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ENHANCING APPRENTICE TRAINING THROUGH SUPERVISION OF WORK EXPERIENCE

by

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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
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DOCTOR OF PHILOSOPHY

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OLD DOMINION UNIVERSITY
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Approved by:

Dr. John M. Ritz (Chair)

Dr. Philip A. Reed (Member)

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ABSTRACT

ENHANCING APPRENTICE TRAINING THROUGH SUPERVISION OF WORK EXPERIENCE

J. Scott Christman

Old Dominion University

Director: Dr. John M. Ritz

To remain globally competitive, U.S. companies need to consider new strategies for developing a workforce. The apprenticeship model has been identified as a viable solution for companies to invest. The problem of this study was to determine if an apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. To aid current and potential companies offering apprenticeship programs, this study identified a population of apprentices ($N = 877$), tracked them from entry into the program until five years after graduating, and analyzed their outcomes relative to program completion, academic GPA, work-related GPA, company longevity, and company promotion between those apprentices that were supervised under three unique supervision conditions. Finding significant differences between supervision type relative to completion, academic and work-related GPA's, and promotion, the study concluded that the apprenticeship experience was enhanced by the type of supervision given during the work-related component of the program.

DEDICATION

This dissertation is dedicated to my family. First and foremost to my wife Beatriz, without your patience and understanding this accomplishment could never have happened. Thank you for always being on board with all the crazy ideas I propose. May we forever continue creating lasting memories together.

To my daughter, Aura, thank you for being such a wonderful daughter. As is the word of the Lord in Psalm 127:3, God truly blessed me with a gift when you entered my life. May you have gained the audacity to think big and reach high for your own dreams and aspirations by witnessing me conquer this milestone in my life.

And finally, to my mom and dad, Phyllis and Ray, you gave me the single most important element parents can give a child – *love*. Thank you for working hard, going to church, always doing things together, and showing me the way to live a successful life. Rest assured, I will do the same with my family.

J. Scott Christman

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This dissertation would not have been possible without the assistance and patience of several very special people. First, my committee chair, Dr. John Ritz, you have challenged me to grow as a researcher and a person. From the first college class you taught me in the spring of 1993 until the present, you have been my master craftsperson in every sense. Your door was always open and your belief in me never wavered. Thank you for your guidance and direction with this milestone in my life.

I would also like to acknowledge another committee members, Dr. Phil Reed, for his encouragement and support. I first had you as a professor during the summer of 2003, and ever since I have enjoyed your humbleness and seemingly quiet enthusiasm towards educational subject matter. Your door was always open to me and, though you may not know it, you were absolutely instrumental in helping me make the decision to embark on this journey.

Additionally, I would like to acknowledge my gratitude to Dr. Alok Verma, another committee member. I became an undergraduate student at Old Dominion University in 1990, at which time you were my first academic advisor. I later had you as professor in several courses throughout my undergraduate program of study. You were humble and never too busy to meet with me. You often gave me advice that ranged beyond simple academics. You believed in me from the beginning and often challenged me to raise the bar in my thinking (academically and personally). Thank you Dr. Verma, for being there at the beginning and seeing me through to the end - more than 25 years later.

J. Scott Christman

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CHAPTER I

INTRODUCTION

The United States needs a highly skilled workforce to support economic growth and maintain the standard of living shared among its citizenry. Jobs can define the quality of life of a nation, and with a more educated citizenry, greater opportunities often flourish (Friedman, 2011). According to Holzer and Lerman of The Brookings Institute (2009), 45 percent of the jobs over the next decade will be in middle-skilled occupations requiring more than a high school diploma but less than a bachelor's degree. The concern is that there will not be an adequate supply of qualified individuals for the technical employment demand of the future. Carnevale of the Georgetown University Center on Education and the Workforce (2010) echoed these findings and reported that by 2018, the United States will face major shortages of workers with recognized postsecondary credentials, including shortages of 3,000,000 workers with 4-year degrees and 4,700,000 workers with postsecondary education less than a bachelor's degree. In essence, there may be a knowledge and skills gap in the very near future.

Apprenticeship, and its associated model of development, is a proven methodology for obtaining a higher education while advancing relevant skills needed in high-demand industries (Lerman, 2012). It combines a complementary blend of college-level academic courses, career theory (training), and relevant work experience in the form of cooperative or full-time employment within an occupational area (Cantor, 1997; Lerman, 2012). Unique to this model of development is a guiding structure that encourages an identified set of legitimate performance experiences moving from simple to complex; modeling, scaffolding and fading instruction; and articulation and reflection

(Collins, Brown, & Holum, 1991; Fuller & Unwin, 2004; Lave & Wenger, 1991; Rosenheck, 2013). Filliettaz (2010) explained that supervisors often act as gatekeepers to the community, and they are significant contributors in apprentice success. In apprenticeships of the past, a master craftsperson meticulously supervised the work-related component and mentored a small group of young apprentices into work and life while articulating context from the apprentice's education and training (Barlow, 1974; Brewer, 2011). This model of development served the United States labor market well and helped the country secure its high status among the global community. Today, however, the master craftsperson approach and its one-on-one mentorship interactions have become expensive and impractical to employ (Brewer, 2009). Apprentices typically serve the work-related component alone at the job site under the direction of a front-line foreman as a supervisor who is often overburdened and ill-prepared to focus on the contextual articulation of the apprentice's education and training (Ellinger, 2013; Fuller & Unwin, 2009). As apprenticeships in the United States continue to evolve regarding internal components, it is not known if and to what extent the type of supervision provided to apprentices during the work-related component of a program either enhances or exacerbates the apprenticeship experience.

According to Lerman (2009b), individual employers typically sponsor and pay for apprenticeship programs and often need to weigh the expenditures with the drawbacks in their decision to support their efforts. This includes whether to offer an apprenticeship in general, but also the extensiveness of grouping apprentices together under a supervisor that is specially trained and educated in providing coaching and mentoring, all of which are overhead costs to the sponsor. The drawbacks include losing apprentices to other

employers either midway through or soon after graduating and the expenses associated with hiring and training supervisors to guide and mentor apprentices into the community of the occupation. From the sponsor's perspective, although some of the costs of a program are recouped while the apprentice serves the work-related component as a productive employee, most of the investment is returned when the apprentice completes the program and continues service with the employer, adding value through enhanced and innovative productivity. The longer the graduate stays with the sponsoring company, the greater the return on investment to the sponsor. The return becomes even greater when the graduate is promoted into various higher level supporting areas within the sponsoring company, thereby alleviating the need for externally hiring and training new employees at a higher salary rate.

To aid policymakers, program developers, and sponsors of apprenticeship programs in selecting future training models, this study seeks to determine if the type of supervision provided during an apprentice's work experience – one supervised by master craft instructors utilizing coaching and mentoring attributes, one supervised by frontline foremen utilizing traditional supervisory attributes, or a combination of the two – enhances apprentice training. This study is significant because of the need for a more educated and prepared workforce. By identifying ways to better prepare workforce enterers through apprenticeship, the United States may more easily meet its 21st century challenges of competing with the global community. Education and industry can benefit by having empirical data supporting partnerships that yield favorable results regarding completion, employability, and career advancement. Companies, the sponsors and financial bearers of apprenticeship programs, will benefit from this study by realizing

better ways of conducting internal training programs. Finally, by surfacing successful models, other potential sponsors, those not yet offering programs, will be able to make more informed decisions regarding initiating an apprenticeship or an apprenticeship-like program in their organizations.

Problem Statement

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program.

Research Questions

To guide this study, the following research questions were developed.

