**Assessment of Sustainable Manufacturing Vocational Education for High School Students in Hampton Roads**

An Independent Learning Project Presented by

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To

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# Abstract

This Independent Learning Project analyzes the progression of vocational education throughout history and the development of new educational trends, especially in manufacturing education. Using key points in the history of education in Ancient Greece, the American Thirteen Colonies, and the United States from its formation to the present day, the researcher provides a foundation leading to the innovative manufacturing vocational educational program implemented in the Eleva-Strum High School of rural Wisconsin. This program consists of a machining shop by the name of Cardinal Manufacturing, which frequently collaborates with local businesses in order to fulfill orders for paying customers. The main evidence of the success of this program lies in its ability to virtually sustain itself while providing trained prospective employees to its community. This model served as the benchmark for research on the possibility of developing a similar program in Hampton Roads, Virginia.

Keywords: *manufacturing, vocational education, Cardinal Manufacturing.*

Table of Contents

[Abstract iv](#_Toc361544635)

[Introduction 1](#_Toc361544636)

[Background 2](#_Toc361544637)

[Problem Statement 3](#_Toc361544638)

[Literature Review 5](#_Toc361544639)

[Overview of Education in Antiquity: Ancient Greece 5](#_Toc361544640)

[Education in the United States 6](#_Toc361544641)

[Education in the Thirteen Colonies: Benjamin Franklin 7](#_Toc361544642)

[The Early 20th Century. 9](#_Toc361544643)

[World War II. 10](#_Toc361544644)

[Education in the United States after World War II. 11](#_Toc361544645)

[The American Civil Rights Movement. 12](#_Toc361544646)

[Carl D. Perkins Vocational Education Act. 13](#_Toc361544647)

[Vocationalism 17](#_Toc361544648)

[Views in Favor of Vocationalism. 17](#_Toc361544649)

[Views Against Vocationalism. 19](#_Toc361544650)

[Trends Affecting Vocational Education 20](#_Toc361544651)

[Technological Advances. 21](#_Toc361544652)

[Globalization. 22](#_Toc361544653)

[Outsourcing, Insourcing, and the Revival of American Manufacturing. 23](#_Toc361544654)

[The Eleva-Strum Vocational Education Model 25](#_Toc361544655)

[A Brief History. 26](#_Toc361544656)

[Implementation. 27](#_Toc361544657)

[Outcome. 28](#_Toc361544658)

[Manufacturing Vocational Education in Hampton Roads 30](#_Toc361544659)

[Manufacturing in Hampton Roads. 30](#_Toc361544660)

[Tidewater Community College. 32](#_Toc361544661)

[Other Local Vocational Programs. 35](#_Toc361544662)

[Methodology 37](#_Toc361544663)

[Overview 37](#_Toc361544664)

[Limitations 40](#_Toc361544665)

[Demographics of Participants. 40](#_Toc361544666)

[Availability of Manufacturing Vocational Programs. 41](#_Toc361544667)

[Social, Economic, and Political Factors. 42](#_Toc361544668)

[Data Analysis – Findings 44](#_Toc361544669)

[Survey Results 44](#_Toc361544670)

[Interview Results 46](#_Toc361544671)

[Former Vocational Student. 47](#_Toc361544672)

[CNC Instructor 48](#_Toc361544673)

[Apprenticeship Program Manager. 50](#_Toc361544674)

[Conclusion 52](#_Toc361544675)

[Response to the Introduction and Problem Statement 52](#_Toc361544676)

[Bibliography 54](#_Toc361544677)

[Appendix A 59](#_Toc361544678)

[Appendix B 60](#_Toc361544679)

[Tables 61](#_Toc361544680)

# Introduction

Throughout history, educating the young and preparing them for the future has been a primary concern of any civilization interested in transcending into the future. In ancient times the training of younger generations was essential to the survival of the community, and in many ways that statement remains true today. Using mostly hands-on training, children often learned valuable skills from their parents, through organized education, or through apprenticeships. Although early societies such as that of ancient Greece possess notable examples of academic achievement in philosophy, math, and other sciences; the majority of the population focused their energy in learning manual skills. The Greek city states of the time identified their immediate needs and focused their training in their fulfillment; whether this meant intensive military training, the learning of a trade, or even the education of girls to ensure the continuity of their society (Marrou, 1982).

 The American Thirteen Colonies were not much different from ancient Greece in their mostly utilitarian views of education. It is true that the English educational system of the time, with its religious studies and focus on academic achievements, influenced the education of early Americans (Woody, 1971, p. 102). However, as a matter of survival most inhabitants of the colonies had to learn, and often taught to others, skills relevant to the daily tasks needed for the advancement of the community (Cossons, 2008). With the formation of the United States and its first incursions in the global markets as a young country; the need for a relevant education system became evident in order to achieve competitive advantage. The United States involvement in World War I, World War II, the Viet Nam War, and national periods of social unrest, created a demand for vocational education. This education needed to be relevant to the economic conditions of the time and at the same time help the American people, including returning veterans and minorities, obtain gainful employment.

 With the aid of some private businesses, legislators, and the increasing pressures of foreign competition, the American vocational education system was born. In spite of this, through the years vocational education has taken a back seat to other “more important” school programs whenever budget money begins to run out. In a direct challenge to this tendency, the Eleva-Strum High School in Wisconsin has developed a manufacturing vocational program that provides an ingenious solution to the financial woes that plague similar programs in the country. The solution is simple; train the students to operate the school shop as a private business taking orders from paying customers. Then, reinvest the profits into the program to reduce dependency on its allocated portion of the school budget.

## Background

High School manufacturing vocational education programs in the United States share two common problems: obtaining funds and the substantial costs of investing in capital equipment (Zelinski, 2012). Normally, these programs are the first ones to experience cuts or complete elimination when budgets are tight due to their high overhead costs (Zelinski, 2012). Under funding, outdated equipment, and sometimes the school’s attitude toward these programs has led to disinterest from the students who often sense that the school is not interested either (Zelinski, 2012). As lack of participation becomes more prevalent, many local businesses in need of young talent struggle to find suitable candidates; and in the end the local economy could suffer. Knowing this, a technology education teacher at Eleva-Strum High School in rural Wisconsin decided to take a different approach to manufacturing vocational education. His name is Craig Cegielski and he is responsible for the creation of a highly successful, and profitable, program by the name of Cardinal Manufacturing.

 Cardinal Manufacturing operates as a normal machining shop with orders coming in, deadlines, quality control, dimension tolerances, scrap, associated costs, deliveries, and profits. Local businesses take advantage of the low labor costs inherent to a high school shop, and use the student’s skills to fulfill small orders, which usually they cannot perform cost-effectively (Zelinski, 2012). Through sound financial management, the program has been able to create a profit sharing program, provide maintenance for existing equipment, and even buy new equipment to better meet the customers’ needs (McIntosh, 2012). Since the students perform all the work in a shop on school grounds, and usually during scheduled instruction, there are no safety or liability concerns which were not already part of the class (Zelinski, 2012). Most importantly, this program has given students a real world purpose through learning, has helped them build a resume, and has given them the opportunity to create business connections (McIntosh, 2012). However, one of the most important results of this experiment is a self-sufficient high school vocational program within the school budget, and largely free of financial problems (McIntosh, 2012).

## Problem Statement

 Manufacturing vocational education programs in the United States face many financial difficulties, and as mentioned before, they are often the first victims of budget cuts. In addition, some of these programs lack the involvement of local businesses and governments that could benefit greatly from a steady supply of trained prospective employees. This is why the program implemented by Craig Cegielski at Eleva-Strum High School is not only innovative, but it also provides educational and economic benefits. Since students have to make something as part of most shop class requirements, why not make a sellable, useful item instead of the usual make-work trinkets that end up collecting dust on some shelf, or worse, in a local landfill. To become a part of this program, students must submit a resume and go through an interview process, which in itself prepares them for future job interviews. Once they are part of the program the students develop lifetime skills in manufacturing processes that greatly enhance their future employability.

So, why is this program confined to a small high school in rural Wisconsin? Furthermore, why isn’t this program being considered by the Department of Education for nationwide implementation? Southeastern Virginia, Hampton Roads, has at least seven manufacturing companies employing over 1,200 people at any given time (HREDA, 2012). In spite of this, there are very few vocational programs dedicated to fostering an interest in manufacturing processes in high school students. In fact, outside of apprenticeship programs sponsored by local companies, the researcher found only one serious attempt at vocational manufacturing education for high school students. However, this program at the Advanced Technical Center in Tidewater Community College still falls short of the success achieved in Wisconsin. The researcher, as a professional in a major manufacturing plant in the area, has personally experienced the trouble of finding trained prospective employees ready to occupy technical positions. Therefore, the purpose of this research is to raise awareness to this critical issue, suggest a possible solution, and ask a simple question to those who can affect change in our educational system: If this program has worked so well in rural Wisconsin, then why not here?

# Literature Review

## Overview of Education in Antiquity: Ancient Greece

 The preparation of younger generations to take on the challenges of adulthood has been a shared concern for all cultures since the beginning of human civilization. Ancient humans all over the world understood the dire necessity of teaching their offspring relevant and useful skills to ensure the survival of their societies. During this period, most children would learn these skills from their parents or other members of their community through a process akin to our modern on-the-job training. Although this is true for many early humans, the arrival of the great Mediterranean civilizations also brought the advent of organized education based on specific areas of their societal structures. These areas included pre-military and military instruction, physical training, hunting as a compliment to a military education, the education of girls, and other subjects leading to the transition to a more intellectual way of thinking (Marrou, 1982).

 Spartan education in ancient Greece provides a very good example of an educational system geared toward the needs of the state. As a military culture, the city state of Sparta provided male children with basic reading and writing skills while mostly focusing on the military aspects of their instruction (Marrou, 1982). Although Spartans devoted most of their time to the training and development of soldiers, they did not neglect the education of girls. Spartan girls learned music, singing, and dancing; as well as acquiring an understanding of their roles as child bearers and the future mothers of the next generation of warriors (Marrou, 1982, p. 23). This differentiation may seem sexist and archaic to our modern society, but it shows us the importance of a skills oriented education, where everyone plays a defined role on the advancement of society.

