment, and retention found positive effects on beginning teachers who participated in some kind of induction" (p. 51). In another study, Carver-Thomas, Darling-Hammond (2017) reported, "among the two-thirds who leave for reasons of dissatisfaction cite concerns with school administrators, lack of influence on school decision-making, and school conditions" (p. 6). Induction participation, school administration, decision-making, and school conditions, among others are just a few of the variables that can effect teacher satisfaction.

Teacher preparation programs (TPP) are designed to prepare teachers for the rigor of today's classroom and are closely regulated by the U.S. Department of Education to ensure that new teachers have the skill and knowledge to succeed. In 2015, the U.S. Department of Education published regulations that brought transparency to the effectiveness of TPP's and provided programs with improvement feedback. The new regulations required individual states to report beyond the basic requirements of the Higher Education Act with a specific outcome requiring feedback from graduates and their employers on the effectiveness of program preparation (U.S. Department of Education, 2015).

TPP's evaluations may use different measures that are not easily computable and often "a combination of input and output measures forms the basis for a variety of inferences – findings and interpretations – about the quality of TPP programs" (Feuer, Floden, Chudowsky, & Ahn, 2013, p. 2). A common output of higher education institution measures are results from surveys administered to program completers, first-year graduates, and post-graduates. Survey of graduates assess their rating of the program and their perception on teaching preparedness. An advantage to collecting program data using surveys is that it provides a large amount of data at a minimal cost and the results of the data can easily be used to compare results between programs and cohorts (Worrell, et al., 2014). There is also value in surveying program graduates that are first-year teachers and program graduates that have several years of developing their teaching practice. Graduates can provide, "feedback on how prepared they felt by many key aspects of their teacher preparation program for their role, now that they are actually in the field" (Worrell et al., 2014, p. 25).

The use of surveys for TPP evaluation are not without disadvantages. Coggshall, Bivona, and Reschly (2012) reported surveys are subject to bias and rely heavily on perception rather than reality. They have also cited the timeliness of distributing the survey and response rate as a weakness of this evaluation instrument (p.41). Yet another concern from The National Research Council (2010) stated that not all TPP's are held to the same state standards with inconsistent standards and licensure requirements. Without the use of a common survey used by all TPP's within or across states, it is impossible to compare programs based on survey results. The National Council for Accreditation of Teacher Education (2010) recommended that all TPP's be "held to same standards; data-driven accountability based on measures of candidate performance and student achievement, including gains in standardized test scores. Data drives reform and continuous improvement" (p.12).

The value-added model is an outcome measure focused on measuring a teacher's contribution to growth in student achievement. "The basic premise of all value-added assessment of TPPs is that variance in K-12 student gains on standardized achievement tests can be attributed to the quality of teacher training a teacher received when other variables are controlled or adjusted" (Evans & Lee, 2016, p. 2). The greatest strength of the value-added model is that it provides a common metric to compare programs; however, it does not provide recommended actions for program improvements (Coggshall, Bivona, & Reschly, 2012, p. 12). Evans and Lee (2016) concluded, "because value-added estimates of TPP effects are not completely accurate or unbiased it is difficult, if not impossible, to base decisions about programme quality or teacher candidate quality on value-added estimates" (p. 15).

Essentially, the literature regarding evaluating TPP's supports the use of a broad set of inputs and outcomes to make comprehensive program evaluation. Bastian, Patterson, and Pan (2017) stated, "there is no consensus regarding the teacher experience levels or the school-level/licensure are breakdowns to include the TPP evaluation systems" (p. 431). The intended use of the survey evaluation tool for this study was focused on identifying the program's strengths and weaknesses to guide improvements and positive change. This study contributes to the literature by narrowing the focus to a specific licensure area within Career and Technical Education rather than all institutional teacher preparation graduates.

Method
This study focused on the perception of teacher satisfaction of their teacher preparation programs (TPP) after five or less years of teaching compared to their perception of their teacher preparation program before their teaching experience. In addition, this study investigated if there is a relationship between graduates' perceptions of program quality to teacher retention. This study followed a longitudinal method.

Population. The population of this study included graduates from a Midwest university TPP in a specified licensure area within Career and Technical Education. The first phase

consisted of surveying all graduates at the completion of their licensure program from fall 2008 – fall 2012. In spring 2013, the same graduates from the 2008 - 2012 timeframe were administered the same survey. The second phase consisted of surveying all graduates at the completion of their licensure program from fall 2013 – fall 2017. In spring 2018, the same graduates from the 2013 – 2017 timeframe were administered the same survey.

A total of 71 graduates participated in the survey completion from 2008 – 2012 with a response rate of 34.5 % or 41 alumni completing the survey in spring 2013. A total of 46 graduates participated in the survey completion from 2013 – 2017 with a response rate of 30.4% or 14 alumni completing the survey in spring 2017. The N value represents the total number of program graduates completing the survey. The overall response rates are presented in Table 1.

Table 1
Survey Completion Response Rates

Participants	N	Number of Participants Completing Alumni Survey	Percentage of Alumni Responses
2008 - 2012	71	41	34.5
2013 - 2017	46	14	30.4
Total Number of Participants	117	55	

Survey Instrument. The TPP survey included a series of open-ended questions that captured the semester and year the participant completed the program; if the participant is currently teaching in the licensure content area; if not teaching how many years did they stay in the profession and the reason for leaving. A four-point Likert Scale was used as the rating for the following questions:
　　1. Overall, how relevant did you find the course materials in regards to your initial teaching experience?
　　2. Overall, how effective did you find the methodology used in the delivery of your program courses?
　　3. Overall, how would you rate the quality of the program course content?
　　4. Overall, how do you feel about the quality of preparation you received as a beginning teacher?

The TPP survey was developed in 2008 by program faculty as a way to capture the perception of student satisfaction of their teacher preparation program. Cronbach's alpha was used to measure the scale of reliability for the four survey questions used in this study. A reliability analysis was carried out on the perceived task values scale comprising of four items. Cronbach's alpha showed the questionnaire to reach acceptable reliability, $\alpha = 0.85$.

The TPP survey questions structured in this study were directly aligned to the content-related evidence of validity. Specifically the questions of the survey are representative of the target construct of identifying the difference in perception of teacher satisfaction of a TPP after five or less years of teaching compared to their perception of their teacher preparation program before their student teaching experience.

Results
This study investigated the perception of teacher satisfaction of their TPP after five or less years of teaching compared to their perception of their TPP before teaching experience and if there a relationship of graduates' perceptions of program quality to teacher retention.

Results Research Question 1. What is the perception of teacher satisfaction of their TPP after five or less years of teaching compared to their perception of their teacher preparation program before teaching experience? The results are based on participants that answered all four survey questions. Partially completed surveys were excluded from these results. The Mann-Whitney U Test was used to compare teacher program satisfaction of program graduates to teacher program satisfaction of post-graduate teachers with five or less years of teaching experience. The Mann-Whitney U Test is a nonparametric test that does not require the assumptions of normal distributions. The mean rank and the sum of ranks for the two groups is presented in Table 2.

Table 2
Mann-Whitney Test Ranks for Program Satisfaction

Group	N	Mean Rank	Sum of Ranks
2008-2012 Graduates	59	42.32	2497
2012 Post-Graduates	27	46.07	1244
2013–2017 Graduates	34	22.57	767.5
2017 Post-Graduates	8	16.94	135.5

| 2008-2017 Graduates | 93 | 65.04 | 6049 |
| 2012 and 2017 Post-Graduates | 35 | 63.06 | 2207 |

The results of Table 2 indicate varying satisfaction results. Comparison of the 2008 – 2012 program graduates mean rank of 42.32 and the 2012 post-gradates mean rank of 46.07, the post-graduates had the higher mean rank. Comparison of the 2013 – 2017 program graduates mean rank of 22.57 and the 2017 post-graduate mean rank of 16.94, the program graduates had the higher mean rank. Comparison of the 2008 – 2017 program graduates mean rank of 65.04 and the post-graduates mean rank of 63.06, the program graduates had the higher mean rank.

The actual significance values of the test are presented in Table 3.

Table 3
Mann-Whitney U Test Statistics

	Program Satisfaction Between 2008-2012 Program Graduates and 2012 Post-Graduates	Program Satisfaction Between 2013-2017 Program Graduates and 2017 Post-Graduates	Program Satisfaction Between 2008-2017 Program Graduates and 2012 and 2017 Post-Graduates
Mann-Whitney U	727	99.5	1577
Z	-0.642	1.153	0.267
p-value	.522	.250	.787

From this data, it can be concluded that the results from all comparisons of program graduates and post-graduate program satisfaction is that there is no statically significant difference of program satisfaction at p < .05.

Results Research Question 2. Is there a relationship of graduates' perceptions of program quality to teacher retention? The results of the status of employment survey responses are presented in Table 4.

Table 4
Number of Program Completers Employed as a Teacher

Employment Status	High Level of Program Satisfaction	Low Level of Program Satisfaction	Chi-square Totals
Employed as a Teacher	28	2	0.03
Not Employed as a Teacher	4	0	0.25
Total Participants	32	2	0.28

A chi-square test of independence was performed to examine the relation between the satisfactions of program completers that are employed to those not employed as a teacher. The relation between these variables was not significant, X^2 (1, N = 34) = 3.841, p<.05. Therefore the null hypothesis is not rejected that program satisfaction and retention in the field of teaching are independent.