RQ_1: Is there a difference in program completion between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_2: Is there a difference in academic Grade Point Average (GPA) upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_3: Is there a difference in work-related GPA upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_4: Is there a difference in company longevity within five years of completing the program between apprentices who were supervised by master craft

instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_5: Is there a difference in company promotion within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

Background and Significance

Globalization and its accompanying economic impacts caused by such advances in automation and information technology pose major challenges for the United States. To remain competitive in the global community, companies need to consider global economic and thoughtful production strategies for their future (Ellinger, Ellinger, Bachrach, Wang, & Elmadag, 2011). According to the Association of Career and Technical Education (2007), the competitiveness of the United States economy is heavily debated nationally, with federal, state, and local leaders examining ways for the country to regain its lead in innovation as other countries do the same. The National Academies (2010) strongly suggested that the United States focus on high-quality, knowledge-intensive jobs and innovative enterprises driving the economy to maintain our standard of living. As other nations have developed a competitive advantage with a low-wage workforce, the Academies strongly advised optimizing knowledge-based resources. The bottom line is that United States companies have to run faster, work harder, and produce better results than they ever did in the past – and the way to do this is with a highly skilled and knowledgeable workforce.

Jobs define the quality of life of a nation, and with a more educated citizenry, greater opportunities often flourish (Friedman, 2011; International Economic Development Council, 2010). Producing a citizenry that is workforce-ready is a major objective of our education system in the United States (National Panel, 2002; Symonds, 2011). As described by Symonds (2011), this preparation includes "preparing all young people with a solid enough foundation of literacy, numeracy, and thinking skills for responsible citizenship, career development, and lifelong learning" (p. 1). According to Kacirek (2009), career and technical education (CTE) is heavily focused on workforce readiness, both at the secondary and post-secondary levels. Responding to critics from industry and government of a lack of preparedness, CTE is heavily focused on closing the knowledge gap and preparing students for careers and further education. Educational institutions frequently partner with business and industry, providing greater relevancy to the student's education. To help provide relevancy, apprenticeship is an educational strategy that is slowly gaining in popularity (Halpern, 2009).

Apprentice Schools

Modern apprentice schools in the United States typically reside at the post-secondary level and provide a complementary blend of college-level academic courses and career theory (training) coupled with relevant work experiences in the form of cooperative or full-time employment in an occupational area (Cantor, 1997; Lerman, 2010, 2012). Figure 1 depicts the integration of the three areas that work together and complement each other in ways that develop and benefit both employee and employer. Although many apprenticeships exist in traditional trades such as construction and manufacturing, newer industries such as biotechnology, geospatial technology, health

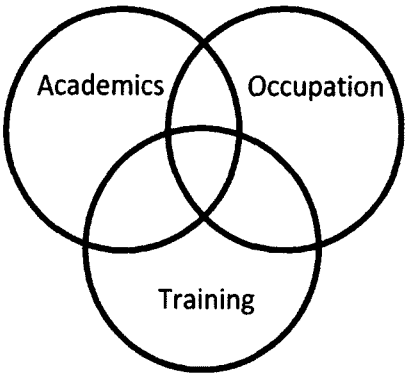

Figure 1. Apprenticeship Model of Development

care, information technology, and engineering are becoming popular (Gaudet, 2010; Gonzalez, 2010; Torpey, 2013). Apprenticeships offer participants a paycheck while taking courses and being trained for an occupation. Lave and Wenger (1991) expressed that even greater benefits occur as learners participate in authentic occupations where legitimate situations arise requiring real problem solving. When this happens the apprentice gains a contextual understanding of the education and training components of the apprenticeship. Lerman (2012) explained partnerships between community colleges and industry as characterizing a significant portion of the United States apprenticeship model of learning. He added that research in apprenticeship is sparse at best and recommended qualitative and quantitative studies to provide important policy-relevant information.

Recent support for community college and business partnerships was voiced by Louis Soares, Director of Postsecondary Education at the Center for American Progress. In his paper developed for the White House Summit on Community Colleges, Soares (2011) stated that "community colleges have the scale and pedagogical diversity to improve post-secondary attainment for many Americans" (p. 3). He believed that when community colleges and businesses partner, better results occur in terms of relevant

knowledge, skills, and degree attainment. In an attempt to spotlight the apprenticeship model of developing a prepared workforce, Soares made reference to The Apprentice School of Shipbuilding in Newport News, Virginia, where the company trains and educates employees for careers in shipbuilding. It is not known, however, what attributes about this school contribute to longitudinal benefits for the company or the degree to which it makes economic sense to make such investments.

Theoretical Concept

The theoretical framework supporting the inquiry of this research is described by Lave and Wenger (1991) as legitimate peripheral participation. Drawing on Albert Bandura's interpretation of social learning theory, Lave and Wenger (1991) described learning to be situational. They expressed that authentic learning occurs more as individuals join legitimate communities of practice. Having to perform legitimately in occupational situations, learning becomes constructive and personal discoveries motivate the learner to seek even more knowledge to become more legitimate within the community. Lave and Wenger argued that real communities provide legitimate feedback and offer the strongest potential in driving learner motivation and understanding. As the learner grows and develops within the community, he or she gains self-worth and a sense of legitimacy within the community, ultimately affecting self-efficacy and the desire to advance in and throughout the community. More specifically, the theory contends that when newcomers (apprentices, in this case) are legitimately welcomed into a community of practice and become acquainted with the tasks, vocabulary, and organizing principles of the community, they will move further into the community, seeking additional knowledge for greater legitimacy, and eventually become full participants in the

community. Membership in a workplace community is important and is often determined by the forms of participation to which newcomers have access. The most influential figure overseeing and allowing participation in the workplace community is the supervisor (Lave & Wenger, 1991).

Fuller and Unwin (2008, 2009) investigated apprenticeships and revealed the importance of focusing on the internal components delivered in a program. They described wide variations among existing apprenticeship programs and categorized programs as being either expansive or restrictive in nature regarding experiences apprentices encounter. Important characteristics of expansive programs afforded the learner high-quality opportunities to discover solutions to situations that normally occur at the worksite. With emphasis on discovery, the apprentice operating in an expansive program obtained a deep understanding of the business and was given the opportunity to reflect and articulate the information learned. Their research indicated that this most often occurred when apprentices had access to supervisors that operated with coaching qualities and other more knowledgeable peers as teachers. Fuller and Unwin (1998) found the development process hampered in today's apprenticeship programs because apprentices often "find themselves as the only learner in the workplace and . . . do not have access to peer group interaction" (p. 166). Their finding suggested that apprentices benefited from being around coaching style supervisors and a guiding structure that recognized apprentices as learners/workers in lieu of just workers – what Fuller and Unwin described as expansive characteristics.

Filliettaz (2010) explained that frontline supervisors are often the gatekeepers of the community apprentices join. In a case study based on empirical material that

documented the interactions between first-year apprentices and their supervisor, Filliettaz illustrated the importance of the linguistic signals of legitimacy from the supervisor to the apprentice in the early days of work. This research showed that when apprentices had the opportunity to interact with a supervisor who focused on the apprentice's development (utilizing coaching and mentoring attributes), they were more motivated, gained greater understanding, and were more likely to complete their program. Conversely, newcomers who were provided supervisors not focused on human development and were mainly concerned with daily productivity were less motivated and less likely to be successful. Fuller and Unwin's (1998) research indicated that when apprentices work among other learners/workers, the supervision tends to treat them as such – learners/workers. It is understood that these workers are new and will be making small errors in the transition into the community. However, as apprentices often serve their work-related component among general employees that are not apprentices, the supervision often expects the apprentice to be just that, a productive employee like the others in the crew. These two forms of supervision set the tone in linguistic signals sent from the supervisor to the apprentice.