Another example comes from the Athenian education, also in ancient Greece, and their different approach to teaching. Around the seventh century all Greek education followed the militaristic methods of the Spartan culture, but eventually some city states became increasingly civilian (Marrou, 1982, pp. 36,37). As education began to change due to this societal shift, the nature of instruction also shifted its focus to the teaching of music, poetry, and philosophy (Marrou, 1982). The Athenian education embraced this change without neglecting physical education or its military roots (Marrou, 1982, p. 37). This adaptability to the new demands of the Athenian community is a timeless lesson on the necessity of education to be flexible and receptive to the skill needs of the society it serves.

The Greek educational model was extremely influential in the ancient world and became so popular that even the Roman Empire adopted many of its precepts and methods (Marrou, 1982, p. 254). These early civilizations knew that the only way to guarantee their future was to teach their children those skills which would make them valuable members of their societies. The researcher acknowledges that some of the methods used in ancient times were inhumane and incongruent with modern views, but at its core, an education that satisfies the needs of the society it serves, is a universal concept unaffected by time or modern moral standards.

## Education in the United States

As early as the 1700s in the pre-United States thirteen colonies, people like Benjamin Franklin identified the need for a relevant education system geared toward the public good. His views on education led to the formation of numerous organizations, mainly in Philadelphia, and laid the foundation for modern American education. At the turn of the 20th century, major technological advances required a reevaluation of educational methods and exposed the need for alternatives to conventional academic curriculums. The advent of World War I, World War II, the American Civil Rights Movement, and the introduction of the Carl D. Perkins Vocational Education Act had a profound impact on vocational education in the United States. In the following paragraphs, the researcher will analyze briefly the progression of American education through the major events previously mentioned with an emphasis on vocational education.

Education in the Thirteen Colonies: Benjamin Franklin. During the time of Benjamin Franklin education in the thirteen colonies was, as in ancient Greece, mostly directed toward those skills that ensured the survival of its inhabitants. Due to social, economic, and geographical circumstances, the people of the Thirteen Colonies often had to possess many skills in order to survive (Cossons, 2008). As a result, during this time a single person could be a farmer, shoemaker, gardener, or soldier depending on necessity (Cossons, 2008). Many Europeans visiting the colonies marveled at the variety of skills exhibited by a single American (Cossons, 2008). In spite of this, many early Americans also believed that academic studies were essential to prepare civic, moral, and intellectual leaders (Grubb & Lazerson, 2004, p. 58). This unique situation made the American system a lot more receptive to new technologies and teaching methods which could improve the performance of daily tasks for the average citizen (Cossons, 2008).

Some exceptional people, such as Franklin, dedicated their lives to the pursuit of higher education and the intellectual advancement of society, largely through their own endeavors (Woody, 1971, p. 37). As early as 1743, Franklin became interested in creating a society that would teach “living, rather than dead things” in an obvious reference to the teaching of practical skills (Woody, 1971, p. 21). It was this type of thinking that led to the foundation of the American Philosophical Society, the Academy of Philadelphia (known today as the University of Pennsylvania), and the Library Company of Philadelphia. Through these organizations and the mutual improvement society by the name of The Junto, Benjamin Franklin sought to promote a culture of learning in order to keep up with new technological advances (Woody, 1971).

 Franklin was a staunch critic of the English educational system of the time where only the wealthy had access to intellectual advancement. Even after admission into one of these colleges, Franklin noted that ecclesiasticism and useless ancient languages dominated the class curriculums of these schools (Woody, 1971, p. 102). In one of his letters to Richard Jackson (British lawyer and politician), Franklin stresses the value of practical education by retelling the story of and Indian Chief’s reply to a request from English Commissioners (Woody, 1971). In the story, a group of English Commissioners told an Indian Chief that, with his permission, they would happily take half a dozen of their best youths back to England and provide them with a college education (Woody, 1971, p. 110). To this offer the Indian Chief replied that some of these youths had already been to that college and that upon their return they were useless to the tribe because they never had the chance to become proficient at hunting or surprising an enemy (Woody, 1971, p. 111). The use of this analogy fully exemplifies Franklin’s views on the need to provide a utilitarian education and the foolishness of educating people “for places in life to which they would not be called” (Woody, 1971, p. 109).

The Early 20th Century. At the end of the nineteenth century education in the United States concentrated on conventional academic subjects and was perceived as disconnected from the needs of our early industries (Grubb & Lazerson, 2004, pp. 6,7). During this time colleges and universities focused more on the liberal arts than on real workplace skills to the dismay of businesspeople and industrialists (Grubb & Lazerson, 2004). It was around the year 1900 that these industrialists began to examine the German system of work-based apprenticeships and began to advocate for vocational education and trade training to prepare workers for industry (Katznelson & Weir, 1985, p. 151). Technological advances such as the development of the assembly line in 1908 by Henry Ford served as a catalyst for the transformation of education into organized vocational instruction. At the beginning of this movement there was widespread disagreement as to the content and vehicle for the implementation of a vocational program, but the movement gained so much momentum that it resulted in the creation of the National Society for the Promotion of Industrial Education (NSPIE) in 1906 (Katznelson & Weir, 1985, p. 152).

 The NSPIE became the foundation for the development of other organizations dedicated to vocational education such as the American Vocational Association, and provided the spark needed for government action in this matter. In 1917, Europe was involved in the early stages of World War I and the United States was on the brink of sending troops to the European fronts. At the same time Senator Hoke Smith and Representative Mays Hughes proposed the Smith-Hughes Act which gave vocational education recognition, and more importantly, federal funding (Lozada, 1999). The next year, the United States enters the war and at the end of the conflict a few months later, Congress passed legislation to help provide vocational education for the returning war veterans (Lozada, 1999). These events marked the beginning of a long history of support and opposition to vocational and technical education in the American educational system.

World War II. In 1939 L.H. Dennis, then executive secretary of the American Vocational Association, recognized that any involvement in the looming second European conflict would require a supply of skilled workers for essential industries (Reese & Thompson, 2002). In 1940 the American incursion in World War II was inevitable; which resulted in Congress securing funds for technical schools in order to train 12 million men and women for war production (Lozada, 1999). The United States finally became involved in World War II in 1941 launching the American manufacturing industries into a frantic growth while developing an insatiable appetite for resources.

These manufacturing industries were pivotal to the American forces success by providing weapons, ammunition, heavy equipment, food, medical supplies, and other logistical support. As raw materials became scarce, so did the most important resource of all: the dependable pool of skilled workers L. H. Dennis had mentioned a few years earlier. Faced with this challenge, the American Vocational Association identified the need to train women in jobs traditionally held by men (Reese & Thompson, 2002). By September 1943, over 741,000 women had enrolled in vocational training programs and 81 percent of them ended up in jobs supporting the war production industries (Reese & Thompson, 2002). At the end of the war the defense production training program was suspended, but not before silencing all dissenters with its accomplishments and proving that success is possible when a vocational program adapts to the changing times.

Education in the United States after World War II. Soon after the end of the war, the American Vocational Association faced a new challenge: the possibility of having to train or retrain around 30 million people to develop skills for peacetime jobs (Reese & Thompson, 2002). In 1944, a year before the victory over Germany and her allies, President Roosevelt signed into law the G.I. Bill of Rights which would ultimately provide a college education to 8 million war veterans (Lozada, 1999). During this period the Soviet Union established itself as a world superpower and began to develop and expand a vocational education program of its own (Reese & Thompson, 2002). The American Vocational Association saw the Soviets’ actions as a threat and a possibility of communism playing a bigger role in the world’s marketplace. Due to this, all efforts were concentrated in expanding and improving our own programs at home while lobbying to improve support and obtain more funding (Reese & Thompson, 2002).

As a secondary benefit, all the veterans who began attending college with the G.I. Bill freed up seats to postsecondary technical classrooms and improved the chances of a vocational education for the rest of the population (Lozada, 1999). In response to the increasing demand imposed on vocational schools, President Harry S. Truman signed the George-Barden Act in the summer of 1946. (Reese & Thompson, 2002). This act increased vocational education funding from $14 million to $29 million annually providing veterans and civilians alike with further opportunities for professional growth (Reese & Thompson, 2002). Many people benefited from these programs, but especially women would see an opportunity to continue their education after their invaluable contributions in the home front and in the theater of operations of World War II.

Most women who during the war obtained employment in occupations such as welding, shipyard activities, and crane operators became unemployed and returned to their roles as homemakers. Nursing and other health related jobs are areas in which women exceled during the war, not only at home, but also in hospitals abroad specialized in treating the battle wounded soldiers. The George-Barden Act sought to take advantage of the skills they had obtained in the performance of these jobs and ensure their efforts would not go to waste. This is most evident in an amendment to the act that addressed vocational education in practical nursing and raised awareness on opportunities for women in health occupations (Lozada, 1999). Up to that moment, even some Congressmen viewed women as weak and lacking mechanical abilities to complete most tasks, but their role in the war and legislation such as the George-Barden Act helped lay the foundations for the influence of the American Civil Rights movement in education and its subsequent changes in American society (Reese & Thompson, 2002).

The American Civil Rights Movement. The 1960s were a period of intense turmoil and social unrest in the United States as American society struggled with the changes demanded by civil rights activists and their followers. During this time our nation began to question the status quo and realized that African Americans, Native Americans, Hispanics and women also had the potential to be successful if given the proper training opportunities (Reese & Thompson, 2002). Up to this point, these groups of people had experienced discrimination, ostracism, and exclusion, which seriously limited their economic development. The American Vocational Association played an important role during this time due to their extensive experience educating non-traditional students, special needs students, women, and World War II veterans (Reese & Thompson, 2002).