Discussion

Quality teacher preparation programs (TPP) have long been concerned with developing graduates that can demonstrate positive student learning gains. Recently attention has been given to the effectiveness of TPP's, specifically how teacher preparation programs ensure they are preparing effective teachers. Worrell, et al., (2014) noted, "surveys can be very useful as a program evaluation tool with former teacher candidates" (p. 25) this aligns with federal regulations to require feedback from graduates on the effectiveness of program preparation. While this study did not reveal a significant difference in TPP satisfaction between program graduates and post-graduate students with five or less years of experience, the high level of program satisfaction reported suggest graduates and post-

graduates of this Career and Technical Education program area are satisfied with the quality of education.

This longitudinal study focused on one evaluation instrument to identify program satisfaction, but failed to address the impact on student learning. The development of a comprehensive survey that incorporates the value-added model would provide data that measures the impact on student achievement. Currently, value-added models are the only approach to "judge teacher preparation programs quality based in the effectiveness of their graduates in producing growth in student achievement" (Feuer et al., 2013, p. 36). Data collected from value-added models would provide another means for determining the necessary program improvements.

This study also investigated the relationship of graduates' perceptions of program quality to teacher retention. While the findings of this study did not show a significant relationship between TPP's satisfaction and retention, the literature suggests there is an association. Feuer et al., (2013) found that the perception of preparation programs are modestly associated with the effectiveness and retention of first and second-year teachers" and "suggest that, on average, those who feel better prepared to teach are more effective and more likely to remain in teaching" (p.24). DeAngelis, Wall, and Che (2013) also found, "a direct association between new teachers' perception of preservice preparation quality and their intentions to remain in their current school and in the profession" (p. 350). While this study did reveal that a large number of graduates (87.5%) of this Career and Technical licensure program remained in the profession, it can be concluded that graduates are satisfied with this TPP. However, to further study the relationship between graduates' perception of program quality and retention it is more important to look at the induction supports offered to new teachers. Ingersoll (2012) revealed induction has a positive effect. It is unknown in this study if induction practices influenced the retention of teachers, however, analysis of this data could provide valuable insight to the influence induction or mentorships have on the perception of program quality in TPP's.

Recommendations
This study is important because it brings attention to the importance of collecting and analyzing data to improve teacher preparation programs. TPP's must develop systematic evaluation procedures that meet state and federal accountability regulations, but, perhaps more importantly; these evidence-based evaluations should provide the necessary data to support program improvements. It is recommended and support by the literature that evaluation procedures use a variety of assessments consisting of both inputs and outputs and consideration be given to evaluations that incorporate value-added models. Equally important, post-graduate surveys can provide valuable feedback regarding the influence of induction program during the first few years of teaching, because of this it is recommended that evaluation instruments used to survey post-graduates include questions to collect data on supports used during the first few years of teaching. These

recommendations support the ultimate goal of TPP's to prepare quality, effective teachers that can positively affect student learning.

Conclusion
Teacher preparation programs (TPP) have long prepared effective and quality classroom teachers. There has been a lack of interest to enter the teaching profession causing many states to have concerns about filling teaching positions in urban, rural, high-poverty, high-minority, and low-achieving schools, and even in certain subject areas. In efforts to provide transparency to the effectiveness of TPP's federal and state regulations require a greater degree of TPP accountability. This longitudinal study compared the perception of teacher satisfaction of their TPP between program graduates of a Career and Technical Education licensure area to the same graduates after five or less years of teaching. This study also investigated the relationship of graduates' perceptions of program quality to teacher retention. This finding of this study concluded no statistically significant difference in perception of program satisfaction between program graduate and post-graduates, but the data does suggest a high level of satisfaction of program graduates and post-graduates with five or less years of teaching experience. In addition, the findings of this study concluded no significant relationship between the satisfactions of program completers of those employed as a teacher to those who have left the teaching profession.

Given the strong focus on evaluation of TPP's and the results of the literature review it is appropriate to survey program graduates and post-graduate program completers; however, collecting only the perceptions of program satisfaction are subject to bias. To strengthen the evaluation data it is recommended TPP's include evidence-based evaluations such as value-added models in questionnaires. Further research is needed on how TPP's influence the performance of graduates in relation to greater gains in student learning.

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Veterinary Technologist and Technician Career Path Exploration

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Introduction

The purpose of this article is to give detailed and precise information to those who are potentially interested in pursuing a career as a veterinary technologist or technician. This article will assist in developing a deeper understanding of the intricacies of a career as a veterinary technologist and technician. Topics explored in this article include: responsibilities of a veterinary technologists and technician, how to become one, the pay and benefits and the job outlook.

Responsibilities of Veterinary Technologists and Technicians

The main responsibility of veterinary technologists and technicians is to care for animals through observing their behaviors and conditions. They also work to provide care or aide to recovering and injured animals. This care and aide includes bathing the animals, maintaining the animal's hair or clipping their nails. Veterinary technologists and technicians can also assist the veterinarian. This assistance involves conducting a variety of procedures and research (Department of Labor, 2015).

Both technologists and technicians assist the veterinarian with a variety of tasks. These tasks consist of restraining animals during examination or other procedures, as well as administering anesthesia and monitoring the animals' responses. They also assist the veterinarian when he or she is not looking after an animal. This assistance consists of conducting laboratory work on samples, such as blood, taking and developing x-rays, preparing animals and instruments for surgery, and collecting and recording an animals' health history. Not only can veterinary technologists and technicians assist a veterinarian, but they can also assist scientists. When working with scientists, technologists and technicians make sure that the animals are handled with care and are treated humanely. They also help the scientist conduct research for biomedical, disaster preparedness and food safety purposes (Department of Labor, 2015).

The tasks for veterinary technologists and technicians rely heavily on advancements in technology. Without technology, many of the practices used for the care of animals and for conducting research could be considered inhumane. Some tools and technology associated with a veterinary related career path can be medical software for various species of animal, emergency medical devices, equipment to catch animals without harming them and equipment to improve the care and well-being of animals (Veterinary Technologists and Technicians, 2015).

Veterinary Technologists
Veterinary technologists are responsible for more advanced research conducted with animals. They mainly work with veterinarians and/or scientists in a laboratory setting. They administer medication, prepare samples for examination, and record information about an animals' signs of pain, weight, diet and genealogy.

Veterinary Technicians
Veterinary technicians are responsible in assisting a veterinarian either through laboratory duties or through the examination of an animal (U.S. Department of Labor, 2015). This may include helping animals who are in the hospital and assisting veterinarians with surgeries or tests performed on animals (Sanders, 2010). Technicians also get a chance to communicate with pet owners. They explain pet diagnoses and how to properly administer medication prescribed by the veterinarian (Department of Labor, 2015).

How to Become a Veterinary Technologist and Technician
Completing high school with some courses in biology and mathematics and postsecondary education is necessary for both occupations. Apprenticeships and/or internships are highly recommended to gain experience while pursuing an education. Being a technologist or technician is dependent on how long one wishes to attend postsecondary school. Veterinary technicians must complete two years of postsecondary education for an associate's degree in veterinary technology. Veterinary technologists must obtain a bachelor's degree in veterinary technology (Department of Labor, 2015). While in postsecondary school, technologists and technicians may have the opportunity to focus their studies and become specialized in one or more of these areas: avian medicine, biomedical research, clinical pathology, clinic supervision, dentistry, emergency medicine, exotics, large animals, small animals and surgery (Veterinary Technician Job Description and Duties, 2016). Both technologists and technicians also must complete and pass a credential exam called the Veterinary Technician National Examination proctored by the American Association of Veterinary State Boards. Certification is not mandatory but can be beneficial to finding employment. Not only does someone need to possess the drive to complete an education and pass an exam for this career path, but candidates must possess certain skills to be successful. These skills include: compassion for both humans and animals, communication, problem-solving, manual dexterity and focus on details (Department of Labor, 2015). Communication and problem-solving skills are especially essential for veterinary technicians because they work more directly with animals and need to have an understanding of what the animal needs and what the owner needs if applicable (Sanders, 2010).

One organization, the American Association for Laboratory Animal Science (AALAS), offers certification for technologists and technicians who would like to work in research. These certifications are called Laboratory Animal Technician and Laboratory Animal Technologist (Department of Labor, 2015). This organization also offers a certification called Assistant Laboratory Animal Technician. The AALAS also offers educational and

membership opportunities that allow one to be well informed about the technological and academic advancements in laboratory animal science (AALAS, 2014).

The work environment should be considered when pursuing a career as a veterinary technician or technologists because there are some dangers to be aware of in this career field. This career can be demanding both physically and emotionally. The physical demands can include standing for long periods of time, cleaning animal cages and holding animals. The emotional demands can include witnessing the abuse of animals and assisting in the euthanasia of animals. Following euthanasia, additional physical and emotional demands include lifting the animal's body, breaking its bones, and saving ashes and bones for the owners of the animal (Sanders, 2010). Injury and/or illness incidents occur at a higher rate than the national average of all careers for veterinary technologist and technician. Injuries can occur when working with aggressive or frightened animals. The work schedule for technicians and technologists varies. Most laboratories and veterinary clinics operate 24 hours a day, making scheduling for work dependent on the availability of the staff. Working weekends and holidays is required (Department of Labor, 2015).