Focus of This Study

In apprenticeships of the past, a master craftsperson meticulously supervised the work-related component and mentored the young apprentice into work and life while articulating context from the apprentice's education and training (Barlow, 1974; Brewer, 2011). With this training method, the master craftsperson was the more knowledgeable other and enhanced the legitimate peripheral participation process. The master craftsperson was a supervisor; however he or she also acted as a mentor to the apprentice

and understood that the apprentice was a work in process. Today, because of the rapid growth of technology and changing needs of the workplace, the master craftsperson has often become too expensive and impractical to employ. Present-day apprentices typically serve the work-related component under the direction of a normal front-line supervisor in a particular career field or community of practice (Ellinger, 2013; Gamble, 2001). According to Filliettaz (2010), frontline supervisors are the gatekeepers to the occupational community and often treat or expect the newcomer to be a productive contributor within the community. The voice from the normal frontline supervisor is often harsh to the newcomer.

Mosley (2011) stated that companies often commit two errors when selecting and hiring frontline supervisors. First, they automatically select the best technician, those who have had a proven track record for performance; and second, they inadequately prepare the new supervisor for the very different requirements he or she is about to encounter, especially for newcomers to the occupation. Cordero, Farris, and DiThomasco (2004) found that it was more beneficial and stimulating for supervisors to possess people and administrative skills rather than technical know-how. Mosley (2011) drew a distinction between the traditional supervision practices of managing through fear and "my way or the highway styles" (p. 22), and a more emerging supportive role mirroring that of a facilitator and coach – attributes similar to a master craftsperson acting as a supervisor.

Reed (2012) with Mathematica Policy Research found that individuals participating in a United States apprenticeship had substantially higher earnings than those not participating. This research also found a positive social benefit resulting from

the meager amount of government funds allocated to support apprenticeship programs compared to the tax revenue created by employees and employers participating and sponsoring apprenticeship programs. Mathematica's study recommended further investigations into the benefits to employers and the investments they make. Like Reed's study, most studies on apprenticeship simply address the value of the institution and its model of learning to either the learner or state and local governments regarding the revenue generated when participants gain economically. Little research investigates the internal elements contributing to the experiences or the benefits to a sponsoring company, the financial bearers of the apprenticeship program.

This research seeks to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. As existing research has shown the positive value of apprenticeship on relevant post-secondary skill attainment, this study addressed the benefits to the individual and sponsor of apprenticeship programs. It analyzed apprentice success in program completion, academic GPA, and work-related GPA; and sponsor success by employee longevity and promotion within a sponsoring company between those apprentices provided master craft instructors, frontline foremen, or a combination of the two as a supervisor mentoring the apprentice into the occupation. Furthering research in this area will provide data for government, business, and industry to aid in developing future apprenticeships or training programs.

Limitations

Throughout the acquisition and analysis of the data for this study, the following limitations were identified.

1. Generalizability: The geographic scope of this study was limited to apprentices that entered an apprenticeship school during the years 2002, 2003, and 2004. Although the school is a private post-secondary school interacting with other local colleges, the results of this study cannot be generalized to other two- or four-year institutions of higher education or other sponsors of apprenticeship programs. Therefore, the results obtained only represent the success of the students and sponsor from this school.
2. Confounding variables: This study only considered the type of supervision and the differences in the outcome variables (program completion, academic and work-related GPA, company longevity, and promotion). It examined apprentices serving in a variety of occupational areas and did not attempt to separate them by those occupations within the groups. As a result, the conclusions may only suggest supervision as a possible contributing factor to differences found.
3. Broadly measuring success: Another limitation of this study is in broadly measuring success. The variables used in this study (program completion, academic and work-related GPA, company longevity, and promotion) probably only begin to reflect the complexities of apprentice and sponsor success in the workforce.
4. Group similarities: A final limitation of this study is the level of certainty that the three groups under investigation were alike. As this is a case study using an ex post facto research design to investigate differences between three groups, random group assignment was not possible. Ary et al. (2006)

articulated weakness in ex post facto research design as the researcher can never be certain that groups were exactly alike before the treatment occurred. Although this study is non-experimental and does not randomly assign or manipulate variables, it should be noted that "not all important questions in education can be answered with experimental research" (p. 355).

Assumptions

The following assumptions were made and considered true throughout the acquisition and analysis of the data for this study:

1. All apprentices received the same level of academic instruction and rigor regardless of instructor. Although all apprentices take the same academic curriculum of college level coursework, they may have different academic instructors. The study assumes the independent measure of academic GPA is accurately reflected regardless of having different instructors.
2. All apprentices received the same level of work-related evaluation and measured equally regardless of individual type of supervision. While serving their work-related component at the job-site, each apprentice is evaluated and measured monthly using the Work Related Evaluation Form (see Appendix A). Although instruction is provided in using the scorecard, inconsistency could still exist across evaluators. The study assumes independent measure of work-related GPA is accurately reflected regardless of having different evaluators.
3. All apprentices entering the program have similar motivational and persistence characteristics. This study does not attempt to account for any

prior social, cultural, or environmental factors that might affect an apprentice's performance.

4. Program completion will represent when an apprentice satisfies all sponsoring company requirements for completion of the program, in this case 8000 hours of training and education.
5. Promotion status denotes moving into a middle-skilled occupation as determined by the sponsoring company when a subject moves from an hourly to a salaried position.
6. The number of promotions will be classified based on the number of job family increases as determined by the sponsoring company. Lateral organizational changes between job families will not count as a promotion.

Procedures

This study was a non-experimental ex post facto case study investigation of program success through the type of supervision given during the work-related component of an apprenticeship. It tracked students who enrolled in a post-secondary apprentice school during the years 2002, 2003, and 2004 ($N = 877$) for five years after graduating from the program. It employed a convenient nonrandomized sample comparison designed to determine if apprentice and company sponsor success was enhanced by the type of supervision given during the work-related component of an apprenticeship program.

The school operates under an apprenticeship style of teaching, combining education and training while working in an occupation, and it maintains an enrollment of approximately 850 students throughout the four-year program. All students are required

to perform eight work-related components, frequently called on-the-job rotations, to satisfy apprenticeship requirements and learn technical skills and abilities. Depending on the sponsoring company's needs, students rotate through various phases of the manufacturing process (e.g., heavy metal fabrication, electrical motors shop, modular outfitting), while they gain applicable industry certifications.

The school employs approximately 60 educationally trained master craft instructors with the intent to supervise apprentices serving each of their work-related components at the work-site. However, because of fluctuations in workload, needs of certain apprentice competencies, and a lack of master craft instructors, some apprentices are actually loaned-out and supervised by a frontline foreman (see Figure 2). A craft

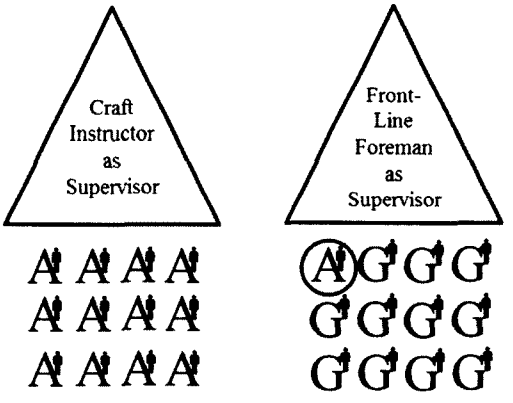

Figure 2. Two Possible Methods of Apprentice Supervision

instructor operates as any other frontline foreman supervising employees at the worksite; however, instead of general employees, he or she will supervise approximately 12 apprentice employees serving their work-related component at the worksite. An apprentice graduate him or herself, the master craft instructor acts as a master craftsperson and mentors the apprentice into work and life while articulating the needed

context from the apprentice's education and training. Unlike the frontline foreman, the master craft instructor reports and is given specific direction by the school and has dual responsibilities: (a) meeting production requirements like other frontline foreman, and (b) developing the apprentice into a full participant of the community. A frontline foreman supervises approximately 12 general labor employees. Uniquely in this program, every effort is made to place apprentices with master craft instructors. However, due to production needs apprentices are sometimes randomly placed with a frontline foreman and works among the general labor force. This study compared apprentices in three groups: those who were supervised entirely by master craft instructors, those supervised entirely by frontline foremen, and those who were supervised under a combination of the two methods.