 Eventually, the push for racial and gender equality resulted in historic pieces of legislation that would change the educational system forever. Such legislation was the Vocational Education Act of 1963 (The Perkins Act), which became the first federal vocational act to address the problem of persons with socioeconomic issues preventing them from succeeding in regular vocational education programs (Friedel, 2011). Although analysts of the time described this act as the most comprehensive vocational education legislation in the history of the United Sates, it didn’t do enough to alleviate the inequalities denounced by the Civil Rights movement (Reese & Thompson, 2002). A year later, in 1964, Congress passed the Civil Rights Act finally providing a solid foundation for equal employment opportunity and making it illegal to discriminate against race, color, religion, sex, or national origin in hiring and educational practices (EBSCOhost, 2009). These steps did not provide an instant solution to the many inequalities in education, but provided the necessary legal support for the establishment of an egalitarian educational system.

Carl D. Perkins Vocational Education Act. In 1976 Congress passed the Education Amendments Act calling for the National Assessment of Vocational Education in an effort to probe into the implementation of vocational education legislation (Lozada, 1999). President Ronal Reagan’s Commission on Excellence in Education presented the report: *The Nation at Risk: The Imperative for Educational Reform* in 1983, which demonstrated the importance of education as a matter of national security (Friedel, 2011). The 1976 assessment and the 1983 report showed the weaknesses of the current vocational programs and resulted in the passing of the Carl D. Perkins Vocational Education Act of 1984 (Lozada, 1999). Carl D. Perkins, who had also authored the Vocational Education Act of 1963, was a representative from Kentucky’s 7th District and a lifelong advocate of vocational education (Reese & Thompson, 2002). President Ronald Reagan signed Perkins’ bill into law in 1984 providing “individuals who are disadvantaged, handicapped, entering non-traditional occupations for their sex, adults in need of training or retraining, single parents or homemakers, individuals with limited proficiency in English and individuals who are incarcerated" with access to quality education (Reese & Thompson, 2002). Unlike other federal education and training programs the funds provided by the Perkins Act do not assist individuals directly; instead it provides states with grants to support activities related to vocational education (National Skills Coalition, 2011).

 The passage of this law opened many opportunities to underprivileged sectors of society who now could obtain an education, improve their economic situation, and become productive members of their communities. Congress has revisited this act three times since 1984 in an effort to update its content and improve its relevance in a changing global economy and job market. In 1990, the Carl D. Perkins Vocational and Applied Technology Act sought to recognize global economic trends as well as the displacement of American jobs overseas (Friedel, 2011). It also recognized the transition of the United States’ economy from manufacturing to service based and the emergence of technological advances in the area of information and computer technologies (Friedel, 2011). The next reauthorization occurred in 1998 with the passing of the Carl D. Perkins Vocational and Technical Education Act officially repealing the Smith-Hughes Act of 1917 (Friedel, 2011). This time the new law focused on the consolidation of different vocational programs and on giving the states more flexibility in the use of funds while requiring more accountability through detailed reporting (Friedel, 2011).

 In 2004 the Perkins Act reauthorization of 1998 was set to expire, which incited a heated political debate with a focus on using federal vocational funds on academics instead of career and technical education (Friedel, 2011). The Bush administration argued that career and technical education had failed to produce any improvements in the academic achievements of high school students, therefore the funding’s focus should be on other educational programs (Friedel, 2011). Based on this premise, President Bush’s proposal attempted to use Perkins funds to support Pell Grants for college students and to reduce the number of new students entering college in need of remedial coursework due to a poor high school education (Friedel, 2011). Congress rejected the Bush’s administration proposal and unanimously passed the Carl D. Perkins Career and Technical Educational Act of 2006 changing the term Vocational Education to Career and Technical Education (CTE) and reauthorizing the program through 2012 (Friedel, 2011). At this moment it is not clear when Congress will convene to reauthorize this legislation, but the Department of Education’s Office of Vocational and Adult Education expects it will happen during the current year of 2013 (National Skills Coalition, 2011).

 In early 2012 President Barack Obama expressed his concern about transforming the Perkins Act to meet the challenges of the 21st century global economy and the importance of helping students learn the skills needed by employers (Obama, 2012). In a report released in April, 2012 the Secretary of Education acknowledged the failures of the Perkins Act of 2006 and warned about the embarrassing higher education ranking of the United States in terms of enrollment when compared to other developed countries (Duncan, Office of Vocational and Adult Education, 2012). According to this report the United States ranks 9th in the world in adult college enrollment and 16th in certificates and degrees awarded to adults in the 25 – 34 age range (Duncan, Office of Vocational and Adult Education, 2012). Due to these alarming figures, President Obama has publicly recognized the need for increased college graduation rates or for students to complete at least one year of postsecondary education (Duncan, Aligning Secondary and Postsecondary Education: Experiences from Career and Technical Education, 2012).

According to the National Skills Coalition website the Perkins Act experienced a funding decline between 2010 and 2012 going from $1.27 billion to $1.14 billion due to spending cuts (National Skills Coalition, 2011). In 2012 the Office of Vocational and Adult Education of the Department of Education released a document where it outlines President Obama’s plan to strengthen our economy through education programs and the Perkins Act. In this document the Obama administration proposes that vocational programs must offer a structured sequence of courses covering secondary and post-secondary education (OVAE, 2012). These courses must lead to an industry certification or license and enable students to obtain employment in a high-growth industry upon completion (OVAE, 2012). The new proposal for reauthorization revolves around four core principles: alignment, collaboration, accountability, and innovation (OVAE, 2012). The Obama Administration has proposed a FY2013 budget of $1.1 billion to support the transformation of the Perkins Act (OVAE, 2012). Along with other investments in Community Colleges and Career Academies totaling $11 billion, President Obama’s short-term goal is to train at least 2 million new workers to satisfy the demand of skilled labor in our fastest growing industries (OVAE, 2012).

## Vocationalism

 As mentioned before, at the end of the 19th century American businesspeople, industrialists, and some educators were the first to propose the introduction of vocational education into public schools (Katznelson & Weir, 1985, p. 151). After the Civil War, the United States experienced an expansion of its railways, heavy industries, mining, and machine-centered agriculture (Benson & Lyons, 1990, p. 219). These events exposed the weaknesses of the apprenticeship systems and on-the-job learning methods in use until that moment (Benson & Lyons, 1990, p. 219). Founded in 1895, the National Association of Manufacturers was one of the earliest proponents of vocationalism as a way to meet the challenge of national and foreign competitors (Benson & Lyons, 1990, p. 217). But as it happens with any idea, vocational education has had its share of supporters and dissenters in a constant struggle to prove or disprove its benefits. In this section, the researcher will explore both sides and their main arguments in favor and against vocationalism.

Views in Favor of Vocationalism. From its beginnings, proponents of vocational education argued that technological advances required the development of a skilled workforce with “industrial intelligence” (mental power to see beyond the task at hand) and the ability to quickly learn and adapt to changes in the business environment (Grubb & Lazerson, 2004, p. 9). One of the main arguments in favor of vocationalism stems from the idea that formal schooling is overly academic and has failed to respond to modern business needs (Grubb & Lazerson, 2004, p. 6). Supporters of this idea argue that a predominantly academic education attempts to prepare students for college, but not all students are “college material” or have the desire to attend college (Crosby, 2006, pp. 67,68). When these students realize that school, or more specifically high school, does not respond to their interests, they become disruptive and antisocial (Crosby, 2006, p. 67). As a solution, the availability of vocational education in these schools attempts to provide alternatives for those whose interests do not include a formal college education (Crosby, 2006, p. 67).

Those in favor of a separation of conventional academic subjects and vocational education often cite the need of “real life” skills over knowledge that seems distant from the concerns of the everyday world (Grubb & Lazerson, 2004). According to Brian Crosby(2008), author of the book *Smart Kids, Bad Schools*, since the year 2000 enrollment in vocational education programs has risen 58 percent, and the schools supporting these programs have lower dropout rates as well as higher rates of students going on to college (p.70). Additionally, a vocational education provides students with the higher status associated with having a career, but in this case without the need of a four year degree (Grubb & Lazerson, 2004, p. 156). Unfortunately, the public’s perception is that most manufacturing jobs traditionally learned through vocational programs have been lost to automation, outsourcing, or other technological advances (Crosby, 2006, p. 74). Although in some cases this is true, it is also a reality that manufactures struggle to find qualified workers for those remaining jobs, which sometimes pay upwards of $50,000 to $80,000 a year (Crosby, 2006, p. 75). Based on the previous arguments, vocationalism can be a viable and beneficial alternative to traditional academic education for those who wish to follow this path, and society as a whole.

Views Against Vocationalism. In spite of the much discussed benefits of vocationalism in education, other aspects of this issue deserve serious consideration. Just as proponents of vocational education have been able to provide very powerful arguments in favor of this method, dissenters have also identified many negative effects of an overly vocational education system. One of the most quoted adverse effects of an excessive focus in vocational education is the undermining of the academic curriculum, as well as the moral and civic purposes of education (Grubb & Lazerson, 2004, pp. 15, 48). This line of thought warns of the decline of the high school as a place of civic learning due to vocational programs which emphasize “narrow trade training” and largely ignore subjects such as history or geography (Grubb & Lazerson, 2004, pp. 48,139). The vocational model, in this view, is conducive to a scenario where only those interested in academic subjects will ultimately benefit from civic education and often will go on to attend college (Grubb & Lazerson, 2004, p. 46). On the other hand, vocational students upon completion of their programs could lack the citizenry skills necessary to fulfill their civic duties, and even fully participate in American democratic processes (Grubb & Lazerson, 2004, p. 48). In this case the result of an excessive vocational focus would be a workforce fundamentally ignorant of its own history and unable to answer basic questions related to social studies.