Pay and Benefits for Veterinary Technologists and Technicians
Salary and wage information has been available since May 2014 through the U.S Department of Labor (2015). The median annual salary for all employees in 2014 was $35,540. Meanwhile the observed median annual salary for veterinary technologists and technicians in 2014 was $31,070. The range of salary for employees in this particular occupation from the lowest ten percent to the highest ten percent was $21,390 to $45,710 (Department of Labor, 2015). According to a report provided by U.S.News.com (2016) the average annual salary in 2014 was $32,350. It should be noted that a veterinary technologists and technicians that work in full-time research positions earn a higher salary (Department of Labor, 2015). This career path's benefits include personal and sick days, paid vacations, and health insurance, and clinics tend to pay for uniforms and offer discounts for their employees. Additionally, veterinary technologists and technicians can often continue their veterinary education, and the clinics will fund it ("Veterinary Technician Job", n.d.).

Job Outlook for Veterinary Technologists and Technicians
Veterinary technologists and technicians have a projected rate of 19% employment growth from 2014 to 2024. This is much faster than the average rate of all occupations in the U.S. economy. In 2014, the Department of Labor reported that there are a total of 95,600 veterinary technologists and technicians. It is projected that a 19% growth rate will increase the number of available positions to 113,600. This is a total of 17,900 new positions from 2014 to 2024. The overall outlook for finding employment is very good, especially in rural areas that are in need of veterinarians and technologists and technicians. It is important to keep in mind that with the large growth of demand for veterinary technologists and technicians, a number of postsecondary schools are

supporting such programs and graduation rates are increasing, resulting in a competitive job market (Department of Labor, 2015).

Interview with Sarah Snider at the Care Animal Hospital in Muncie, Indiana
Sarah Snider is a veterinary technician with the Care Animal Hospital in Muncie, Indiana. (See Figure 1.). Sarah Snider was interviewed by Dr. Edward J. Lazaros, Angela Gervais, and Mary Pat Stemnock on April 5, 2016. To read more about the Care Animal Hospital, visit http://care-animal.com/about-us/. The following section details the questions that Sarah was asked about her career, along with read her responses:

Figure 1. Sarah Snider displaying the computer used to view diagnostic test results including blood work.

What is your daily routine as a veterinary technician?
"The first thing we do when we arrive in the morning is come in and set up for the day. We begin by logging in to the computers, checking patients, and then moving into our treatment area. We do vital signs on the patients that stayed overnight and give them medications. Our main goal at the beginning of the day is to make sure everybody who stayed the night is doing well. Then, we set up for appointments and get the day prepared, which includes things like pulling up any vaccines or drugs that we may need. Every day is about getting into a routine.

In order to know what each day will be like, we have a computerized schedule. It's a breakdown of who's coming in for each hour of the day. We see appointments from 8 until 6:30, which adds up to around 20-30 per day. We have two doctors that often run out of time because we're so busy. Sometimes we have three patients here at a time. We also have a whiteboard that lists treatments for the day and night to keep us organized" (S. Snider, personal communication, April 5, 2016).

What is the best part of being a veterinary technician?
"Obviously, it's fun to see animals come in each day, but you also get a reward from helping them. It's rewarding when you have a sick patient come in, and two days later

they're walking out to see their owners. The look on their owners face makes it worth it. They're their children.

When I was a child, I enjoyed watching television like Animal Planet and was upset by ASPCA commercials—I've always been an animal lover. The animals don't have a voice and you have to speak for them. There's an animal that's hurting and you have to figure out how to fix it. That's what I'm here for" (S. Snider, personal communication, April 5, 2016).

How do you diagnose an animal?
"Asking questions is important to give a proper diagnosis. We start by asking the owner what they think is wrong. First we check on eating and drinking, because there's a clear problem if the animal is not eating or drinking. Then we start to break it down—is it their arm? Do they put pressure on it? Where does it hurt? More answers can also from diagnostics. We take x-rays, do blood work, and find out concrete answers if need be" (S. Snider, personal communication, April 5, 2016).

What kinds of fun technology do veterinary technicians get to use?
*"The digital x-ray machine allows us to get a better idea of what is wrong with a patient (*See Figures 2 and 3*). The machine breaks down the scanning area by column so only the affected area gets the radiation. You can increase or decrease the amount of radiation. Once the image is taken, it immediately appears on another computer"* (S. Snider, personal communication, April 5, 2016).

Figure 2. Sarah Snider demonstrating how to select an area by column on the digital x-ray.

Figure 3. Sarah Snider showing images that can be displayed on the digital x-ray screen.

"The dental x-ray machine is used to look at a patients mouth, including their gums and teeth (See Figures 4, 5, and 6). *A black piece is inserted into the patient's mouth to take the image. Then, the image appears on the television screen. You can use the images to*

decipher what is wrong with each section of the mouth" (S. Snider, personal communication, April 5, 2016).
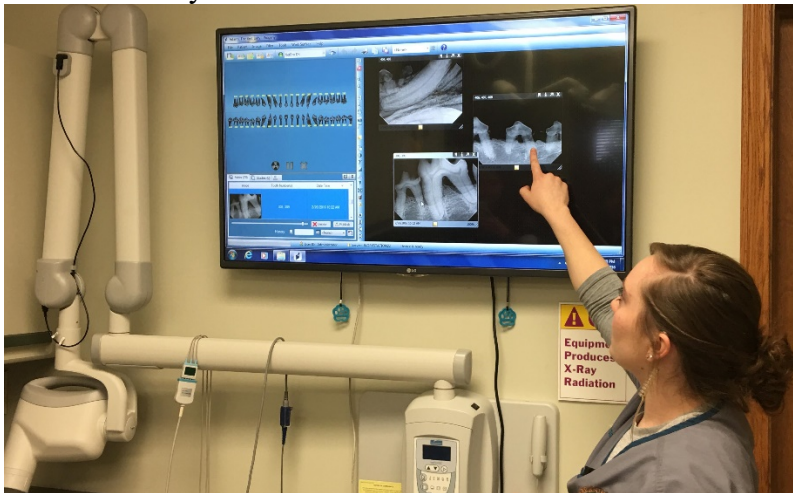
Figure 4. Sarah Snider adjusting the dental x-ray machine.

*Figure 5.* Sarah Snider showing images taken by the dental x-ray machine.

Figure 6. Sarah Snider examining and addressing the medical issues in an image taken by the dental x-ray machine.

"This the computer we use for our calendar and patient charts (See Figure 7). *The calendar is color coded and marked for each type of appointment. Our charts are also stored here. The charts contain all of the information about a patient and should be accessible to all employees"* (S. Snider, personal communication, April 5, 2016).

Figure 7. Sarah Snider displaying the appointment calendar.
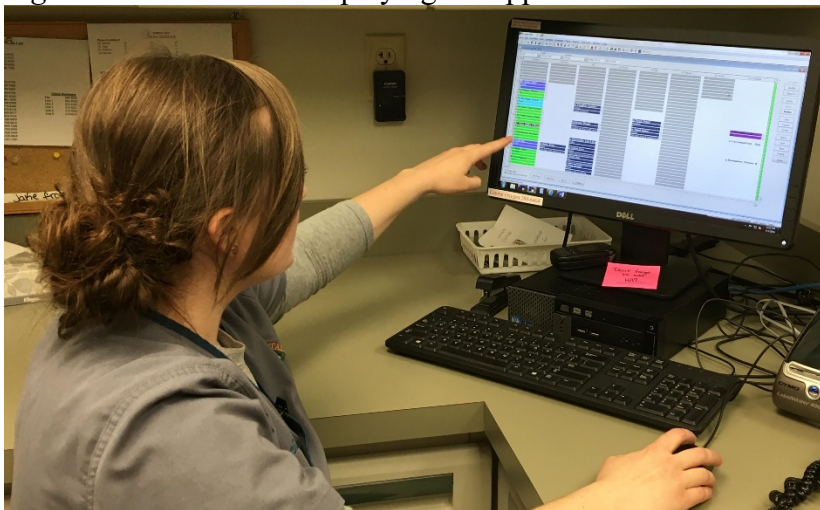
"The laser therapy machine is used to treat animals dealing with pain (See Figures 8 and 9). *It can be rolled over a muscle or other area such as an ear for relief. The laser therapy machine is essentially a massage for our patients. It does wonders"* (S. Snider, personal communication, April 5, 2016).

Figure 8. Sarah Snider demonstrating how to use the laser therapy machine.
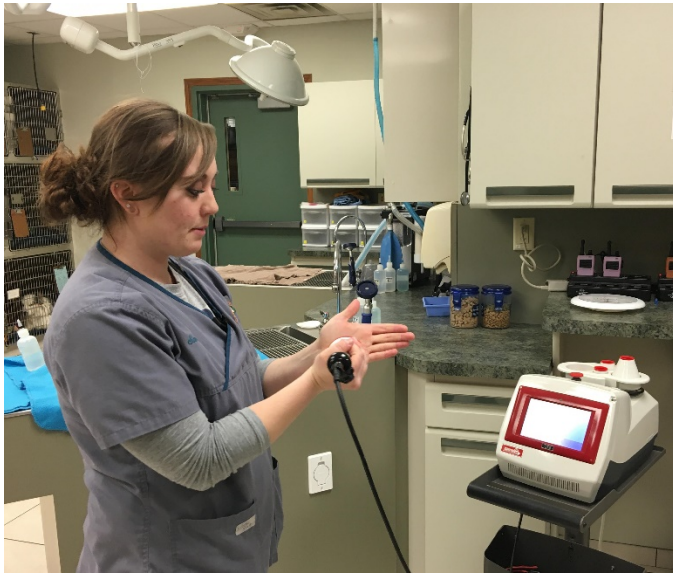
Figure 9. The laser therapy machine screen and applicator.