The hiring processes and job descriptions for the master craft instructor as supervisor and frontline foreman as a supervisor are very different. Master craft instructors are hired by the school and have the same supervisory duties of a frontline foreman, but with additional coaching, mentoring, and human development responsibilities and expectations. As Filliettaz (2010) illustrated, the interactions between apprentices and their supervisor is critical. In this study, apprentices were conveniently categorized into one of the three groups depending on the method of supervision during their rotations.

The study analyzed the five research questions as applied to apprentices who were admitted to the program in 2002, 2003, and 2004. Investigating the students who entered the program in these years is relevant because (a) the school began keeping relevant data electronically at the beginning of 2002, (b) three years of admittance data provides a large

enough population to analyze and draw conclusions, and (c) ending before 2005 allows an adequate number of years after completing the program to measure company longevity and employee promotion. As this research was conducted ex post facto, the researcher collected data from the school's admissions manager on each apprentice's pre-enrollment characteristics including high school GPA, previous college GPA, and previous work-related experience for all students enrolled during 2002, 2003, and 2004. These data were used for group comparisons addressing the study's internal validity. Data were next collected from the school's registrar on each student's program completion, academic GPA, and work-related GPA. Data on company longevity and promotion were then collected from the manager of student services. After entering the data into a database, the researcher used a Chi-square test to analyze program completion (RQ_1) between the three groups. Analysis of Variance (ANOVA) was then used to analyze differences in academic GPA (RQ_2), and work-related GPA (RQ_3). Company longevity (RQ_4) was analyzed in two ways: the status (still employed by the sponsoring company or not); and if not with the company, the length of time before leaving the company. Significant difference in longevity status was determined by a chi-square test and longevity length of employment used an ANOVA. Company promotion (RQ_5) was analyzed in three ways: promotion status (promoted or not); if promoted, the time at which the promotion occurred; and if promoted, the number of promotions within five years of completing the program. A chi-square test was used to determine if a significant difference existed in promotion status. Promotion timing and number of promotions used an ANOVA test to determine significant differences.

Definition of Terms

For the purpose of this study, the following definitions were used:

1. Academic Grade Point Average (GPA): the cumulative grade point average of all academic classes taken in the basic educational curriculum.
2. Company longevity: the number of years the apprentice graduate was with the company after completing the apprenticeship.
3. Company promotion: when an employee moves from a frontline worker to a middle-skill salaried occupation.
4. Master craft instructor: supervises apprentices while serving the work-related component of an apprenticeship. He or she is a graduate of the program and reports to the apprenticeship program's administration for management and direction.
5. Expansive apprenticeship: apprenticeship programs that offer internal components that provide the learner the time to study deeply, see the business from all angles, and the opportunity to reflect on what was being learned. These programs help produce employees who can contribute to various areas within an organization and are focused on a worthwhile long-term career (Fuller & Unwin, 2008).
6. Master craftsperson: a more knowledgeable person acting as a mentor providing direct instruction to a learner by passing on the skills and knowledge of a particular occupation (Brewer, 2011).
7. Frontline foreman: supervises approximately 12 general employees, but at times can have an apprentice on-loan to the work crew.

8. Program completion: when an apprentice completes his or her apprenticeship and graduates.
9. Restrictive apprenticeship: only offers internal components that intend to produce productive workers fast. These programs are not concerned with providing apprentice experiences that build long-term growth within a worthwhile career. The intent is to get new workers to perform lower level work efficiently and effectively (Fuller & Unwin, 2008).
10. Work-related GPA: the cumulative 4-year grade point average of an apprentice's work performance.

Summary and Overview

Current research on apprenticeship often focuses on educational or training pedagogy and not on what happens when the apprentice is on the job. Lacking in the research is attention to the company practices that teach, guide, motivate, and care for apprentices during the critical beginning years when entering the workplace and the effects this has on apprentice and sponsor success. Chapter I introduced apprenticeship as an effective model for developing a workforce capable of competing globally. In the United States, apprenticeship is funded almost entirely by private companies that choose to sponsor such programs. However, many companies are reluctant to fully invest in the internal components that enhance their programs. Supervision was identified as one of the most important variables an apprentice encounters while transitioning into a new work community. The problem of this study was to determine if apprentice and company sponsor success is enhanced by the type of supervision given during the work-related component of an apprenticeship program. Five research questions were identified

regarding the supervision being offered while on the job relating to academic GPA, work-related GPA, program completion, five-year post-graduation company retention, and five-year post-graduation company promotions.

Chapter II provides a review of the literature focusing on apprenticeship. It includes a historical perspective of career and technical education and apprenticeship in the United States. Previous research on apprenticeship is identified and the type of supervision given at the worksite is explained as a possible factor contributing to apprentice success.

Chapter III presents the methodology and procedures used to collect and analyze the data to determine if the apprenticeship experience is enhanced by the type of supervision given during the work-related component of a program. Additionally, this chapter explains the research population, variables, and design.

Chapter IV reports the findings of the study, including the statistical analysis used to answer the five research questions regarding academic GPA, work-related GPA, program completion, five-year post-graduation company retention, and five-year post-graduation company promotions. Tables with corresponding text are used to support the findings.

Chapter V summarizes all information regarding supervision type in this dissertation. The effects of supervision are discussed in relationship to each of the research questions, and conclusions and recommendations are outlined based on the results of the study.

CHAPTER II

REVIEW OF LITERATURE

This review of literature provides the foundation for this study. It begins with an examination of national studies on developing a United States workforce for the 21st century. Identifying the need for a better prepared citizenry, career and technical education (CTE) and apprenticeship are historically reviewed, and important legislation is identified that contributed to the growth of our nation and a prepared workforce. Apprenticeship is then analyzed showing how beneficial this model is to learning and ultimately how it benefits in preparing a workforce. Next, previous research within apprenticeship is discussed pinpointing supervision as a contributing variable in success. Legitimate peripheral participation is explained, resulting in the need for this study. The review of literature concludes with a summary transitioning into the methodology that will guide this study.

Preparing a Citizenry for the 21st Century

Young adults today are expected to graduate from high school and go to college, obtaining at least some post-secondary credentialing (Halpern, 2009). According to the National Academies (2010), advisors to the nation on science, engineering, and medicine, it is a matter of ensuring the nation's position as a prosperous member of the global community in the 21st century. Jobs define the quality of life of a nation, and with a more educated citizenry, greater opportunities flourish. After all, jobs provide the tax revenue from individual and business earnings that allow expected benefits from government, i.e., national security, physical infrastructure, education, and now health care. Quality job growth has much to do with entrepreneurialism, advancements, and

innovations, and the single best way for society to create these welcoming conditions is through its education system (Carnevale, 2003; National Governors Association, 2007).