The Ronald Reagan’s administration report entitled *A Nation at Risk: The Imperative for Education Reform* (1983) mentioned before described a very bleak outlook for the American educational system, especially on core subjects such as Science and Math (Lozada, 1999). This report serves as a good example of the consequences of a weak academic curriculum due to excessive vocationalism, which paired with arguments such as inequality in education or even distrust in the system, make for some of the most popular arguments against vocational education. Dissenters argue that the separation of academic and vocational subjects lead to inequality because it could create a “second-class” education system for working class students, while a select few will obtain a better education and the prospect of a high-paying career (Grubb & Lazerson, 2004, pp. 16,17). Others who believe schools are not capable of preparing students for the workforce readily dismiss the value of vocationalism altogether without a more rational explanation other than distrust (Grubb & Lazerson, 2004, p. 16). The American philosopher and educational reformer John Dewey, who opposed narrow forms of vocational training, provided a more balanced view of what vocational education should be. According to Dewey, the pace of technological change requires a broader education system which combines academic subjects with vocational ones in order to better prepare the student for the workplace (Grubb & Lazerson, 2004, p. 9). Unlike some of the other dissenters, John Dewey was able to identify the advantages and disadvantages of vocational and academic education, and proposed a system that took both into account.

## Trends Affecting Vocational Education

Numerous factors in the history of the United States and the world have affected the development of Vocational Education. Such factors like, sheer necessity in the Thirteen Colonies, the Industrial Revolution and its technological advances, or the need to provide logistical support for World War I and II all have had an impact in Vocational Education. However, this research will focus on four ongoing events, which to this day continue to shape and develop Vocational Education: technological advances, globalization, outsourcing, and insourcing.

 Technological Advances. Given the young age of the United States as a country, the most important event after the small-scale agricultural production and craft work of the Thirteen Colonies, was the Industrial Revolution (Grubb & Lazerson, 2004, p. 12). In manufacturing, the Industrial Revolution ended the tradition of craftsmen making goods in small quantities as per a customer’s personal specifications (Cossons, 2008). The new manufacturing systems changed the division and organization of labor by breaking down tasks into series of small discrete steps, which increased production, efficiency, and quality (Cossons, 2008). Around 1890 to 1900, the Communications Revolution, or the Second Industrial Revolution as some called it, brought new technological developments such as electricity, the telephone, and the radio (Grubb & Lazerson, 2004, p. 40). As the 20th century progressed, inventions like the automobile, the airplane, computers, and the World Wide Web continued to affect the way we live to this day (Grubb & Lazerson, 2004, p. 40). These technological advances required, then as now, a skilled workforce capable of learning and adapting to new developments in an increasingly technical business environment.

 In today’s business environment, technology advances at a vertiginous rate causing most job positions to require a minimum of computer literacy and other technical skills. Many businesses have assimilated new technologies, such as Apple’s iPhone, iPod, or iPad replacing the traditional personal computer in its roles of helping managers coordinate work, communicate with employees, and provide information for decision making (Laudon & Laudon, 2013). These devices allow employees to execute transactions, manage applications, access Customer Relationship Management (CRM) software, surf the internet, and communicate with customers from virtually anywhere in the world (Laudon & Laudon, 2013). In the manufacturing industries, the arrival of the Computer Numerical Control (CNC) system marked a new era in the automation of machine tools. According to Tooling University, a popular workforce development training website for engineers, machinists, operators, and other manufacturing professionals, CNC is “a versatile system that allows you to control the motion of tools and parts through computer programs” (ToolingU, 2013). In modern manufacturing, the operation of lathes, mills, grinders, and other tools is a complex endeavor which requires specialized training. As a result, Vocational Education has had to evolve in order to keep pace with new technological advances and the constant upgrades to existing technologies.

 Globalization. The term globalization often incites mixed feelings due to some of its well-publicized negative connotations and the public outcry over the loss of jobs in the United States. Defined as the “increasing economic and cultural connections of nations”, globalization has experienced an exponential acceleration in the past 20 years (Vogel, 2012). There are many motivations for companies to expand internationally, but costs reduction, especially in wages; rank very high as a motivator to make this decision (Vogel, 2012). Consequently, American workers are engaged in a fierce competition with high and low skilled foreign workers who will often work for less money and are willing to relocate (Hickman & Olney, 2011). This issue becomes even more complicated when some companies recognize the added cost savings they could obtain from offshoring and accessing the supply of foreign workers at its source (Hickman & Olney, 2011). In the face of these challenges the American workforce has had to make adjustments in order to acquire those skills necessary to compete in the global market.

 As countries become more and more interconnected in spite of geographical distances, business and development opportunities become available in new markets around the world. On a positive note, globalization has increased economic cooperation between countries, but it has also increased competition due to the new international division of labor (Vogel, 2012). In an effort to remain competitive, many American workers have returned to school to hone existing skills or to learn new ones to become more appealing to firms increasingly preoccupied with efficiency and costs savings. According to a study of the impact of globalization on human capital investment decisions between the years 2000 and 2007, and published in the Industrial and Labor Relations Review publication of Cornell University, American workers are increasingly attending community colleges in response to global competition (Hickman & Olney, 2011). Other educational institutions are not experiencing the same enrollment increases, but community colleges generally offer some vocational education programs relevant to local industries providing the greatest benefit to local workers, and possibly explaining their popularity (Hickman & Olney, 2011). The relative availability of training, and the fact that American workers are responding to globalization in a rational way, make vocational education an attractive option and raises questions about funding needs for the retraining of displaced workers (Hickman & Olney, 2011).

Outsourcing, Insourcing, and the Revival of American Manufacturing. The

The topic of outsourcing has been, and continues to be widely debated, perhaps due to its controversial nature and the emotions it also tends to bring out in some people. Those who have witnessed or experienced the negative effects of this business practice know very well the consequences of American jobs being lost to low-cost labor alternatives. Supporters of outsourcing argue that in a globalized business environment, outsourcing makes sense economically, and will eventually produce new high paying jobs in the United States in sectors boosted by the growth in global trade (Jones & George, 2011) However, the fact is that between the years 2000 and 2010 over 6 million American manufacturing jobs have been lost to countries such as China, Taiwan, Malaysia, and India (Regalado, 2013). Even more alarmingly, these jobs do not solely represent the manufacturing sector; tens of thousands of information technology jobs have been lost to countries where professionals are willing to work for a third of the salary acceptable to their American counterparts (Jones & George, 2011). In spite of this, recent trends point to an imminent shift in outsourcing practices with many companies returning or expanding their presence in the United States.

The return of American manufacturing companies to the United States from overseas is often referred to as insourcing or reshoring. This recent trend is the result of many factors which are slowly reducing the appeal of lower-cost labor abroad, as well as highlighting the benefits of doing business in the United States. One of these factors is the steady increase in manufacturing costs many traditional manufacturing hubs (such as China) have experienced in recent years (Lee, 2013). This situation paired with increasing shipping costs and a desire to reduce supply chain uncertainty has set the stage for a manufacturing comeback (Lee, 2013). As of January, 2013 this comeback has been relatively small and moderate in terms of investments and job gains, but the Boston Consulting Group predicts that by 2015 the cost advantage of Asian labor could disappear, paving the way for an increase in American manufacturing (Regalado, 2013). Although some manufacturing industries are expected to remain abroad in the near future, some lines of thinking suggest that he United States should take this opportunity to take advantage of its core strengths of advanced technologies, innovations, access to skilled labor, strong intellectual property protection, and higher education (Regalado, 2013).

Even though many previously outsourced manufacturing operations are indeed making a slow comeback to our shores, the days when multinational corporations had a major share of activities in the United States are long gone (Porter & Rivkin, 2012). In order to remain profitable in the modern business environment companies must compete at a global level by maintaining a presence in foreign markets (Porter & Rivkin, 2012). This situation requires a national workforce capable of competing with skilled foreign workers who are able to perform efficiently and for significantly less compensation. One of the core strengths of the United States is that it possesses an excellent university and college system capable of meeting the needs of any industry (Porter & Rivkin, 2012). However, for this system to work to our advantage, especially in the area of vocational education, our country must address the weaknesses that continue to prevent further investments in our workforce. Our vocational education programs must provide a skilled, adaptable, creative, and globally conscious worker who is capable of making the revival of American manufacturing a reality (OVAE, 2012).

## The Eleva-Strum Vocational Education Model

The main purpose of career and technical education is to train the future workforce to ensure they are ready to enter the working world with as many skills and competencies as possible (McIntosh, 2012). Supporters, dissenters, and current trends aside, vocational education does provide an alternative to a formal college education and for the most part benefits the local economy when its programs support local businesses. One of these programs is the highly successful Cardinal Manufacturing vocational education model currently in place at the Eleva-Strum High School in rural Wisconsin. In the next sections, the researcher will describe this program and analyze the sources of its success.

A Brief History.With an area of 43 square miles, the Eleva-Strum District in Wisconsin includes the two small towns of Eleva and Strum with a combined population of approximately 1,800 people (McIntosh, 2012). The local high school has an average enrollment of 200 students, and like many other similar high schools in the country, it has a career and technical education manufacturing program (McIntosh, 2012). Unlike teaching English or Math, teaching manufacturing processes such as machining or welding require a substantial investment in capital equipment (Zelinski, 2012). It is precisely this high investment requirement what prevents many schools from developing similar programs. In addition even when these programs already exist, they are the first target for funding cuts due to their large overhead costs (Zelinski, 2012).

The Eleva-Strum High School faces the same budget problems as many other schools in the United States. In March of 2009, the school announced it would be rejoining a cluster of six other school districts in order to share resources and programs (Rupnow, 2009). Around the same time the school board decided to cut the school guidance counselor and advisor, discussed sharing the services of a food service director with other schools, and considered the elimination of the greenhouse classes to cut on heating costs (Rupnow, 2009). Faced with these tough financial decisions it would be just a matter of time before any school had to examine its career and technical education programs. But the ingenuity of a “shop class” teacher would lead to the creation of a highly popular and successful vocational program. This program uses the resources already available in the shop floor of the school’s technical education classroom to manufacture small quantity custom parts for local businesses (Marlaire, 2009).