"We have a few types of x-rays. We have digital x-rays and dental x-rays. X-rays are useful because you can see what you can't when you're just looking at the animal. For example, the dental x-rays allow us to see below the gum line to see if a tooth needs to get pulled. With x-rays, we can catch things earlier.

Another type of technology we have is a laser therapy machine. It is used to reduce pain faster. If an arthritic dog comes in and it's limping, we can take the laser therapy machine and go over the affected area with heat. The next thing you know, they're walking. We also do a lot of things for ears with the laser therapy. The cats and dogs

enjoy it. It's therapeutic and its helps faster. It's also not medication, which some owners cannot give. It's much less invasive than surgery as well.

We also chart our patients on the computer. Each animal that walks in for an appointment gets a chart. The process we use to fill out the chart is called SOAP: subject, objective, assessment, and plan.

The subject category includes the history you get for each animal. This tells you more about them and their medical records. After reviewing the subject, you move on to the objective category. This includes looking and seeing what's going on with the patient. The objective category includes taking note of the patient's mouth, teeth, body weight, and other observable aspects. The assessment comes from observation including notes, vital signs, and diagnostics, or other data. Once all of this has been completed, you create a plan of treatment for the patient" (S. Snider, personal communication, April 5, 2016).

What will be the most challenging thing a recent graduate will encounter when trying to break into this industry?
"The hardest thing to do is to build a relationship with the clients. You have to talk to people about what's going on with your pet, which can be difficult. You have to figure out how to talk to them and build that relationship and that trust.

Being able to communicate is something that school doesn't prepare you for. Experience, like talking on the phone and what questions to ask, comes with practice. They teach you in class that clients can ask questions that might not make sense. When this happens, you have to be able to answer that question quickly and confidently to show that you know what you're talking about.
The relationships are also the most rewarding thing, though. I get to see older people and talk to them and have a conversation, which is really nice. Talking about their animals and how cute they are is fun.

Experience is what teaches you. I've been in the field for a year, and I'm still getting used to answering questions. It's hard to learn to know what to do in certain situations. You don't get to face an emergency in school. We take walk-ins, so you'll have situations where dogs get hit by cars and you have to know what to do to make the animal comfortable right now. You have to be able to talk to the client, comfort them, and give them a game plan" (S. Snider, personal communication, April 5, 2016).

Conclusion
Veterinary technologists and technicians help man's best friend and other pets recover from medical issues and conduct research to solve medical issues for animals. Becoming a veterinary technologist or technician could be the right choice for those who have a passion for animals and are willing to invest in postsecondary education. It is also important to find opportunities to participate in internships or apprenticeships to gain

experience in the field. The job growth rate in this field is high, meaning the job market will be competitive. Having something unique on one's resume, such as some type of specialization, can make one a good candidate for a position. It is important to consider all aspects of this career path before committing to it.

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The Business Education Advantage for Closing the Employability Skills Gap

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Introduction

Business education has an important presence in the American educational system with some forms dating as far back as ancient Greece. While the early business education curriculum provided instruction in the development of basic office skills, today's curriculum "has developed into a multilevel discipline that embraces technology and provides preparation for students to work in a global marketplace and to function as intelligent consumers" (NBEA, 2013, p. 19). Business education transforms to the changing needs of society and continually prepares students in "occupational competence and … economic efficiency" (NBEA, 2013, p. 19). Business education is positioned to prepare secondary and postsecondary students for a labor force that is projected to grow "from 159.2 million people in 2016 to 169.7 million people in 2026 - an increase of about 10.5 million people" (Lacey, Toossi, & Dunbina, 2017, para. 3). The 2018 job sectors classified as high-demand include health services, technology, hospitality, business and administration, and skilled trades (Trade Schools, Colleges, & Universities, 2018). The business education curriculum as a whole emphasizes continuous quality education. One aspect of the business education curriculum is to prepare students for career readiness, which is designed to encompass business topics and integrate other academic skills such as reading, writing, and math (PCBEE, 2014). Other aspects of the curriculum include developing employability skills such as problem solving, critical thinking, collaboration, creativity, and communication to ensure students can master the knowledge, applications, and attitudes that will reinforce workplace competencies (NBEA, n.d., para. 9). Business education with its rigorous and relevant curriculum is instrumental in preparing secondary and postsecondary students with the knowledge, application, and attitudes for high-demand careers.

How Business Education Supports High-Demand Sectors

Business education plays a key role in preparing students to be college and career ready in high-demand occupational sectors. With specialized curriculum in business management, business administration, finance, and information technology, business education prepares secondary and postsecondary students for entry-level positions such as administrative assistants, bank tellers, property and real estate managers, food service managers, lodging managers, and technical support specialists, among others.

Growth will be significant in the current and future high-demand sectors. According to the Occupational Outlook Handbook, employment of business and financial operations as well as administrative services managers is projected to grow 10 percent from 2016 to 2026 (Bureau of Labor Statistics, 2018b). Healthcare service positions are anticipated to "account for 16 of the 30 fastest growing occupations from 2016 to 2026" (Lacey, Toossi, Dunbina, & Gensler, 2017, para. 3). Even more impressive is the growth in the

information technology sector which "is projected to grow 13 percent from 2016 to 2026, faster than the average for all occupations" (Bureau of Labor Statistics, 2018a, para. 1).

All U.S. states and territories are using Career and Technical Education (CTE) programs "to prepare students of all ages for success in college and career by helping them develop the skills, technical knowledge, academic rigor and real-world experience for high-skill, high-demand, highly successful careers" (Advanced CTE, 2019b, para. 1). The National Career Clusters Framework provides the structure for CTE programs of study. This Framework includes 16 Career Clusters; and within these Clusters, there are more than 79 Career Pathways. Each Career Pathway is a comprehensive program of study that provides essential knowledge and skills that connect secondary and postsecondary curriculum (Advanced CTE, 2019a). Specific to the high-demand sectors, Career Pathways in business education include Business Management and Administration and Finance. Business education also supports Health Science and Information Technology Pathways, among others. The number of CTE concentrator enrollments in each of these Career Pathways, according to the U.S. Department of Education, Office of Career, Technical, and Adult Education (2017), is shown in Table 1.

Table 1

Number of CTE Concentrators Enrollment in Career Pathways

CTE Career Pathway	Secondary CTE Concentrator Enrollment	Postsecondary CTE Concentrator Enrollment	Percent of Increase/Decrease in Enrollment from 2016 - 2017	
			Secondary	Postsecondary
Business Management and Administration	409,993	305,019	+2.7	+1.6
Finance	121,244	28,120	+5.4	-13.1
Health Science	390,212	509,526	+9.2	-1.2
Information Technology	233,864	151,712	+10.2	+5.8

Note. CTE CONCENTRATOR.—The term 'CTE concentrator' means: (A) at the secondary school level, a student served by an eligible recipient who has completed at least 2 courses in a single career and technical education program or program of study; and (B) at the postsecondary level, a student enrolled in an eligible recipient who has (i) earned at least 12 credits within a career and technical education program or program of study or (ii) completed such a program if the program encompasses fewer than 12 credits or the equivalent in total.

Both the Business Management and Administration and Finance Career Pathways prepare students with the skills and knowledge to pursue careers that require postsecondary degree attainment, thus preparing students to be college and career ready. Presented in Table 2 are examples of secondary and postsecondary business education content that support the preparation for development of knowledge and skills in high-demand careers.

Table 2.

Business Education Course Content in High-Demand Areas

High-Demand Areas	Secondary Business Education Course Content	Postsecondary Business Education Course Content
Business Management and Administration	Accounting Business Communications Business Management Business Essentials Business Law Business Technology Applications Global Business Entrepreneurship Personal Finance Marketing Human Resource Management Customer Relations Economics Professional Development Business Ethics	Accounting Business Communications Business Management Information Technology and Applications Human Resources Management Global Business Project Management Business Ethics Marketing Management Information Systems Operations Management Supply Chain and Logistics Management Organizational Behavior Microeconomics and Macroeconomics Business Law Finance

		Statistics
Finance (may include content from the Business Management and Administration Pathway)	Accounting Banking Service Securities and Investments Insurance Economics Business Ethics	Accounting Banking Service Securities and Investments Insurance International Finance Microeconomics and Macroeconomics Analytics
Health Science	Business Technology Applications	
Information Technology	Programming/Coding Business Technology Applications Technical Writing Web Design	Information Technology and Applications Technical Writing Management Information Systems Programming/Coding

	Social Media Applications	Network Management
	Computer Hardware and Software	Data Analytics

Career Pathways in business education prepare secondary and postsecondary students for college and career readiness in high-demand sectors with curriculum that develops not only career-related content knowledge but also career employability skills. Presented in Table 3 are examples of employability skills business education develops in high-demand sectors.

Table 3.

Business Education Employability Skills for High-Demand Sectors

High-Demand Sectors	Employability Skills Developed in Secondary and Postsecondary Business Education
Business Management, Business Administration, and Finance	Business ethics Critical thinking Design, operation, and maintenance of technological systems Leadership Oral communications Problem solving Project management Teamwork Written communications
Health Services	Design, operation, and maintenance of technological systems

Information Technology	Presentation management
	Videoconferencing
	Design, operation, and maintenance of technological systems
	Oral communications
	Problem solving

All Career Pathways have a limited number of courses based on graduation requirements and content area course work in the chosen pathway. An analysis of secondary and postsecondary Career Pathways in health services and information technology programs indicated a lack of business education course content taught by a licensed business educator at the secondary level and appropriately academically qualified instructors at the postsecondary level. This is concerning for these high-demand sectors. The healthcare industry is facing a shortage of qualified job applicants, not with technical skills, but with soft skills [employability skills] (iCIMS, 2017, para. 2). The top soft skills required in the healthcare profession are communication, teamwork, adaptability, empathy, and time management (iCIMS, 2017, para. 3). Similar to the healthcare field, professionals in information technology often have exceptional technical skills, but "the lack of soft skills [employability skills] like communication skills, analytical skills, interpersonal skills, negotiation skills etc. are becoming the issues of greater concern in this rapidly growing industry" (Agarwal & Ahuja, 2014, p. 85).