According to the Association of American Colleges and Universities (National Panel, 2002), higher education should provide practical liberal education that prepares students for life, work, and civic participation. *Pathways to Prosperity* (Symonds, 2011), a report by the Harvard Graduate School of Education, similarly indicates that education should prepare all young people with a solid enough foundation for responsible citizenship, career development, and lifelong learning. According to Symonds, with the great push for more students to obtain a higher level of education, what seems to be emerging from the workforce are even greater disappointing outcomes. Casner-Lotto (2009) conducted survey research on the level of preparedness of new hires from companies throughout the United States. This was a descriptive study using a survey of 217 United States employers to examine practices on training newly hired graduates at three educational levels: high schools, two-year colleges, and four-year colleges. The results were disappointing and showed the need for education to rethink how or for what it is preparing students. The report found that the more successful developmental programs conducted apprenticeship-style offerings to new employees. Spotlighting the few successful programs from the study, Casner-Lotto specifically recommended more partnerships between industry and community colleges utilizing the apprenticeship components found in their study.

Halpern (2009) performed ethnographic studies on youth apprenticeships and concluded that most students obtain education and training secluded in an academic arena for too long before ever experiencing real practice and are only given decontextualized

skills at best. According to Rojewski (2002), many teachers work creatively to provide relevancy, realness, and meaning to the curriculum. However, many researchers identify critical thinking and problem-solving skills as the primary need and argue the current academic model provides little value (Carnevale, 2011; Halpern, 2009; Lerman, 2010). The *Pathways to Prosperity* study (Symonds, 2011) pinpoints a deep-rooted cause of the lack of learning and student attrition by suggesting that too many students do not have a clear or transparent connection between what they are studying and tangible opportunities in the labor market. A consistent theme among the *Pathways* researchers indicated a need for a higher level of access to an occupation beyond simply learning in the classroom. They recommended that learners need to be practicing legitimately within a career or at least a pathway to a career.

Today, companies realize how important it is to focus on partnerships between industry and community colleges in developing workforce readiness skills (Casner-Lotto, 2009). Many authors have researched and concluded advocating for an apprenticeship model in providing a more grounded secondary and postsecondary pathway (Cantor, 1997; Halpern, 2009; Hamilton, 1990). For the 2011 White House Summit on Community Colleges, Soares (2010) wrote that partnerships between businesses and community colleges stand the best chance to impact learning and workforce development. She explained that success comes with the collaboration between community colleges and businesses where students acquire relevant skills and expertise that are needed in the local community. In her paper, Soars made reference to apprenticeship and how this model is an ideal partnership that benefits students, businesses, and community colleges.

Historical Perspective

Career and technical education and apprenticeship are separate entities that are guided and directed from two completely different governmental agencies. Today, the funding for CTE comes from Perkins legislation and is primarily streamed along with other sources through the Federal and state departments of education for secondary and post-secondary education (Brustein, 2006). Apprenticeship is primarily funded privately by the independent organizations or businesses that choose to implement such programs. Oversight for registered apprenticeship programs is provided by the U.S. Department of Labor (U.S. Federal Register, 2008). It is helpful, however, to see a historical perspective and the pathways each have taken through history in understanding their relationship.

Career and Technical Education

Prior to organized schooling for the masses where learners congregate to learn inside a classroom, humans typically learned to live and work through imitation and trial and error at the workplace. Families typically provided for needs internally and were mostly self-sustaining. According to Keller (1948), early teaching consisted of mothers and fathers passing on survival skills to their children. This often included building shelters, hunting, and preparing food. Keller identified the first form of education as being vocational, and cited 7th century monks as formally teaching the skills needed to conduct research and live productive lives within the monastery. As societies grew, the need to prepare individuals to meet societal demands grew and apprenticeships became the primary way of passing on knowledge and skills.

In Colonial America, before the United States was formed, apprenticeship was the early form of vocational education (Barlow, 1974; Brewer et al., 2000; Keller, 1948).

According to Barlow (1974) "apprenticeships provided for five basic elements: a) food, clothing, and shelter; b) learning to read and write, c) religious instruction; d) instruction in the trade, and e) secrets of the trade (related science and mathematics)" (p. 16). According to Miller (1993), in 1642, the Massachusetts Bay Colony successfully passed a "comprehensive apprenticeship law" (p. 4) that required families and apprenticeship masters to ensure that children were learning a specific trade and the colony's laws and religious views. The law further defined the importance of combining technical skills with general education, ensuring that all students become productive members of society. Hogg (1999) indicated that formal education remained a minor element in American life prior to and during the 18th century. Although schools existed during these times, apprenticeship remained the primary way to prepare individuals for a productive career.

The 19th century saw the shift from an agrarian to an industrial society, and along with this came a different way of preparing individuals for work. The Industrial Revolution marked a time of increased factories, machines, technologies, and efficiencies that required knowledge and skills to be passed on in a more efficient way. Barlow (1974) indicated that during this time period, schools and training programs began to replace the apprenticeship style of learning. Common schools teaching traditional subjects began that included practical arts in the curriculum, and trade schools became prevalent throughout the country. The nation, now with a more defined federal government, realized the need for legislation to provide adequate training and preparation for a competent workforce. As noted by Hogg (1999), the Morrill Land Grant Act was passed by the federal government in 1862. This act gave public land grants to states to establish colleges for the benefit of agriculture and mechanical arts. Brewer (2011)

identified the Morrill Act as the first legislation passed by the national government to support vocational education. In 1887, the Hatch Act was passed which provided funding to states to develop experimental stations for agriculture, assisting farmers in upgrading the methods used in farming.

In the 20th century, it became clear that the nation needed to focus on education. According to Barlow (1976), secondary education existed, but many chose not to remain in school as it was not mandatory. Only the elite completed post-secondary education, and the majority of society was not getting the skills needed to be successful in the industrial work environment. The National Society for the Promotion of Industrial Education was first formed in 1906 to promote vocational education. Eventually becoming the American Vocational Association (AVA), under the leadership of Charles Prosser, this organization was responsible for much of the legislation during the beginning of the 20th century. Brewer (2011) reported that the boom and bust characteristics brought by World Wars I and II had huge impacts on vocational education, and the American people and their government realized the importance in funding programs to increase the productivity of the nation's citizens. There was legislation passed by Congress; the most impactful being the Smith-Hughes Act of 1917, also known as the Vocational Education Act of 1917. This act provided funding to the states for developing secondary vocational programs in agriculture, trade and industry, and home economics. As noted by Brewer (2011), several acts followed that expanded and maintained funding streams for vocational programs at the secondary level, including the George-Reed Act of 1929, the George-Ellzey Act of 1934, the George-Deen Act of 1936, and the George-Barden Act of 1946. Covering a slightly different population, two other

acts were passed: the Fess-Kenyon Act of 1920 (providing vocational rehabilitation of industrial-disabled individuals) and the Servicemen's Readjustment Act of 1944 (known today as the G.I. Bill, helping soldiers returning from war).