Implementation.So how did one teacher alleviate the financial problems that plague most vocational education manufacturing programs around the country? The answer lies in a very good idea and years of preparation. A graduate of the University of Wisconsin-Stout, high school teacher Craig Cegielski started a unique vocational manufacturing program out of the Antigo High School machine shop where he taught from 1998 to 2004 (Marlaire, 2009). This program consisted of a student-run business where participants worked on higher-end projects for local businesses, allowing the school to use the profits to purchase more equipment and materials with little effect on traditional school funds (Marlaire, 2009). After his success in Antigo, Craig Cegielski moved to the Eleva-Strum district high school beginning a new chapter in one of the most innovative vocational manufacturing programs in the country (Marlaire, 2009). Cegielski spent the first few years at Eleva-Strum rebuilding the shop and preparing the students with the skills necessary to take on real work (Marlaire, 2009). Today his program is very successful and popular with the students, maintains a strong cash flow, and provides local manufacturers with experienced potential employees who are ready to meet customer’s demands (Zelinski, 2012).

 According to Craig Cegielski, the first year of implementation was very difficult because he found himself begging local businesses for badly needed equipment and other donations (Zelinski, 2012). Some of the earliest products made by the students were not for customers; instead they made workbenches, shelves, or welding booths for the program itself (Zelinski, 2012). The earliest graduates became valuable advocates of the program once local companies hired them and this awareness resulted in more support from the business community (Zelinski, 2012). Today the Eleva-Strum Central High School’s junior and senior year manufacturing class goes by the name of “Cardinal Manufacturing”, and it is a student-run machine shop located on school grounds (Zelinski, 2012). This program is so popular that the school has emblazoned the name “Cardinal Manufacturing” on hats, t-shirts, pens, business cards and other products which not only show pride in the program, but also serve as marketing tools (Marlaire, 2009). Currently, students interested in this program are able to apply in 11th grade, only if they have completed metalworking classes in grades 8th to 10th (Zelinski, 2012). Then the students must submit a resume and go through a formal interview process geared toward developing important interview skills in preparation for the future (McIntosh, 2012). Once accepted into the program students learn real-world skills related to manufacturing processes as well as lessons on the positive or negative effects of decisions in the operations of a business (McIntosh, 2012).

Outcome.The efforts of Mr. Cegielski and the student-workers of Cardinal Manufacturing have resulted in a vocational program that behaves like a business in almost every sense of the word. Students are responsible for obtaining the specifications from the customer, creating the manufacturing order, making the product, handling the billing, and finally delivering the final product (McIntosh, 2012). Although the proceeds are not enough to buy expensive machining equipment, such as CNC machines, it is certainly enough to maintain the existing equipment as well as keeping the shop stocked with tooling, gaging, and supplies (Zelinski, 2012). In addition, the students participate in a profit sharing program that tracks hours worked and provide compensation in the form of a check at the end of the school year (Zelinski, 2012). Most students will typically collect checks of about $500, but those willing to put in the extra time, especially during the summer break, have been able to collect checks of over $2,000 (Zelinski, 2012). This system provides the students with a better understanding of manufacturing processes than the traditional system of engaging in useless projects that simulate production, but otherwise serve no purpose (Zelinski, 2012).

 The success of Cardinal Manufacturing is also attributable to the support of the local businesses that are the main customers and have embraced their methods. In recognition of this program as an excellent source of talent for their shops, these same businesses have donated some the most expensive equipment currently in use, including CNC lathes and other machining tools (Zelinski, 2012). Initially, there was some concern related to the low labor costs of a student-run shop and its effects on competing with local shops for contracts, but any perceived threats turned out to be baseless. The fact is that Cardinal Manufacturing works less hours per week, but its low operating costs make it a valuable resource for local shops to outsource the simple, small batch-work that is usually not cost effective for a larger shop (Zelinski, 2012). As a result, local businesses are consistently using Cardinal Manufacturing for small special orders and internal projects such as benches, shelving, and other support equipment (Zelinski, 2012). As of 2012, Cardinal Manufacturing has worked with more than 15 companies in the Eleva-Strum district and has served an additional 100 paying customers (McIntosh, 2012).

## Manufacturing Vocational Education in Hampton Roads

 In this section the researcher will provide a brief overview of the economic environment of Hampton Roads with an emphasis in the manufacturing industries. Then, the researcher will address the topic of manufacturing vocational education through an analysis of some local vocational education programs, especially at Tidewater Community College (TCC) and Thomas Nelson Community College (TNCC). Finally, the researcher will include an overview of some apprenticeship programs available in the area.

 Manufacturing in Hampton Roads.Hampton Roads is the name of the southeastern metropolitan area of the state of Virginia, which includes the cities of Virginia Beach, Norfolk, Chesapeake, Hampton, Newport News, Williamsburg, Poquoson, Suffolk, Portsmouth, Franklin, the town of Smithfield, and six counties (Hampton Roads Performs, 2013). This area is well known for its historic sites as well as its military presence, with all services being represented in multiple military bases throughout the region. The economy of Hampton Roads is driven by a mixture of federal sources, tourism, services, and manufacturing (Hampton Roads Regional Benchmarking Study, 2010). In the area of manufacturing Hampton Roads is home to Huntington Ingalls Industries Shipbuilding division, formerly known as the Newport News Shipbuilding and Drydock Company, which is currently the largest shipyard in the world (Huntington Ingalls Industries, 2013). In addition, this area also houses other important manufacturing entities such as the Norfolk Naval Shipyard, Smithfield Foods, STIHL Inc., and Canon Virginia Inc. The following table illustrates Hampton Roads’ top ten manufacturing industries ranked by number of employees (HREDA, 2012):



The previous table is a snapshot of a larger list that includes all 133 manufacturing businesses of Hampton Roads as of September of 2012. Employees in the field of manufacturing totaled 59,598 at this time, which is approximately 7.32 percent of the total civilian workforce population of 814,141 people (HREDA, 2012). In comparison, nearly 12 million Americans (9 percent of the total workforce) in the United States are employed directly in manufacturing jobs (National Association of Manufacturers, 2013). In 2012, manufacturing jobs contributed $1.87 trillion to the national economy which is approximately 11.9 percent of the total Gross Domestic Product (National Association of Manufacturers, 2013). To further put these figures in perspective, for every $1.00 spent in manufacturing, another $1.48 is added to the economy making it the highest multiplier effect of any economic sector (National Association of Manufacturers, 2013). The previous statistics support the notion that at 7.32 percent of the workforce population, the Hampton Roads region is a mere 1.68 percent less of the national percentage, making manufacturing a very important part of the local economy.

However, between the years 2006 and 2009, Hampton Roads lost approximately 5,000 manufacturing jobs, mostly due to the economic recession and other factors such as outsourcing and global competition (Hampton Roads Performs, 2013). This troubling trend deserves the attention of the local government given the importance of manufacturing as a job provider and contributor to Gross Domestic Product. One way to guarantee the continuity of the Hampton Roads’ manufacturing industries is to provide a well-trained and qualified workforce through vocational training. Local institutions such as Tidewater Community College, the New Horizons Center for Apprenticeship and Adult Training, and the Thomas Nelson Community College offer programs of study related to manufacturing vocational education. Nevertheless, these programs usually suffer from budget issues and several other inefficiencies which could have a direct effect on the overall availability of skilled workers in the Hampton Roads workforce.

 Tidewater Community College. Founded in 1968, Tidewater Community College (TCC) is the largest provider of higher education and workforce development in Hampton Roads (Tidewater Community College Celebrates 45 Years of Service, 2013). TCC enrolls nearly 47,000 students per year, it is the 11th largest two-year community college in the country, and it was the choice for 51percent of Hampton Roads’ students who enrolled in higher education during the 2011-2012 academic year (Tidewater Community College Celebrates 45 Years of Service, 2013). In the workforce development area TCC offers many programs in areas such as automotive, construction and safety, health care, and information technology (Tidewater Community College, 2013). However, in the area of manufacturing the offerings are limited to apprenticeship training in the form of registered apprenticeship programs through major local manufacturing businesses and Autodesk 3D Modeling Software training (Tidewater Community College, 2013). Although, the learning opportunities in manufacturing may seem limited in the workforce development area, TCC also offers a manufacturing related program at the Advance Technology Center (ATC) site involving high school students.

 The Advanced Technology Center (ATC) opened its doors on April 30, 2003 as a result of a partnership between the City of Virginia Beach, the Virginia Beach City Public Schools (VBCPS), and TCC (Tidewater Community College, 2013). Located within the TCC campus, this state of the art facility constitutes a model for technical education in Virginia Beach and assists in addressing the local demands for a well-trained workforce in the areas of information technology and engineering (Advanced Technology Center, 2011). In the area of High-Performance Manufacturing and Engineering the ATC offers programs in engineering technology and computer-aided design (CAD) to prepare students for future careers in various areas of engineering and manufacturing (Advanced Technology Center, 2011). This training is available to High School students through a competitive admission process for grades 10th through 12th and provides an opportunity for those who are considering manufacturing careers after graduation, expect to pursue higher education, or a combination of both (Virginia Beach City Public Schools, 2011). The VBPCS currently pays for all industry credentialing tests and has adopted an ambitious strategic plan named Compass to 2015 aimed to ensure student success in the modern business environment (Virginia Beach City Public Schools, 2011).