Business education has long been a leader in preparing students for career readiness with curriculum focused on both technical and employability skill development in business and industry. However, course content deemed as business education is not often part of the required curriculum in health services and information technology pathways. With the growing concern over the development of employability or career-readiness skills in high-demand occupational sectors, it is time to integrate business education into all disciplines. Business education is the advantage for closing the employability skills gap.

The Business Education Advantage
Nearly two decades ago the Policy Commission for Business and Economic Education Policy Statement 67 "This We Believe About Teaching the Soft Skills: Human Relations, Self-Management, and Workplace Enhancement" (2000) sounded the alarm that being only a technically competent employee will not be enough in the 21st Century. In addition to technical competence, employees will be required to display collaboration, critical thinking, ethical behavior, and self-management to be successful in today's global and diverse work place. However, the National Association of Colleges and Employers (NACE) *Class of 2017 Student Survey* reported at the postsecondary level:

> Employers and graduating seniors differed greatly when it came to rating
> proficiency in competencies such as professionalism/work ethic, oral/written

communications, and leadership as students considered themselves much more proficient than did employers. The gap between the two groups was greatest when it came to students' professionalism and work ethic; nearly 90 percent of students considered themselves proficient in this area, but less than half of employers agreed. (2018, para. 3)

Business education has a strong curriculum that provides an advantage for students to be both college and career ready. Business educators are long-time leaders in addressing the employability skills gap through business education course content and experiential learning, including student organization involvement.

Business education courses develop employability skills in the areas of communications, problem solving and critical thinking, organizational systems, leadership and teamwork, ethics and legal responsibilities, among others. For example, Business Essentials is a foundational course in the Business Management and Administration career cluster in which students:

- develop academic skills in mathematics, economics, and written and oral communications
- examine current events to determine their impact on business and industry and legal and ethical behavior
- acquire knowledge of safe and secure environmental controls to enhance productivity
- determine how resources should be managed to achieve company goals, and identify employability and personal skills needed to obtain a career and be successful in the workplace
- interpret industry laws and regulations to ensure compliance
- identify principles of business management and analyze business practices to determine ethics and social responsibilities

The introduction of employability skill development in this one course could benefit students in all disciplines. Additional business education courses further develop these and other employability skills through the reinforcement and content building of knowledge and application. Integrating business courses that improve employability skills in the health services and information technology curriculum can be accomplished with teacher collaboration. Collaborating with health services and information technology on curriculum redesign that includes business courses related to employability skills will benefit students in these occupational areas. The U.S. Chamber of Commerce Foundation (2017) noted K-12 educators lack the resources to implement teaching employability skills on their own, therefore collaborating with business education can be an advantageous solution.

Collaboration is not without its challenges. While the idea of collaboration is promising for student success, the challenge to find time for collaboration is less favorable. Johnson

and Tsai (2018) reported, "only 31 percent of teachers reported that they have sufficient time to collaborate with other teachers" (p. 1). In addition Johnson and Tsai described other factors that hinder collaboration as limited instructional support from administrators and teacher autonomy. These challenges should not deter interdisciplinary collaboration, but rather be set as a priority within school districts to begin improving the lack of employability skills.

Conclusion
Business education prepares secondary and postsecondary students for employment in today's high-demand occupational sectors. The curriculum is dynamic, rigorous, and relevant in preparing both technical and employability skills. Business education prepares students in high-demand business areas with coursework that builds upon technical skills to develop communication, problem solving, leadership, and teamwork skills, among others. Curricula preparing students for other high-demand occupational sectors such as healthcare and information technology focus on the technical requirements, but often lack the development of employability skills needed in these industries. Including core business education courses in the health services and information technology pathways can provide the necessary content needed to develop employability skills. Business education is the advantage for closing the employability skills gap.

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Career and Technical Education Teachers Career Path Exploration

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Introduction

This manuscript provides current information for students and others who might be interested in a career as a career and technical education teacher. The information in this manuscript may benefit those who are thinking of pursuing the education and credentials necessary to teach in this specialty area. The purpose of this manuscript is to report on the intricacies of this career for those who are looking to make an informed decision regarding whether it is right for them. The information regarding the profession of a career and technical education teacher will be presented in the following order: responsibilities, how to become one, pay and benefits, and job outlook.

Responsibilities of Career and Technical Education Teachers

Career and technical education teachers are responsible for delivering content to learners in a variety of technical and vocational subjects so that they will possess the knowledge and skills necessary to enter a specific career. The duties of a career and technical education teacher include preparing assignments and lesson plans; delivering instruction related to specific skills; helping to reinforce classroom knowledge via hands-on activities; supervising students' use of equipment and tools to guarantee safe operation; assessing knowledge and assigning grades; communicating with students, parents, and school counselors; and developing safety procedures and rules to be used in the classroom environment (United States Department of Labor, 2019).

In addition, career and technical education teachers are responsible for collaborating with local businesses and nonprofit organizations. By doing so, teachers are often able to secure employment opportunities for students to help them receive practical professional experience. These teachers also act in service capacities as advisors for career and technical education student organizations. The responsibilities of career and technical education teachers vary depending on the grade level taught, which often influences the amount of practical application that students experience in laboratories and shops (United States Department of Labor, 2019).

How to Become a Career and Technical Education Teacher
A bachelor's degree is typically required to be hired as a career and technical education teacher, along with work experience in the subject area taught. For those who seek employment in public schools, a state-issued license or certification is often required. Please note that the licensure and certification requirements vary by state (United States Department of Labor, 2019).

The work environment should be considered when thinking of the career and technical education teaching career path. These teachers typically find employment in middle schools, high schools, and postsecondary schools. The primary workday is during school hours when teachers work with students. Meeting with parents before or after school is also common, as is the need to work in the evenings and on weekends on lesson plans. It is most common for teachers to work during a traditional ten-month school year with a two-month break during the summer. Some school districts have year-round schedules, which consist of teachers working nine weeks in a row with three-week breaks (United States Department of Labor, 2019).

Pay and Benefits
According to the United States Department of Labor (2019), the median annual wage for career and technical education teachers was $55,240 in May 2017. The lowest ten percent earned less than $33,430 and the top ten percent earned more than $89,880. According to Salary.com (2019), the average salary for a high school teacher is $59,897 as of January 2019. According to Glassdoor.com (2019), the average base pay for a high school teacher is $50,000.

Job Outlook
The projected growth for career and technical education teacher employment from 2016 to 2026 is four percent. This growth will vary depending on the type of educational institution. There is projected to be little growth at the post-secondary level as opposed to the middle school and high school level where growth is projected to be as fast as the average for all occupations. It is possible that career and technical education teaching positions may be affected at the middle school and high school level as students continue to take more academic classes and fewer career and technical education classes. Budgets for career and technical education programs are often dependent on government funding; therefore, these programs are reduced as budgets are adjusted. As of 2016, there were 219,400 career and technical education teachers. This is projected to rise by four percent to 227,100 by the year 2026. (United States Department of Labor, 2019).

Interview with Troy Davis at Yorktown High School, Yorktown, Indiana
Troy Davis is career and technical education teacher who teaches in the areas of business, marketing, and information technology (IT). He also is a DECA advisor and student government and junior class sponsor at Yorktown High School in Yorktown, Indiana. According to DECA.org (2019), "*DECA prepares emerging leaders and entrepreneurs for careers in marketing, finance, hospitality and management in high schools and*

colleges around the globe" para. 1. Troy Davis was interviewed by Dr. Edward J. Lazaros on January 25, 2019. The following section presents the questions that Troy Davis was asked about his career along with his responses:

1. What do you like best about your job?

   "The best part of job is the ability to be part of the changing world of business and technology. Being engaged with the next generation every day and helping them gain skills and knowledge that they can bring to the next level makes every day great" (T. Davis, personal communication, January 25, 2019).

2. What is your advice for high school student looking to get into teaching?

   "I would say to someone wanting to go into CTE education to spend some time in industry (either in an internship or part time job) while getting your education. Industry hours are required and every CTE teacher needs real world experience to bring into the classroom" (T. Davis, personal communication, January 25, 2019).

3. What type of activities you do on a typical working day?

   "My typical work day involves face to face and online classroom instruction, monitoring and mentoring students in work based learning experiences, designing and implementing curriculum, and supporting students and faculty in various extracurricular activities" (T. Davis, personal communication, January 25, 2019).

4. What type of fun technology do you get to use on your daily work?

   "Most state of the art technology used in the classroom is available to me on a daily basis including: MacBooks and PCs, IPads, Interactive Media Boards and Displays, and all currently widely used software applications" (T. Davis, personal communication, January 25, 2019).

5. What are the main challenges you have in your daily work?

   "The biggest challenge for most teachers, including myself, in regard to daily work is balancing the layers or change that seem to be mandated monthly to secondary education. Gone are the days of just lesson planning and teachers. Many pockets of the day are not concerned with making sure everyone can check the correct box to meet various new or incoming statutes that have be legislated" (T. Davis, personal communication, January 25, 2019).