The second half of the 20th century continued to see wars. Brewer (2011) identified the Korean and Vietnam Wars and the lingering Cold War with Russia as causing the nation to focus on producing war materials and filling the employment gaps as it had in the first half of the century. Retraining was still needed for those returning from war. In addition, as the Cold War escalated and technological advances continued to grow, workers needed to have a higher level of preparation, resulting in more demands on vocational education. No longer was it adequate to simply teach specific skills, general education and career development became key aspects of vocational education. As a result of the wars, the need to keep domestic production up, and the huge advancements in technology, the federal government continued its focus on vocational education legislation. Sarkees-Wircenski and Wircenski (1999) identified such acts as the Manpower Development and Training Act of 1962 (training for adult unemployed workers), the Vocational Education Act of 1963 (supplementing the original Smith-Hughes Act by now including graduates or people who dropped out of high school, as well as disadvantaged and disabled populations), and the Economic Opportunity Act of 1964 (helping those living in poverty-stricken areas), in response to the huge changes in workforce needs. They also identified the Elementary and Secondary Education Act of 1965 (calling for an increase in quality of vocational equipment, classrooms, and teachers), and the Education Amendments of 1972, 1974, and 1976 (mainly dealing with counseling, career education, and program evaluation). Responding to the continued

growing needs of the workforce, four Carl D. Perkins Acts emerged and largely continue the vocational focus of the nation today. Brewer (2011) noted that Perkins I passed in 1984 and focused on regaining the credibility of vocational education to improve workforce productivity and address the needs of underserved students. Passed in 1990, Perkins II improved vocational education and expanded academic components in the curriculum to meet the needs of increasing technology. Perkins III was passed in 1998, and it strengthened Perkins I and II, calling for strong pairing of academic and vocational and technical components for success in both secondary and post-secondary programs. Finally, Perkins IV, passed in 2006, is the current legislation funding vocational education; it is officially titled the Carl D. Perkins Career and Technical Education Improvement Act of 2006.

The Perkins Act of 2006 was the first legislation to officially change the name of vocational education to career and technical education (Threeton, 2007). According to Brustein (2006), career and technical education is focused on accountability, academic and technical integration, connections between secondary and post-secondary education, and links to business and industry. It provides opportunities for all students through 16 career clusters and 79 programs of study. Modern CTE programs provide knowledge and skills that are suitable in all careers and enhance general education. Today CTE prepares youth and adults for a wide range of careers and strengthens their ability to further educational opportunities. According to the Association for Career and Technical Education (ACTE, 2006), these careers may require differing levels of education that often include industry-recognized credentials, post-secondary certificates, and two- and four-year degrees.

Throughout our nation's history, vocational education has changed and progressed to meet pressing demands. Beginning informally even before the nation was formed, it served to ensure that certain operations existed to aid in communal living among the colonies. During wars here and abroad, it helped provide the skills needed to design and build the machinery for war as well as the training and retraining for those individuals returning from war. As our country developed into the world power it is today, vocational education has helped secondary and post-secondary students transition efficiently into the workplace of the 21st century.

Apprenticeship

Apprenticeships existed long before the United States was ever formed and are among the earliest forms of vocational education (Barlow, 1974; Brewer et al., 2000; Jacoby, 1996; Keller, 1947). Cantor (1997) identified the traditional apprenticeship model of passing on skills and knowledge by way of a master craftsperson as early as 2100 B.C. in the Babylonian Code of Hammurabi. He explained that serving an apprenticeship was quite beneficial for the learner, as having one often assured a position of honor within the community. Barlow (1974) explained that early apprenticeships were an effort to ensure that job functions in a given community were performed efficiently and effectively. He identified the early apprenticeship model as including five basic elements: food, clothing, and shelter; learning to read and write; religious instruction; trade training; and the acquired secrets within a trade or vocation. Brewer (2011) defined early apprenticeship as a form of learning wherein a master craftsperson provided direct instruction to a student or an apprentice by passing on the skills and knowledge of the particular occupation.

Prior to 1911, apprenticeships in the United States were developed and operated unregulated and dated back to the colonial period. Brewer (2011) cited the Massachusetts Bay Colony as passing a law in 1642 ensuring that families and master craftspeople taught not only specific trades, but also the colony's laws and religious views. The apprenticeship law stressed the importance of providing both technical skills and general education, striving for all students to become productive members of society. Cantor (1997) recognized the U.S. Navy apprenticeship programs as being the oldest programs still operating in the public sector. The Navy's first apprentice was enrolled in 1810 at Washington Naval Yard, and the first formal apprentice school was formed at Mare Island Navy Yard in 1858. Cantor further noted that the first apprenticeship law was passed in 1911 in Wisconsin, providing safeguards for both the employee and employer. This law led the way for the National Apprenticeship Act of 1937, commonly referred to as the Fitzgerald Act. According to the U.S. Department of Labor (n.d), this federal act formulated and promoted "labor standards necessary to safeguard the welfare of apprentices, to extend the application of such standards by encouraging the inclusion thereof in contracts of apprenticeship, to cooperate with State agencies engaged in the formation and promotion of standards of apprenticeship" (para. 4).

Most of the literature indicates that apprenticeship became less popular and almost disappeared after the Industrial Revolution. Barlow (1974) cited that increases in technology and efficiency in many occupations contributed to faster production and fewer needs for the master craftsperson, so apprenticeships became less viable. From an educational perspective, by the beginning of the 20th century, two movements prevailed in the United States: the practical arts movement, stressing general education including

basic life skills, and the trade school movement, formally teaching a trade. As the debate grew over how much general education should be included with vocational education, one thing was certain: The belief held that workforce skills could be taught in a classroom setting, and apprenticeships, the idea of actually being employed in an occupation, became even less popular.

Throughout the 20th century, multiple U.S. laws were passed aimed at developing a more prepared citizenry and apprenticeships operated almost silently alongside vocational education. Hogge (1999) explained that the Smith-Hughes Act of 1917 and the George-Barden Act of 1946 provided funding to states with approved vocational education plans. As apprenticeship primarily operated through employers, it was largely ignored as part of educational efforts. However, Cantor (1997) described the Carl D. Perkins Act of 1990 as providing a framework for reshaping post-secondary education and portions of funding specifically for apprenticeship training.

Although legislation continues to provide funding for preparing a workforce for the 21st century, only a small fraction – less than $30 million - is streamed to apprenticeship (Lerman, 2012). While apprenticeships still exist, perceptions about them have changed significantly. According to Halpern (2009), young adults have a greater expectation placed upon them to graduate from high school and go to traditional college. He stated while many other developed countries, such as Australia, Germany, Great Britain, and Switzerland, have dual systems for high school students that provided general education and specific training in a career pathway (such as youth apprenticeships), the United States has a more common high school experience for all. The high school curriculum is designed to either prepare youth for college (through an

academic track) or work (through a vocational track). The vocational track has never been able to overcome the stigma of being known as a second-tier, remedial track for students deemed less intelligent and non-college bound. As a result, most students (and their parents) push for the academic track – seemingly bound for college. Unfortunately, many students do not complete college and thus are ill prepared for the workforce (Symonds, 2011).

Apprenticeship as a Model of Development

Preparing our citizens to be workforce-ready and productive in the 21st century remains an important goal today. According to Lerman (2009a), current apprentice schools are post-secondary institutions that provide a complementary blend of college level academic courses and career theory (training), coupled with relevant work experiences in the form of cooperative or full-time employment in an occupational area. The three areas work together and complement each other in a way that develops and benefits all involved. Lerman (2009b) stated that apprenticeships are sponsored by employers, sometimes in partnership with labor unions, and use a model of learning that has traditionally provided a transparent connection between learning and tangible opportunities. Oates and Ladd (2011) recognized that while most students are drawn to traditional apprentice trades such as construction and manufacturing, newer industries such as information technology and health care are becoming popular. Apprenticeships offer participants legitimate employment with a paycheck while receiving specialized training and an opportunity to take college courses. In many instances, apprentices are beginning their careers with a desirable employer, allowing that employer to pay for their college, while learning the logistics of the organization. Although the student may take

longer to complete a college degree, in the end, he or she has the education and the experience necessary for real success (Lerman, 2009).