 On June 25th, 2013, the researcher visited the ATC at TCC in order to obtain more information about their manufacturing program and examine some of the equipment present in the classroom. During this visit the researcher learned that the students’ parents must sign a document guaranteeing the behavior and commitment of their sons and daughters, or the students could face disciplinary actions. As far as funding and maintenance expenses, most funding comes from the Perkins Grant and the instructors usually perform the equipment maintenance. Upon entering the main classroom, a visitor gets the first impression of a well-lit, clean, and organized learning environment. The classroom contains a small assembly line, multiple mills by Emco and Denford, an assortment of Amatrol learning systems, and a Dimension SST 1200es 3D Printer, among other small equipment. During instruction the students learn to operate CNC machines using Mastercam software, which is one of the most widely used CAD/CAM software in the world. The main and adjunct classrooms have multiple stations where the students also learn about solid models, measuring tools, and quality concepts. Currently, most completed student projects on display at the ATC are representative of the national norm of small plastic widgets, such as key chains or name tags. While these parts are instrumental in teaching CNC programming, they have no real useful manufacturing applications and often end up being scrapped.

 Although some of the equipment used in this program is small, not suitable for high scale operations, and somewhat outdated, the researcher believes this program has a lot of potential for improvement. The existing equipment could be a great starting point for a program modeled after the Cardinal Manufacturing program here in Hampton Roads. The adjunct classrooms, in addition to their current functions, could be used as Quality Control labs where students could learn about the importance of scrap reduction in a for-profit business. The cleanliness and organization of this learning shop could also become a great tool in teaching 5S (Sorting, Straightening, Shine, Standardize, and Sustain) concepts used by most successful manufacturing companies. Overall, the researcher believes that the manufacturing program at TCC could be tailored to our own local needs and become a great resource for our manufacturing companies in the form of help with small projects and trained future employees.

Other Local Vocational Programs. The Center for Apprenticeship and Adult Training at the New Horizons Regional Education Center in Newport News, Virginia has been providing technical training programs and preparing adults for employment for 46 years (New Horizons Regional Education Center, 2013). This educational facility currently offers 60 courses and provides training for 1,200 adults annually in vocational areas such as electrician, carpenter, plumber, mold maker, tool and die maker, and machinist (New Horizons Regional Education Center, 2013). In order to take advantage of these programs, a prospective candidate must first identify his/her area of interest and locate an employer willing to provide sponsorship (New Horizons Regional Education Center, 2013). At the completion of the apprenticeship program, a representative from the Department of Labor and Industry meets with the sponsor and the Related Instruction Coordinator to sign a certification to indicate that the apprentice has completed all necessary training requirements (New Horizons Regional Education Center, 2013). Approximately a month later, the apprentice will receive a Certification of Completion of Apprenticeship Training from the Virginia Department of Labor and Industry (New Horizons Regional Education Center, 2013).

The Thomas Nelson Community College (TNCC) is a two-year higher education institution primarily serving the residents of Hampton, Newport News, Poquoson, and Williamsburg (General Information, 2013). The financing of its activities occurs through a combination of state funds, federal funds, and contributions from the participating localities (General Information, 2013). The college offers associate’s degrees, diploma and certificate programs, developmental courses, continuing education programs, and industrial training programs (General Information, 2013). In the industrial training area, TNCC offers training in manufacturing jobs through its Advanced Manufacturing Center (General Information, 2013). This program uses grants awarded under the Training Initiative and the community based Job Training Grant implemented by the United States Department of Labor (General Information, 2013). However, currently these programs through TNCC and New Horizons are not available to High School students, therefore excluding any further considerations from the scope of this research. In spite of this, the researcher believes that these two examples have the potential to develop programs similar to that of Cardinal Manufacturing and are subsequently worthy of mention.

# Methodology

 Vocational education programs across the United States have traditionally suffered from budget cuts and other financial difficulties. A high school program in Wisconsin has solved this problem by turning a typical shop classroom into a profitable business with the support of local companies. Through a combination of historical evidence, surveys, interviews, and observation, this research explores the possibility of implementing a similar program in Hampton Roads. In the next paragraphs, the researcher will explain the methodologies, as well as the limitations encountered throughout the research.

## Overview

 Based on the success of the Cardinal Manufacturing program at Eleva-Strum High School in rural Wisconsin, this research attempted to show that the implementation of a similar program in Hampton Roads is not only feasible, but it also makes sense. During the course of the research, the author analyzed the progression of vocational education with an emphasis on its history as it relates to American society. Further, the researcher explored the impact and contributions of manufacturing in Hampton Roads by identifying the major employers and the percentage of the workforce population involved in this activity. Finally, a look into higher education institutions such as Tidewater Community College, the New Horizons Center for Apprenticeship and Adult Training, and the Thomas Nelson Community College provided invaluable insight into the manufacturing vocational education situation in our area.

As mentioned before, the data collection methods consisted of surveys, interviews, and observation. The names of local businesses, as well as personally identifying information of participants will remain anonymous in order to protect their privacy. The population consisted of 50 randomly selected manufacturing professionals between the ages of 24 and 66 and educational backgrounds ranging from high school, trade school, and some college through Master’s degrees. Their current positions included Quality Technicians, Engineers, Metrologists, Machinists, Assembly Leads, Supervisors, and Key Managers with a length of experience in manufacturing in the range of 2 to 50 years. Women represented a 14 percent of the total surveyed population, which is about half of the national 27.1 percent share of women in manufacturing as of April, 2013 (Congress, 2013). The distribution of surveys was in person at a local manufacturing company. These manufacturing professionals answered two yes or no questions directly related to the implementation of a Cardinal Manufacturing style program in our area. After selecting the answer, all participants had the opportunity to briefly explain their responses. The following are the two questions included in the survey:

1. Do you think a program modeled after the Cardinal Manufacturing experience would be successful in Hampton Roads?
2. Do you think local manufacturing companies would benefit from the implementation of a manufacturing vocational training program similar to Cardinal Manufacturing?

The researcher conducted three personal interviews including one with a former vocational student, an interview with a Computer Numerical Control (CNC) instructor who taught at a local community college, and an interview with the apprenticeship program manager at a local manufacturing company. The interview methodology involved a combination of verbal exchange, notes taken by the researcher based on verbal answers, and written answers to the questions by the interviewees. The purpose of the interviews was to collect first-hand accounts of the daily operations, advantages, and shortcomings of the vocational programs familiar to the interviewees. The interviews consisted of 12 questions geared toward learning about the interviewee’s experiences in vocational education and progressively moving toward their views on the implementation of a Cardinal Manufacturing style program in Hampton Roads. The following are the 12 questions included in the interview:

1. What is your current position within this organization?
2. Please briefly describe your experience with the manufacturing vocational education program you are/were involved with during your career. Focus on your overall assessment (positive or negative) based on this experience.
3. Do you know what is/was the process of acquiring funds to support the program? What are its sources?
4. Do you think the funding is/was adequate?
5. Do you think the equipment available for the program is/was adequate?
6. How would you rate the students’ interest in the program?
7. Do you know if local manufacturing companies provide/provided support for the program?
8. If so, what kind of support? Monetary? Equipment donations? Sponsorship?
9. Do you agree that a program modeled after the Cardinal Manufacturing experience would be successful in Hampton Roads?
10. Do you agree that local manufacturing companies would benefit from the implementation of a manufacturing vocational training program like the one implemented at Cardinal Manufacturing?
11. If this program has worked so well in rural Wisconsin, then why do you think its implementation has eluded us here?
12. Do you have any questions or further views you would like to share?

 After the interviews, the researcher conducted the observation portion of the methodology by physically examining a shop classroom, the equipment, and some supplies at the ATC. In addition, the researcher also examined some of the projects currently in work, as well as previous projects on display inside the training institution.

## Limitations

 During the course of the research, the researcher encountered some limitations related to the demographics of participants, the availability of manufacturing vocational programs in the area, and the inability to truly predict the social, economic, and political impacts of the implementation of such a program in our area. All these limitations are external factors beyond the control of the researcher and will be discussed individually in the next few paragraphs.

 Demographics of Participants. The researcher randomly selected all participants for the surveys and interviews over the course of several days. This randomness helped to ensure the elimination of selection bias, but at the same time it exposed a well-known demographic limitation in a manufacturing environment: the tremendous difference between the male and female representation in the industry. This difference has increased since the women’s share of employment in this sector reached its peak of 32 percent in 1990 (Congress, 2013). As mentioned before, as of April 2013, only 27.1 percent of employees on manufacturing payrolls were women, with a large share of this percentage dedicated to office and administrative positions (Congress, 2013).The main factors which have contributed to this decline are the recession that began in 2008 and the no longer true, but persisting, stigma that manufacturing jobs are difficult, dirty, and require strenuous physical labor (Congress, 2013).

 At only 14 percent of the total surveyed population, women unanimously considered a Cardinal Manufacturing style program to be a good option for Hampton Roads by answering “Yes” to both questions. Although in this particular research the women’s participation is small in comparison to their male counterparts, their opinions are no less important. As of October 2012 the college enrollment rates for young women was at 71.3 percent, while young men lagged behind at 61.3 percent (Bureau of Labor Statistics, 2013). One estimate places the current manufacturing job openings requiring advanced skills at 600,000, but manufacturing companies are currently having difficulty finding and retaining skilled labor (Congress, 2013). Given this situation and the fact that women today make up nearly half of the total labor force should encourage employers to find ways to tap into this underutilized human resource (Congress, 2013). Due to the increasing role of women in higher education and the modern labor force, this one limitation could easily be the most relevant in relation to this research.

 Availability of Manufacturing Vocational Programs. Another one of the most challenging obstacles encountered during this research was the lack of available manufacturing vocational programs for high school students in Hampton Roads. All local manufacturing programs, except the one at the ATC, focus on adult students who are usually in a period of transition in their careers. This situation made the research process particularly difficult due to the absence of an abundant source of reliable data on the success or failures of such programs. The few other manufacturing programs in the area are either not relevant to this research or plagued by budget issues. Conversely, a byproduct of the lack of programs is the lack of students and instructors available for interview. A bigger representation of these two groups could have provided a larger volume of data relevant to the research. This data could have been useful in the decision process of whether to implement a program similar to Cardinal Manufacturing in Hampton Roads or not.