6. What would you like to see as an improvement in the area of CTE Education?

"I would like to see more opportunities for students to get quality internships and job training. Our system needs to continue to build opportunities between education and industry that help students make quality decisions about what career they want to pursue" (T. Davis, personal communication, January 25, 2019).

7. How did you get involved in the world of CTE Education?

"After 25 years as a small business owner, I needed to change careers. When I analyzed my education the logical choice was to teach in the areas of Business, Marketing and IT. Training and developing my own workers seemed to be as great preparation to the classroom which is really education at the retail level" (T. Davis, personal communication, January 25, 2019).

Pictures of Troy Davis at Yorktown High School, Yorktown, Indiana
The following section presents photos of Troy Davis in his classroom along with captions:

Troy Davis is pictured standing in front of the DECA table in his classroom. He is the DECA chapter advisor and State of Indiana Vice Chairperson of the Board. DECA is one of the largest CTE student organizations focusing on marketing, management, finance, entrepreneurship, and hospitality and tourism. DECA gives students the opportunity to put themselves out there and meet with real-world business people who judge them when they compete. It gives them a barometer for the types of people they will compete with for jobs in the workforce.

Troy Davis is pictured using a SMART Board in his dual credit class. He uses technology such as this SMART Board to teach a high school and college course at the same time. The SMART Board helps him to annotate right on the board. He can go to the Internet at a moment's notice. He can also refer to sources that may help with his instruction.
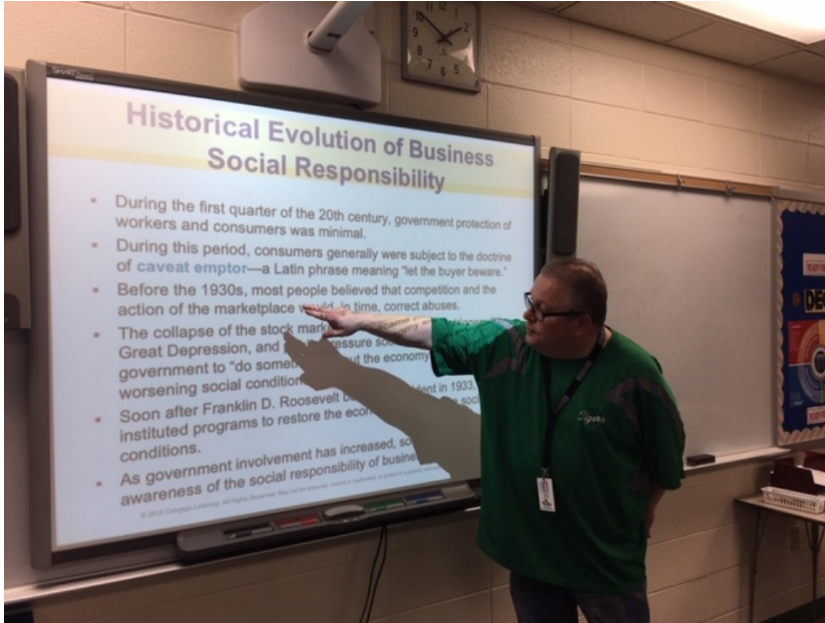

Troy Davis is pictured at his desk, where he often completes tasks such as developing curriculum. He is always looking for current resources for the courses that he is teaching. He also uses his desk computer for grading, taking attendance, and accessing communication tools such as e-mail.

Troy Davis is pictured with three books in his classroom: *Accounting*, *Foundations of Business*, and *Marketing*. These are resources that he uses for the courses that he teaches. Students in his classes use digital versions of the textbooks on MacBook Air computers; however, he still references the physical textbook as needed.
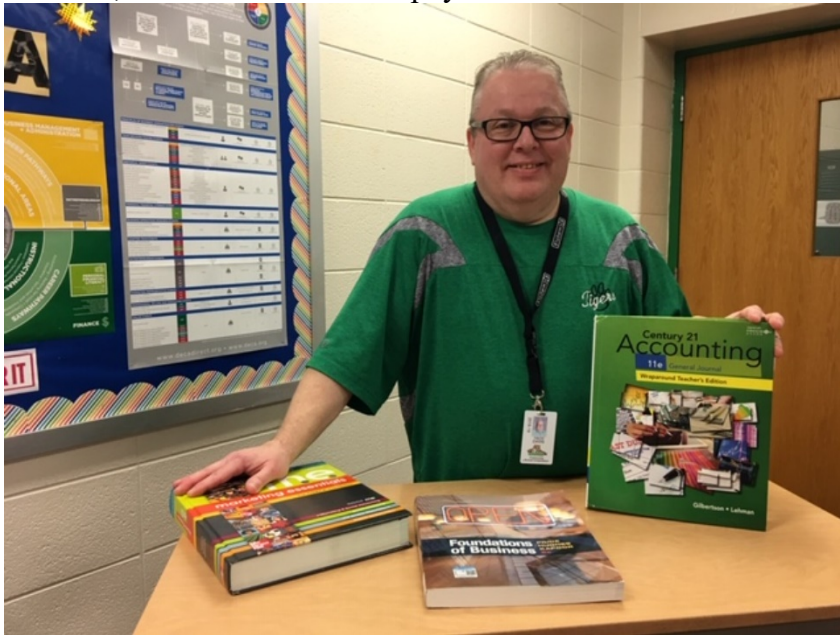
Troy Davis uses computer stations with Microsoft Access when teaching his students. He prefers Microsoft Access because it is used in business and industry. He teaches the software side of things that students will need to be prepared for the business world.
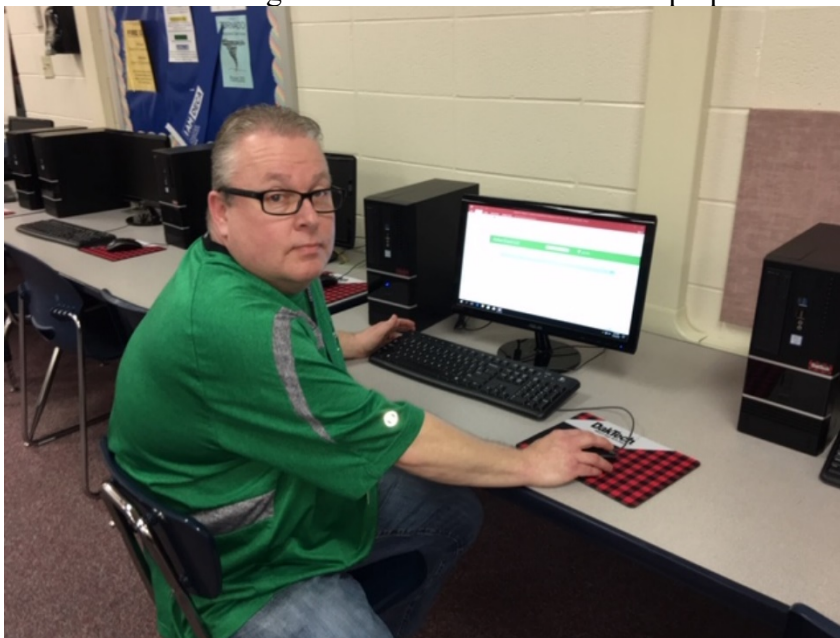
Troy Davis indicates that teachers need to be aware of safety at all times. He has a bulletin board to remind students of important safety information. He also reinforces safety on a daily basis with the students through reminders and drills, such as educational lock-downs and full lock-downs, tornado drills, fire drills, and active shooter drills.
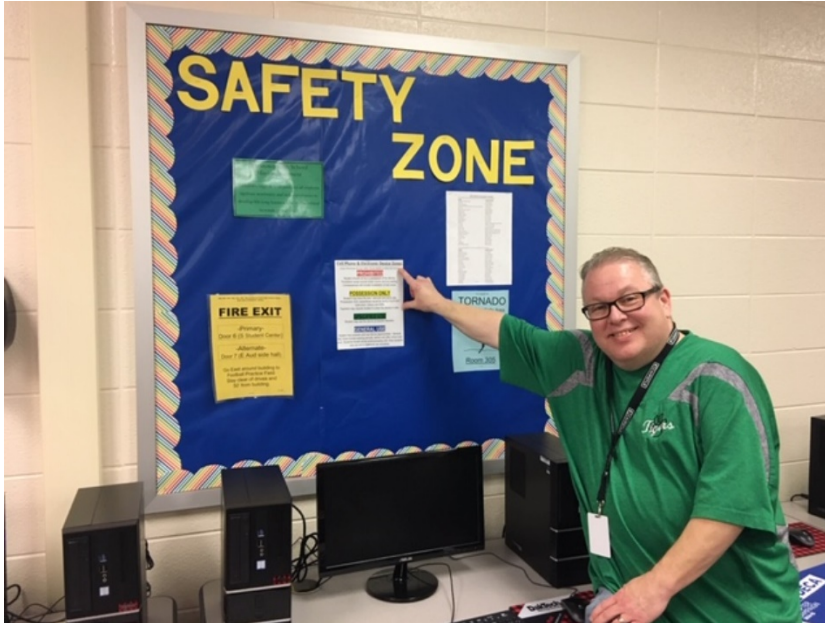
Conclusion

According to ACTE (2019), "*teachers have the capacity to inspire lifelong learning and a passion for knowledge, understanding, and innovation*" para 1.