Historically, the apprenticeship model taught apprentices how to act and conduct themselves in public and private (Keller, 1948), and many believe it can still do this today (Halpern, 2009; Hamilton, 1990; Lerman, 2010). According to Keller (1948), the relationship of the master craftsperson to the apprentice was vital. The master craftsperson provided the care and nurturing, often taking on the role of a parent, and taught character, morals, ethics, and integrity, all while mentoring the novice worker into the traditions of the vocation and life. In essence and most importantly, traditional apprenticeships assisted novice workers in transitioning into adulthood (Hamilton, 1990), often with a mentor-mentee relationship between a master craftsperson and an apprentice.

Supervision

As apprenticeship is one of the oldest forms of vocational education, supervision has existed equally as long. Historically, elders supervised as they shared and passed the essential skills and knowledge to the community's youth. Drake (2014) explained that in the past and present, apprentices have always served their work-related component looking over the shoulder of a master practitioner. Whether a master craftsperson in the Renaissance period or a master surgeon in today's medical residency, these master practitioners serve as supervisors. DeFilippo (2013) recognized the etymologies of the two words, citing *super* as being defined as going to a higher level or being superior in quality, and *vision* as meaning having wisdom and insight. However, the traditional meaning of the term – to oversee, monitor, and police – still prevails among individuals

and industry. Drake (2014) cited the definition of a *supervisor* as "an overseer, one who watches over the work of another with responsibility for its quality" (p. 39).

Successful supervisors effectively perform a broad range of duties. Mosley, Mosley, and Pietri (2011) explained that these duties included planning, organizing, staffing, leading, and controlling. Depending on the level of supervision, these functions are performed differently within the organization. For instance, those supervising non-managerial employees in particular may require greater focus on leading and controlling. This level of supervision is often referred to as front-line supervision (Hassan, 2011; Klein & Posey, 1986; Priestland & Hanig, 2005), and it is important in any organization. According to Priestland and Hanig (2005), approximately 75% of a company's employees report to a front-line supervisor. The actions and decisions made by these front-line supervisors have direct impacts on turnover, cost, quality, safety, and innovation. Brewer (2005) studied 17,000 federal agency employees and found that front-line supervisors were important determinants of performance as they were "key figures in building and sustaining an organization's culture that promotes high performance and they influence many factors of agency performance and effectiveness" (p. 519).

Mintzberg (1975) identified the roles of effective supervisors and grouped them into three categories: (a) interpersonal role: figurehead, leader, liaison; (b) informational role: monitor, disseminator, spokesperson; and (c) decision-maker role: entrepreneur, distance handler, resource allocator, negotiator. More recently, Mosley et al. (2011) explained that supervisors at any capacity utilize certain skills in performing the functions within an organization. These skills include: (a) conceptual skills, a mental ability to

identify relationships with various bits of information; (b) human relations skills, working with and successfully interacting with people; (c) administrative skills, adhering to procedures and processing the paperwork properly; and (d) technical skills, understanding the required processes. While all four skills are used extensively, Mosley et al. found none to be more vital to the front-line supervisor than human relation skills. These skills allow the supervisor to understand and interact with everyone in the system (e.g., subordinates, fellow supervisors, upper management, customers, suppliers). Human relations skills enhance the supervisor's leadership ability as they often involve motivating, coaching, and empowering individuals and groups and even relationships among groups.

According to Mosley et al. (2011), most supervisors are hired internally from within the company or organization. In addition, most internal hires to supervisory positions come from within the particular department for which the position is being filled. This rationale is valid because a person that has been working within the organization will already understand the culture, is familiar with the tasks required, and knows the key personnel associated with the position needing filled. From management's standpoint, the risks are lower with someone for whom they have had visibility regarding prior accomplishments. Promoting from within also serves as a reward system to motivate current employees to perform productively. However, as Mosley et al. stated, companies often commit two errors when selecting supervisors. First, they automatically select the best technician, those who have had a proven track record for performance; and second, they inadequately prepare the new supervisor for the very different requirements he or she is about to encounter - especially in the area of

subordinate development. Cordero, Farris, and DiThomasco (2004) studied over 2,000 technical professionals and found that it was more beneficial and stimulating for supervisors to possess people and administrative skills rather than technical know-how. Mosley et al. (2011) stated that current supervision practices have emerged from managing through fear and "my way or the highway..." (p. 22) styles to a more supportive supervisory and mentoring role. More accurate roles of supervisors today mirror those of facilitators and coaches. Table 1 categorizes the differing views regarding the supervisor's job.

Table 1

Traditional vs. Emerging Views of a Supervisor's Job

TRADITIONAL VIEW OF SUPERVISOR'S JOB	EMERGING VIEW OF SUPERVISOR'S JOB
Supervisor-focused work unit	Team-focused work unit
Dominant role	Supportive role
Technical skills emphasis	Facilitation skills emphasis
Seeking stability	Encouraging change
Telling, selling skills	Listening skills
Personal responsibility for results	Shared responsibility for results
Personal problem solving	Team problem solving
Narrow, vertical communication	Broader, horizontal, external communication
Fear, pressure used to motivate employees	Pride, recognition, growth used to motivate employees
Autocratic decision style	Participative decision style

Source: Mosley, D., Mosley, D., & Pietri, D. (2011). *Supervisory management: The art of inspiring, empowering, and developing people*. Mason, OH United States: South-Western Cengage Learning. p. 22.

Mentorship

Contemporary supervisory roles are similar to a coach or mentor in helping associates perform at their best (Mosley, 2011). Today, new employees need mentors more than ever. Transitioning through the beginning year(s) of work, or in many cases adulthood, is a very critical time wherein the decisions being made could have lasting and sometimes permanent consequences for the individual and employer (Eby, 1997; Filliettaz, 2010). In many cases, mentoring is a term used to describe supervision in much of the literature today (DeFilippo, 2013). Traditional mentorship is known to be a popular program used by companies for employee development (Barnett, 1995; McLeod, 2009; Murphy, 2012; Parker, 2008). Smith, Beveradge, and Boyatzis (2012) explained mentorship as an intense relationship where a more experienced person provides assistance to a less experienced person in order to enhance personal and professional development. Parker (2008) conducted survey research on peer coaching and described mentorship as a relationship in which a highly experienced employee supports a less experienced worker while mutually solving problems together. Both Smith et al.'s (2012) and Parker's (2008) studies voiced a common theme in that mentorship effectively occurs between a more knowledgeable co-worker and a novice worker.

Supporting supervisors acting as mentors or coaches, Liu (2011) studied three internship programs affiliated with large state universities and noted that effective supervisors acted as mentors and typically assigned challenging tasks, provided proper assistance in accomplishing tasks, and purposely helped mentees build a positive impression of themselves and the organization. Gamble (2001) performed qualitative research on cabinet-making apprentices and the master craftspeople that mentored them

into the ways of the occupation and observed that the master craftsperson's style of mentorship is largely missing from many entry-level occupations. Today, this duty is largely the responsibility of a supervisor at the worksite. Unfortunately, this supervisor is often overburdened and typically driven by production demands that overlook the development of a new worker.