 Social, Economic, and Political Factors. The Cardinal Manufacturing program currently operates in rural Wisconsin with the support of the local government and businesses. Its implementation in such a small population seems to have had a positive social and economic impact evidenced in the almost immediate hiring of Cardinal Manufacturing graduates. The local companies see the student run shop, not as a threat, but a resource for the fulfillment of small orders and trained future employees. This symbiotic relationship helps both the Eleva-Strum micro society and economy, and serves as a palpable example of the possibility of success in other areas of the country. On the political side the researcher was unable to find any positive or negative outcomes related to Cardinal Manufacturing and its coexistence with private businesses.

However, the researcher understands that success in rural Wisconsin does not automatically guarantee success in Hampton Roads. Our area has a population that is more culturally diverse and over 900 times larger than that of the Eleva-Strum district. Furthermore, the majority of our manufacturing industries support the shipbuilding enterprise, which the federal government influences heavily. Most of these industries already possess well established apprenticeship programs and a steady supply of funding from government contracts. Due to these factors, it would be very difficult to predict the social, economic, or political impacts a Cardinal Manufacturing style program could have in Hampton Roads. The researcher has found that this inability paired with no other basis for comparison, other than Eleva-Strum, are serious limitations to this study.

# Data Analysis – Findings

## Survey Results

After surveying 50 manufacturing professionals, the researcher obtained enough information to conduct a rational analysis. This analysis led to the breakdown of the total Yes and No answers into percentages of the total of respondents. Surprisingly, both questions garnered the same percentage of responses for the Yes and No options. For the sake of simplicity, the researcher will illustrate the answer percentage of both questions with only one graph.

 The graph shows an overwhelming 98 percent of positive answers to both questions and a 2 percent of negative answers. The positive responses suggest that the participating manufacturing professionals consider the implementation of such a program in Hampton Roads a successful proposition that will ultimately benefit the local manufacturing companies. On the other hand, two participants responded negatively to the questions. One participant answered “No” to question number one, and the other answered “No” to question number two. The reasons cited by the first participant for a negative response to question one were the possible legal differences between Wisconsin and Virginia, his personal opinion that manufacturing is more prevalent in Wisconsin, and the fact that most manufacturing opportunities in Hampton Roads are government related. The participant who answered “No” to question two explained that local manufacturing companies will not benefit from this kind of program and only the students would see any positive outcome.

The tables below provide a snapshot of the explanation to the answers collected during the survey process. The survey structure provided the respondents with an opportunity to expand or explain the reasons why they chose Yes or No as their main answer. In these tables the researcher selected the top five reasons given in response to each question and organized them by number of respondents and percentage of the total. Table 2 refers to the question of whether a program modeled after the Cardinal Manufacturing experience would be successful in the business environment of Hampton Roads:

|  |
| --- |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Respondents** |
| Will provide real-world experience for students | 20 | 40% |
| Reasonable amount of local companies will ensure success | 5 | 10% |
| Strong military presence will help the program succeed | 5 | 10% |
| Manufacturing costs reduction for local companies | 4 | 8% |
| Will provide a good source of skilled workers | 4 | 8% |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |

Table 3 addresses the question of whether this program would be beneficial to local manufacturing companies and why:

|  |
| --- |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Respondents** |
| Will provide a good source of trained employees | 34 | 68% |
| Good opportunities and experience for students after completion | 9 | 18% |
| Will reduce training costs for local companies | 6 | 12% |
| Lower cost parts will be available to the participating local shops | 5 | 10% |
| Will reduce hiring costs due to a highly trained talent pool | 2 | 4% |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |

The outcomes on these tables suggest that the majority of participants view a Cardinal Manufacturing style program as a source of real-world experiences for the students. As a result of these experiences the employers, at least in theory, will have a source of entry level employees who will require minimal training. It is interesting to point out that the two main explanations seem to be interrelated because one could serve as the medium leading to the other one. At the same time, the explanations for the negative responses provide some insight on the possible obstacles a program of this nature could experience in Hampton Roads.

## Interview Results

 Below, the researcher will provide a summary of three interviews conducted in person to a former vocational student, a CNC Instructor, and an apprenticeship program manager. As mentioned before, their personal information, as well as that of their organizations, is withheld in order to protect their privacy.

 Former Vocational Student. The first person interviewed by the researcher is a former vocational student who participated in the High Performance Manufacturing and Engineering Program (HPME) at the Advanced Technology Center of Tidewater Community College during the period of 2005 through 2007. As a sophomore in high school he applied for this program and received the acceptance letter the following year. Today, he works as a Machinist and CNC Specialist for a well-known local manufacturing company. During his time in the program he experienced some positive and some negative aspects of the current vocational education system.

 During his time with the HPME, this student obtained in his own words “a broad base of knowledge on topics ranging from CNC operation, robotics, hydraulic, and electrical systems”. He points out that the focus of the program was the operation of CNC machines using Mastercam, a 2D system that uses Computer Aided Design to help machinists design virtual parts on a computer screen. While he described the opportunity as “fantastic” he was also very quick to call attention to the fact that even though the equipment was adequate in his opinion, there were practical limitations such as shortage of materials and machine down time due to lack of maintenance and repair issues. In spite of this, he claims that all students remained interested and were very eager to use their newly acquired knowledge to make real parts. When asked about sources of funding the interviewee never knew where the funds came from or any other aspect of budget planning. He also stated that to his knowledge local manufacturers did not provide any type of support for the program during his period of attendance.

 At this point the interview focused on the interviewee’s position on the possible implementation of a program similar to Cardinal Manufacturing in Hampton Roads. In his opinion this type of program would provide students with real-world experiences in the form of usable part blueprints, solid models (computer modeling of three-dimensional solids), and other machining concepts and methods. Furthermore, a program of this nature would provide local companies with a resource for the manufacturing of basic or simple parts, and an opportunity to contribute to the training of the future workforce. However, he recognized that the idea of involving high school students in paid labor, especially those below employment age, could be morally reprehensible to some people. On the other hand, since the students are not actually employees in a business, and the program’s ultimate objective is training, a monetary incentive could be a useful tool to foster interest and reward efforts.

 The final question of the interview allows the interviewee to express any further views he/she would like to share. While answering this question, the former vocational student wrote:

 “Had something like Cardinal (Manufacturing) been in place at the ATC during my time there, I believe it would have allowed me to have better prepared for the job I hold today, simply because it would have allowed me to get a real, inside look at the T+D (Tool and Die) trade [sic]”

 CNC Instructor. Currently working as a Machinist/CNC Specialist with over 25 years of experience, this interviewee offered a valuable insight into a local manufacturing vocational program through his personal experience. As a Computer Numerical Control instructor, he has taught the Introduction to CNC class at a local community college for two consecutive years. His main audience is composed of students in a transitional moment in their lives, normally moving between jobs or preparing for a new career. An interesting piece of information is the fact that in two years; only one female took advantage of this program and unfortunately had to withdraw for personal reasons before completion. At a cost of $2,500 the program is 14 weeks long and offers no guarantees of employment upon completion. Students who possess a background in computer science or machining have an advantage over those who do not, and are more likely to get the full benefit from the program, according to the instructor. Although he described the overall experience as positive, his only regret is that the program is not long enough to fully prepare a machinist who will be have enough experience to become attractive to manufacturing companies.

 Funding for this vocational program, the instructor explains, comes from government grants, although he was not sure which one specifically. This situation resulted in virtually no material shortages and major equipment maintenance or repairs done by hired contractors. The performance of routine or scheduled maintenance rested on the instructor. In summary, the interviewee considered the equipment, although outdated by almost 15 years, to be adequate. In his opinion, the funding was also adequate during his two year tenure, in spite of the fact that currently he hasn’t been able to teach for an entire year due to budget cuts. The instructor rates the student’s interest as very high, but also places importance on the dedication and attitude of the teacher toward the subject as a determinant factor. This interest was not undermined by the lack of support from local companies or the lack of employment prospects upon graduation. He claimed that aside from very rare equipment donations, local companies offered little help or support for this program. When asked why he thought that was the case, he responded that in his opinion the program was too short to produce the level of experience required by most companies, and therefore any investment on their part would likely not produce any real benefits.

 At first, the interviewee knew very little about the Cardinal Manufacturing experience, but as he learned about this success story he became very interested in the possibility of implementing something similar in Hampton Roads. He expressed his belief that the organization where he used to teach had the capabilities of implementing such a program, even with students who are not currently in high school. A successful implementation, he says, would definitely benefit local manufacturing businesses in the form of a readily available resource of small parts manufacturing and a steady source of trained future employees. On the other hand, he pointed at politics, internal organizational roadblocks, and funding as the possible reasons why a similar program has not been implemented in other places.

Apprenticeship Program Manager.As an Apprenticeship Program Manager for a local manufacturing company, this interviewee possesses current knowledge about the manufacturing vocational education situation in our area. As part of his job of preparing the future generations of machinists in an industrial setting, he maintains regular communication with the other programs mentioned in this research. The answers he provided are not related to the program for which he is responsible (this program obtains its funds directly from his employer and counts with modern equipment), but are a reflection of his experiences with other local programs.

From this unique position, the interviewee pointed out that Hampton Roads is in dire need of a good vocational program for high school students. However, he recognized that for such a program to be successful our community must address the current shortage of qualified instructors with manufacturing experience as well as the provision of steady funding. When asked if he knew how other programs outside of the one he manages obtain their funds, he was not able to provide an answer. In response to the question of whether the equipment he has seen in other local programs is adequate, he responded that it is antiquated for the most part and some basic peripherals are often missing. As far as the students, he has been in contact with recent graduates of local programs as well as apprenticeship candidates within his organization, and all, in his opinion, need motivation and supervision to remain focused. In relationship to local manufacturer’s support, he mentioned that at some point local companies showed an interest, but the lack of a serious attempt at manufacturing vocational education in the area discouraged any further support. Although, he considered the efforts at the ATC to be the closest to a successful local program, there is still plenty of work to accomplish.