Career and technical education teachers are able to do this and deliver content to learners in a variety of technical and vocational subjects. This occupation typically requires work experience, a bachelor's degree, and a state-issued license or certification. The pay range varies from less than $33,430 to more than $89,880. There is a projected growth rate of four percent from 2016 to 2026. This career field may interest those who want to work with students at the middle school, high school, or post-secondary level and teach technical and vocational subjects.

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Mobile Application Development in the Classroom

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Abstract

The demand for mobile application development is increasing (Scarsella & Stofega, 2017). To keep pace with the demand, educators and schools are increasingly required to provide the necessary skills and training. In this research article, the demand and career pathways for mobile application development, mobile application development environments, and classroom exercises to teach mobile application development are presented.

Introduction

The goal of this article is to provided educator the necessary tools and information in order to teach students how to create their first mobile application. The article begins by providing a common set of definitions related to mobile application development. Next, a literature review specific to mobile application development (e.g., demand, careers, and market space) and teaching application development in the classroom. This will set the context for the subsequent sections and the discussions therein. Following that, the importance of teaching mobile application development is discussed. Finally, three classroom exercises are presented that will engage students in learning about mobile application development. Although the focus of this research article is on the pedagogical aspects of mobile application development, it is important to note that the mobile application development exercises will result in a fully-functional application on a mobile phone.

Definitions

Application development - The process of designing (software development) for a computational system. This process may include programming, designing, testing, debugging, and maintaining software.

Mobile application development - Application development specifically for mobile applications devices such as phones and tablets.

Integrated Development Environment (IDE) - A comprehensive software development environment that provides editing, publishing, debugging and compiling features all in one package.

Literature Review

In this section the authors will present a review of the literature pertinent to the

discussion on mobile application development. This section will begin by exploring the demand for mobile applications related to cell phone adoption as well as software application downloads. Following that, career pathways and educational requirements for application developers will be discussed.   Finally, the income potential for application developers as well as the responsibilities of application developers will be explored.

Demand for mobile applications. The prominence of smart phones and tablets has created an incredible career opportunity in mobile application development. There were 1.53 billion smartphones shipped globally in 2017 (Scarsella & Stofega, 2017). The annual shipment of smartphones is predicted to increase to 1.77 billion in 2021. Sales of smartphones contribute to the 2.53 billion users globally who own smartphones in 2018 (Statista, 2018b). The global tablet market peaked in 2014 with 230.1 million units shipped (Statista, 2018a). In 2017, shipments dipped to 163.5 million units, but production is projected to increase to 185 million units shipped in 2020.

The appeal of these devices can be attributed to the combination of their mobility and ability to run applications. People are attracted to mobile applications because they can make life easier, they are fun, they provide innovative solutions, they facilitate evolving methods of communications, and the applications are inexpensive and provide business benefits (Creed Global Technologies, 2016; Malhotra, 2014). This has created a flourishing market for mobile application development.

The marketspace for mobile application development has increased significantly over the very short term and is projected to grow substantially in the future. According the statistical portal Statistica (2017), worldwide mobile application downloads in 2016 were approximately 149,300,000,000 and is projected to reach 350,000,000,000 in 2021. This represents a large-scale demand side pull for mobile application programmers. As such, it is incumbent upon educators to incorporate this new programming platform into the classroom; much as it was to move from mainframe programming to PC programming years ago.

Pathway to careers in mobile application development. The continued growth in demand for mobile applications has created an enormous demand for individuals capable of developing them. Dickins (2016) suggested that people consider several issues before pursuing a career in mobile application development.

1. What education is required?
2. How much money can be earned?
3. What does a mobile application developer do?

Education. Developing mobile applications requires a strong understanding of multiple programming languages. A well-rounded application developer will be familiar with

programming languages like Java, SQL, C#, C++, Python, PHP, Ruby on Rails, HTML, and Swift (CodeConquest, 2015; IT Career Finders, 2018; Schools.com, 2018; Tittel, 2017). Individuals then must decide how best to acquire these skills.

The traditional path is to pursue a degree in computer science (Bureau of Labor Statistics, 2018; Ku & Capolupo, 2014; Reese, 2015; Schools.com, 2018; Tittel, 2017). A degree in computer science, however, is not a requirement. For those with an aptitude towards learning programming on their own, they may choose certifications and training programs (Schools.com, 2018; Tittel, 2017). There are countless online courses (Adiseshiah, 2018; CodeConquest, 2015), bootcamps (Stewart, 2018; SwitchUp, 2018), and books (Android News, 2017; K. A., 2017; Lewis, 2016; Rocheleau, 2017).

Earning potential. The Bureau of Labor Statistics (2018) has indicated that the median salary for application developers in May 2016 was about $100,000. This salary was based on the broader category of application development, not specifically to mobile application development. A more focused look at mobile application development suggests that average salaries range from around $70,000 to $110,000 (Chegg Internships, 2018; Dickins, 2016; IT Career Finders, 2018; Payscale, 2018; Salary.com, 2018)

Responsibilities. The obvious responsibility of a mobile application developer is to create applications for mobile devices. There are, however, multiple aspects that must be addressed in this process. The responsibilities of a mobile application developer can include (Bureau of Labor Statistics, 2018; Chegg Internships, 2018; IT Career Finders, 2018; Payscale, 2018):

- Create or collaborate in the development of the idea for a mobile application.
- Coding, testing, debugging and documenting changes in the development of a mobile application.
- Adapting or migrating software typically installed on a computer or server into a mobile application form.
- Adapting or migrating web applications into a mobile application form.

Classroom Activities
The following three classroom activities are designed to engage students in the exploration of mobile application programming. There is no *a priori* knowledge of mobile application development required for either instructors or students. However, basic computer, mathematics, proficiency with personal computers, and some knowledge of application development environments is required. These activities are meant to build upon each other. The first is an exercise designed to assist students in understanding a basic Integrated Development Environment (IDE). The second is an activity that will assist students in learning about mobile programming within the IDE. The final activity is a programming exercise that demonstrates mastery of the IDE and the specifics of

mobile application development learned in exercises one and two.

Learning Objectives
1. Students will demonstrate knowledge of an IDE.
2. Students will demonstrate specific knowledge of a mobile application development environment.
3. Students will synthesize knowledge gained in objectives one and two to create a mobile application.

Required Materials
1. Computer with Web Browser
2. Internet Connectivity
3. MS Visual Studio IDE w/ Xamarin
4. (Optional) Mobile Device

Classroom Exercises
1. Installation of MS Visual Studio.
    a. The instructor begins the discussion on IDEs. The following definitions should be explained:
        a. Application development
        b. Mobile application development
        c. Integrated Development Environment
    b. Students may review the literature on the Internet for further information and discussion on IDEs.
    c. The instructor will then demonstrate the download and install of MS Visual Studio with special attention on installing Xamarin.
    d. Students should familiarize themselves with the System Requirements for installing Visual Studio and Xamarin, see systems requirements in References section (Microsoft, 2018).
    e. Students will then download/install MS Visual Studio with Xamarin using the following instructions:

Visual Studio Community 2017 installation steps:
If you already have Visual Studio installed, open **Control Panel > Programs and Features**, choose the **Visual Studio 2017** item, and click **Change**. When the installer opens, click **Modify** and skip to step 5 below.
1. The installation might restart the computer a few times, so save any work in progress and close all the applications.
2. Download Visual studio community from the following link:
   https://www.visualstudio.com/download
3. Open the downloaded .exe file and select mobile development with .Net from the workloads.

4. Click install and the installer will download the required packages. This might take anywhere between twenty minutes and two hours.
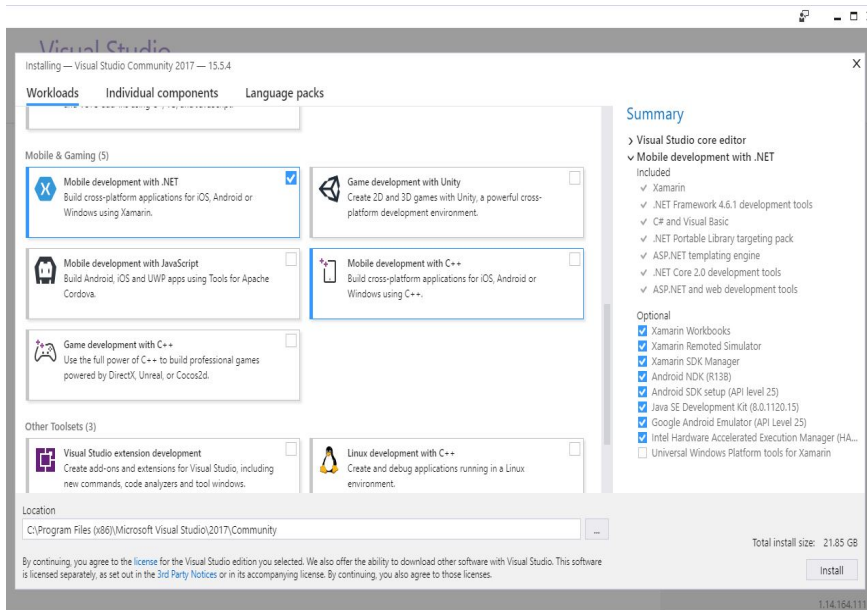

Figure 1. Selecting Mobile development package for installation.
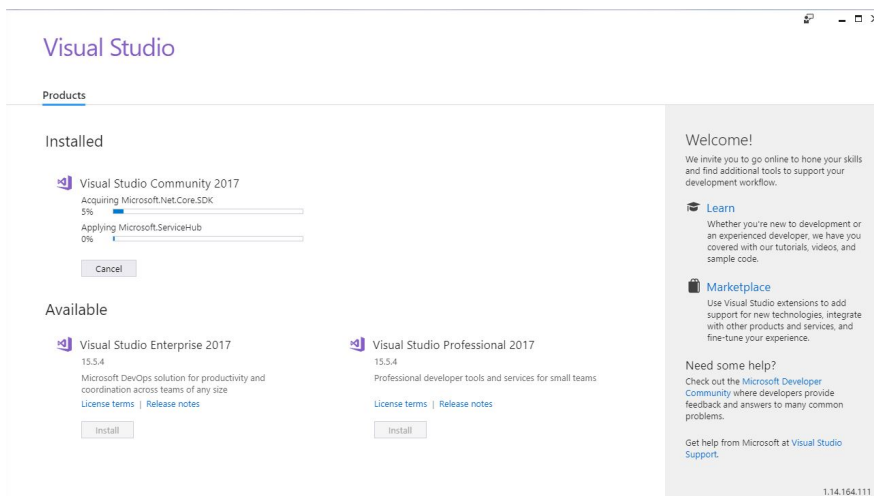
5. The below image shows the progress.