Initially, the interviewee was not familiar with the success story of Cardinal Manufacturing, but after learning about it he dismissed it as a possibility for implementation in our region. The main reason he gave for his negative response as to whether such a program would be successful in Hampton Roads, was that he favored industry sponsored apprenticeships over other programs, especially when it came to funding. He acknowledged that the startup costs and initial investments for a program similar to Cardinal Manufacturing would be too great to justify when local companies could easily manage their own apprenticeship programs. In spite of this, he also conceded that even his program could benefit from a talent pool of high school students with at least a year of prior machining and CNC experience.

# Conclusion

## Response to the Introduction and Problem Statement

As specified in the problem statement, this research attempted to raise awareness to the current shortage of qualified applicants for manufacturing positions in our geographical area and suggest a solution to this problem. The premise for the proposed solution finds its basis on the Cardinal Manufacturing model, which is a successful and relatively self-sufficient high school vocational program in rural Wisconsin. In addition, the problem statement finished with the question: If this program has worked so well in rural Wisconsin, then why not here? The main purpose of this question is to provoke thought and consideration on those who can initiate change in our education system. Throughout the research, the researcher attempts to provide those agents of change with enough supporting data and information to properly answer the question of “why not here?” Our current vocational education system favors methods and shop class projects which yield some benefits to the students, but very little to the school, or the community. The proposal contained in this Independent Learning Project aims to prepare students by providing relevant training based on real business situations, provide a solution to vocational education budget problems, and give back to the community.

Based on the survey and interview results, the researcher’s proposal has a very high level of acceptance among the local manufacturing professionals who participated in the research. In this aspect, the research succeeds in ascertaining the preliminary approval rating of those who will ultimately benefit from the implementation of a program modeled after Cardinal Manufacturing. The overwhelmingly positive responses also suggest that these manufacturing professionals possess a deep awareness of the skills gap that plagues manufacturing industries at most levels of technical proficiency. To this effect they see Wisconsin’s vocational education program as a possible solution for our manufacturing industry’s need for a readily available skilled labor force. However, the limitations identified by the researcher, some logistical obstacles, and the environmental differences between rural Wisconsin and Hampton Roads stand in the way of a definitive answer to the question of why not here. The researcher found that although this question seems simple, the answer is complicated, raises other questions, and has many implications that will require further research.

In summary, this research succeeds in proving that there is support in Hampton Roads for the implementation of a program modeled after, or similar to, Cardinal Manufacturing. In spite of this, there are issues that deserve serious consideration before making the decision of further investing in our vocational education programs. The Eleva-Strum district does not share many similarities with Hampton Roads in the social, economic, and political spheres. Hampton Roads has an economy heavily dependent on government contracts and spending and therefore any changes to our workforce should require an evaluation of our local needs. Furthermore, the researcher understands that the implementation of this program would require a considerable initial investment while the first students become proficient enough to work on projects for profit. These issues will undoubtedly require further research, but if the success of Cardinal Manufacturing show us anything, it is that this program is worthy of consideration.

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# Appendix A

**Manufacturing Vocational Education Survey – Current Manufacturing Employees**

**Introduction**

A High School in rural Wisconsin has implemented a highly innovative manufacturing vocational program by the name of Cardinal Manufacturing. Participants manufacture parts to fulfill orders placed by local businesses for a profit using the existing equipment in the shop classroom. The school uses the proceeds to maintain the equipment, purchase supplies, and sometimes to distribute to the students through a profit sharing program. Upon completion, students enter the workforce with a relevant set of skills based on real-world business experiences.

The purpose of this survey is to ascertain the level of acceptance or rejection of our community to the possible implementation of a similar program in Hampton Roads.

**Current Position: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Gender:\_\_\_\_\_\_\_\_\_\_ Age: \_\_\_\_\_\_\_\_**

**Length of Experience: \_\_\_\_\_ Level of Education: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_**

**Instructions**

Please read the introduction fully before attempting to complete this survey. Then answer the following questions by selecting only one answer.

The researcher will use the information above to place participants in categories relevant to the research. All information and answers are confidential.

**Questions**

1. Do you think a program modeled after the Cardinal Manufacturing experience would be successful in Hampton Roads?

Yes

No

Please, briefly explain your response

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1. Do you think local manufacturing companies would benefit from the implementation of a manufacturing vocational training program similar to Cardinal Manufacturing?

Yes

No

Please, briefly explain your response \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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# Appendix B

1. What is your current position within this organization?
2. Please briefly describe your experience with the manufacturing vocational education program you are/were involved with during your career. Focus on your overall assessment (positive or negative) based on this experience.
3. Do you know what is/was the process of acquiring funds to support the program? What are its sources?
4. Do you think the funding is/was adequate?
5. Do you think the equipment available for the program is/was adequate?
6. How would you rate the students’ interest in the program?
7. Do you know if local manufacturing companies provide/provided support for the program?
8. If so, what kind of support? Monetary? Equipment donations? Sponsorship?
9. Do you agree that a program modeled after the Cardinal Manufacturing experience would be successful in Hampton Roads?
10. Do you agree that local manufacturing companies would benefit from the implementation of a manufacturing vocational training program like the one implemented at Cardinal Manufacturing?
11. If this program has worked so well in rural Wisconsin, then why do you think its implementation has eluded us here?
12. Do you have any questions or further views you would like to share?

# Tables

**Table 1**







**Table 2**

**Top Five Answers**

|  |
| --- |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Respondents** |
| Will provide real-world experience for students | 20 | 40% |
| Reasonable amount of local companies will ensure success | 5 | 10% |
| Strong military presence will help the program succeed | 5 | 10% |
| Manufacturing costs reduction for local companies | 4 | 8% |
| Will provide a good source of skilled workers | 4 | 8% |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |

**Full Table**

|  |
| --- |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Total (50)** |
| Will provide real-world experience  | 20 | 27% |
| Reasonable amount of local companies will ensure success | 5 | 7% |
| Strong military presence will help the program succeed | 5 | 7% |
| Costs reduction for local companies | 4 | 5% |
| Will provide a good source of skilled workers | 4 | 5% |
| Better opportunities for students | 4 | 5% |
| No answer | 3 | 4% |
| Will solve VoTech budget issues | 2 | 3% |
| Alternative to 4-year degree | 2 | 3% |

|  |  |  |
| --- | --- | --- |
| It will take time to establish to ensure quality | 2 | 3% |
| Real world experience is difficult to reproduce in an academic environment | 2 | 3% |
| College is not for everybody | 1 | 1% |
| Cooperation between high schools and local businesses | 1 | 1% |
| Local companies could be customers | 1 | 1% |
| Promote community improvement | 1 | 1% |
| Success depends on offering this program to all technical and trade schools | 1 | 1% |
| Success depends on program planning and preparation | 1 | 1% |
| Success depends on targeting local needs | 1 | 1% |
| Unemployment rates will improve | 1 | 1% |
| Wisconsin is not Hampton Roads | 1 | 1% |
| Does not see the financial success | 1 | 1% |
| Good preparation for higher education  | 1 | 1% |
| Improved local economy | 1 | 1% |
| Incentive for new manufacturing companies | 1 | 1% |
| Manuf. more prevalent in Wisconsin | 1 | 1% |
| Profit sharing could cause backlash from other VoTech programs | 1 | 1% |
| Profit sharing is a great incentive  | 1 | 1% |
| Promote innovation in manufacturing | 1 | 1% |
| Resource for companies to fulfill "small" jobs | 1 | 1% |
| Support from local companies | 1 | 1% |
| Will improve local economy | 1 | 1% |
| Will require high initial costs | 1 | 1% |
| Not enough manufacturing opportunities in Hampton Roads other than government related | 1 | 1% |
| Table 2 Top 5 Explanations to Yes/No Responses - Question 1 |

**Table 3**

**Top Five Answers**

|  |
| --- |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Respondents** |
| Will provide a good source of trained employees | 34 | 68% |
| Good opportunities and experience for students after completion | 9 | 18% |
| Will reduce training costs for local companies | 6 | 12% |
| Lower cost parts will be available to the participating local shops | 5 | 10% |
| Will reduce hiring costs due to a highly trained talent pool | 2 | 4% |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |

**Full Table**

|  |
| --- |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |
| **Explanation to Yes/No Answers** | **Number of Respondents** | **Percentage of Total (50)** |
| Will provide a good source of trained employees | 34 | 47% |
| Good opportunities and experience for students after completion | 9 | 13% |
| Will reduce training costs for local companies | 6 | 8% |
| Lower cost parts will be available to the participating local shops | 5 | 7% |
| Will reduce hiring costs due to a highly trained talent pool | 2 | 3% |
| Increased cooperation between high schools and private sector | 1 | 1% |
| It will help introduce younger generations to manufacturing | 1 | 1% |
| Local manufacturers will not benefit, students will | 1 | 1% |
| No answer | 1 | 1% |
| Only small manufacturing businesses will benefit | 1 | 1% |
| Program could be the base to our future workforce | 1 | 1% |
| Resource for companies to fulfill "small" jobs | 1 | 1% |
| Success depends on program support from manufacturers | 1 | 1% |
| Success depends on targeting local needs | 1 | 1% |
| Real-world manufacturing business experience  | 1 | 1% |
| Difficult to get trained employees in the manufacturing fields | 1 | 1% |
| Graduates will be familiar with local companies' procedures | 1 | 1% |
| Incentive for other manufacturing companies to make Hampton Roads their home | 1 | 1% |
| Local schools are designed to promote higher education only | 1 | 1% |
| Most manufacturing in the area is government related. Will they allow high schools to fulfill orders? | 1 | 1% |
| Government could attempt to regulate programs like this to prevent quality issues  | 1 | 1% |
| Table 3 Top 5 Explanations to Yes/No Responses - Question 2 |