Figure 2. Installation progress.

6. Once installation is complete, launch Visual Studio and sign in with your Microsoft account if you have one or simply start using Visual Studio. Task is complete.
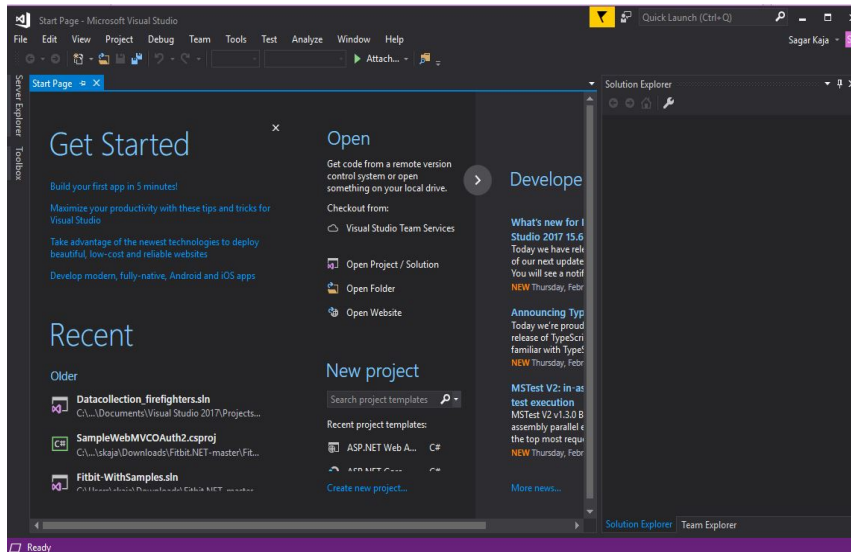

Figure 3. Visual Studio launch after logging in with Microsoft Account.

2. Classroom Discussion of the Xamarin Mobile Programming Platform.
    a. The instructor explains differences between mobile application development and PC application development
    b. Students compare and contrast the two environments.
    c. Instructor demonstrates controls and objects specific to Xamarin and compares similar controls to the PC application development environment.
3. Programming of Xamarin/Visual Studio application.
    a. The instructor tasks the students to write a click counting application (ClickCounter).
    b. Utilize the phone emulator to design and test.
    c. (Optional) After testing, implement the ClickCounter mobile application on the students' devices.
    d. The following steps can be followed to create the mobile click counting (ClickCounter) application:

Android Phone: Development of a Simple Mobile Application

Introduction to Android development with Xamarin.
In this walkthrough, a simple mobile application is created that provides a text-based counter and button. The counter increments by one every time the user clicks the button and the counter reports the total number of clicks. Xamarin is the development environment for Android mobile phones within the Visual Studio environment installed

in Classroom Exercise 1 above. The click counting application is provided by Microsoft and the source code is installed (by default) in Classroom Exercise 1 as well.

Mobile Application programming within the Emulator.

1. If not already opened, launch Visual Studio and sign in with your Microsoft account if you have one.
2. Click on Create new project and select **Visual C#, Android, Single-View App (Android)**
   a. Note the location on the hard drive where Visual Studio stores this application. By default, it is located in Documents\Visual Studio 2017\Projects
   b. Give the Application a name such as "ClickCounter" then click the OK Button.
3. The Getting Started with Xamarin environment is now loaded. In the upper right corner is the Solution Explorer for the ClickCounter application. In the Explorer, the **MainActivity.cs** contains the source code for the click counter. By default, the example code is already given by Microsoft and all that is left is to compile and run the application.
   a. The instructor may encourage the students to explore the Xamarin environment using the Solution Explorer window.
      i. The source code is in the MainActivity.cs file.
      ii. The phone screen and design layout (Buttons, Text boxes and other GUI tools to add to the application) are in the Solution Explorer, Resources, **Main.axml** file.
4. To compile and launch the application, click on **Debug, Start Debugging** or simply press the F5 key.
   a. This will launch the Android Phone emulator (after successful compilation) that is part of the Visual Studio 2017 environment as shown in Figure 4. The emulator behaves as an android phone and the mouse and left-click button are used to press icons on the phone emulator's screen.
   b. Using the mouse, click on the **Apps** button and select the application (**ClickCounter**).
   c. The mobile application is now running. Testing of the mobile application is complete. Task is Complete.
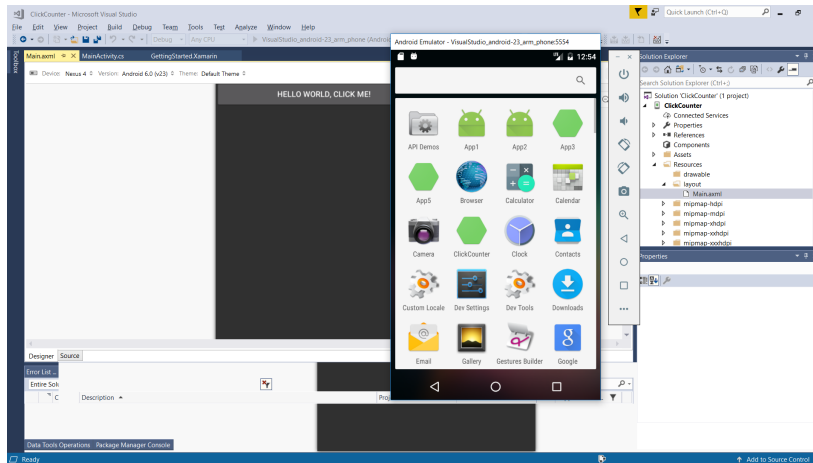
Figure 4. Solution Explorer and ClickCounter mobile application within Visual Studio (Xamarin) Emulator.

Mobile Application program deployed to the Android Phone (Optional).
1. In this optional exercise, the mobile application created in the previous step will be ported to the student's phone. Android debugging must be enabled on the mobile phone for this to work.
    a. Navigate to Settings > About Phone > scroll to the bottom > tap Build number seven (7) times.
    b. Go back and now access the Developer options menu, check 'USB debugging' and click OK on the prompt.
2. With USB debugging enabled, plug the phone into the computer with a USB cable. The phone will now appear as the default Build platform instead of the Android Emulator.
3. To deploy to the phone, click on **Debug, Start Debugging** or simply press the F5 key.
4. The mobile application is now deployed to the phone, the application will launch on the phone automatically after it is deployed over USB as shown in Figure 5. Run the application on the phone. Testing and deployment of the mobile application is complete. Task is complete.
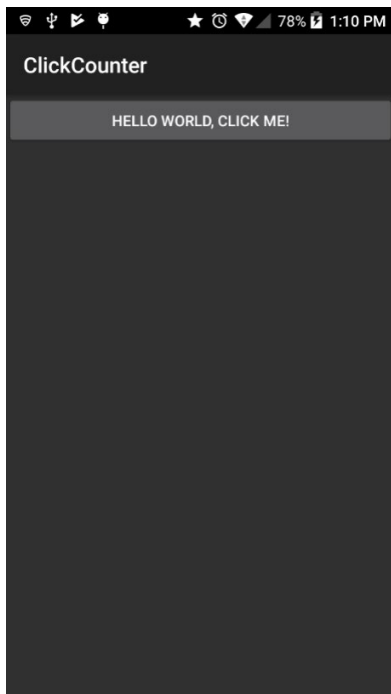
Figure 5. ClickCounter mobile application running on an Android phone.

Configuring Emulators

Various Android emulator tools are available in Visual Studio. Each has different device and performance characteristics. Select the emulator that best suites the target phone including the Android version and screen size. That will simplify the debugging process and assist in the Graphical User Interface (GUI) presentation. To access the Android emulators within Visual Studio, click on **Tools, Android, Android Emulator Manager**. This will bring up the Android Virtual Device Manager.

Conclusion

In this article, the authors begin by providing a literature review and definitions specific to mobile application development and teaching application development in the classroom. Definitions of terms pertinent to mobile application development were provided. A discussion of the importance of teaching mobile application development was presented as well.

At the culmination of this article, three classroom exercises were presented that will engage students in learning about mobile application development. Instructions for completing a click counting mobile phone application were provided. Instructors can follow the steps outlined above, and students will create their own Android applications either on a device or within an emulator.

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