Significant Research in Apprenticeship

Most studies on apprenticeship simply address the value of the institution and its model of learning in general, and very little research investigates the internal elements contributing to apprenticeship's success. Reed (2012) with the Mathematica Policy Research projected the effectiveness of apprenticeship and performed a cost-benefit analysis of programs across a variety of states. It found that individuals who participated in an apprenticeship in the United States had substantially higher earnings than those not participating. This research also found a positive social benefit resulting from the meager amount of government funds allocated to support apprenticeship compared to the tax revenue created by employees and employers participating and sponsoring apprenticeship programs. While Mathematica's study surfaced the benefits of apprenticeship over non-apprenticeship to the apprentice and government, it did not investigate the internal components that add to apprenticeship's success, nor did it address the benefits to the sponsor of the program. It did, however, recommend further investigation into the benefits to employers and the investments they make.

Glover and Bilginsoy (2005) conducted research comparing the performance of building-trades apprenticeship programs in the United States, sponsored jointly by employers and unions, with those sponsored unilaterally, non-jointly, by employers. This

ex post facto design statistically compared enrollment and graduation rates and examined the operation of apprenticeship, including institutional arrangements and recent innovations to cope with the challenging characteristics of the construction labor markets. This study was significant because it began to show the benefits of certain apprenticeship models on attrition and completion. It reported significantly higher enrollment, retention, and satisfaction results from students in programs who were jointly sponsored by the companies and unions. However, it failed to investigate any benefits resulting from long-term success of the apprentice or the companies that jointly sponsored them with the unions.

Rezin (2001) conducted research comparing the effectiveness of cooperative apprenticeships and traditional on-campus automotive technical programs in terms of the industry success and satisfaction of the graduates of these programs. The research used survey data from automotive technology graduates who earned associate degrees from publicly funded colleges in Ohio during the 1993-94 academic years. Frequencies, percentages, and measures of central tendency were used to describe graduates in terms of the variables selected for the study. Two statistical methods, logistic regression and multiple regression, were used to determine the relationship between the independent variables and graduate success and satisfaction. The study found that post-secondary education programs implementing the cooperative apprenticeship style of learning showed significantly more success and satisfaction. The recommendations cited the need for further research in understanding the variable within the model that further explains its success. Lacking from the research was an investigation into what happens

specifically while an apprentice serves a work-related component to an apprenticeship and how this affects long-term outcomes.

Fuller and Unwin (2009) researched apprenticeships, investigating a deeper understanding into specific characteristics that explain successful programs. They reported that successful programs often focused on broad learning as a foundation towards career growth. In particular, they identified expansive programs that afforded the learner rich and legitimate experiences in worksite training, formal education, proximity to skilled workers, and an ability to rotate and experience various skill sets within a community. Restrictive programs, on the other hand, were mainly focused on the tasks at hand and were primarily concerned with getting the immediate job done as quickly as possible. They cited the importance of the organizational environment and the structures that impact learning and learning opportunities. They found that the novice was often dependent on the attitudes and abilities of his or her managers and supervisors at the worksite, which often varied in terms of what learning was seen to be appropriate and how this learning would take place. Fuller and Unwin's study identified that the internal implements offered during an apprenticeship certainly make a difference in program completion; however, it still failed to address results after graduating and benefits to the sponsors of the program.

Research on apprenticeship in general is limited; however, research regarding the apprentice's work-related experiences are particularly sparse (Lerman, 2012; Nielsen, 2008a, 2008b). Lave and Wenger (1991) performed qualitative research on various apprenticeships and the social interactions that occurred within the work communities apprentices chose to undertake. They found that apprenticeship offered a model of

learning that is socially situated and takes place mostly between peers, instead of direct didactic instruction from a trainer or an individual devoted to teach. Their research revealed that through participation, situations arise that allow participants to work through problems and understand how well they are contributing through their efforts. The more successful programs provided a means for self-evaluation that often encouraged or motivated the participant to want to learn more.

In an attempt to understand the learning that takes place while in the work-related component of an apprenticeship, Nielsen (2008a, 2008b) conducted qualitative ethnographic research on the situational aspect of instruction in the work-related component of an apprenticeship. He identified workplace learning as a scaffolding process within the situated learning framework from Lave and Wenger's (1991) research. Through a series of observations and interviews with apprentice bakers as they learned their trade, the study ultimately defined scaffolding instruction as a process whereby beginners in a profession are supported by experienced workers so as to improve their basis for participating in social practice, hence becoming both a more knowledgeable participant and also developing a sense of belonging to a community of practice and acquiring a professional identity. Meaningful learning was reinforced in the study and indicated that genuine learning is often possible only when apprentices work in less judgmental environments, particularly while serving the work-related component of an apprenticeship. It is in the nonjudgmental work environment that the apprentice can explore, test, and truly understand the context of the academic and training components of the apprenticeship. Although Nielsen's study showed the value of the apprenticeship model as a focus of properly utilizing scaffolding, offering more effective opportunities

for apprentices and resulting in greater motivation and success, it also identified how important the signals from the supervisor to the apprentice are in the motivation process. This usually occurred through interactions between the apprentice and his or her supervisor.

Providing more research into the work-related aspect of an apprenticeship, Filliettaz (2010) researched the interactions between first-year apprentices, their supervisors, and their colleagues and illustrated the challenges facing apprentices in the work-related component of their apprenticeship. The study found that as apprentices strive to become members of the professional community, they often must cope with identity transformation while being guided through experiences and supported by supervisors and other more knowledgeable workers. Observations from the study showed that supervisors exerted various forms of power over an apprentice's ability to become immersed into the community. While the supervisor is often required to guide and train the apprentice in the production tasks, in this case study, the supervisor frequently provided negative responses when the apprentice asked for assistance, which provided some explanation for apprentice attrition. The research recommendations urged an increased level of pedagogical understanding in the workplace, enhancing the quality of guidance given by the supervisor. This study is important because of its focus on supervision over apprentice success and how a supervisor often stands as a gatekeeper to the community.

The theoretical framework supporting the inquiry of this research was described by Lave and Wenger (1991) as legitimate peripheral participation. The theory explains that when newcomers join a community of practice and become acquainted with the

tasks, vocabulary, and organizing principles of the community, they may move further into the community, seeking additional knowledge for greater legitimacy, and eventually become full participants in the community. Nielsen (2008b) reported results from his research on apprentices learning in a bakery apprenticeship. He found that Vygotsky's zone of proximal development is frequently employed throughout the apprenticeship method of learning. Lave and Wenger (1991) characterized that zone of proximal development as the distance between a newcomer's ability to solve problems while working alone and the learner's ability when assisted by more experienced people. In the apprenticeship model of development, less experienced learners are often placed in a community of practice where they observe, mimic, and articulate tasks from and to more experienced participants (Dennen, 2004). Instruction is given traditionally from a master, but as Nielsen (2008a) explained, this instruction should come from other experienced co-participants (i.e., other apprentices). Performed properly, legitimate peripheral participation will take on a scaffolding technique naturally that aligns with the zone of proximal development to give just enough help for the learner to advance further into the community of practice.

Legitimate peripheral participation more broadly addresses learning and motivation at a deeper level. It continues that when the learner works, or begins learning, on the peripheral of a community, believing the community to be legitimate and that community appears to accept and welcome the learner as a legitimate participant within the community, the learner will actively move into and within that community with greater vigor. He or she will gladly learn the tools and knowledge needed to advance and succeed in that community, be it algebra, English, current events, or any of the many

specific knowledge needed for advancement in that community. Nielsen (2008a, 2008b) and Filliettaz (2010) explained that the signals sent from the community to the learner are particularly important in the theory. In both studies, the signals largely come from those seen as the legitimate leaders within the community, such as the supervisors. These people were often seen as the gatekeepers of the community, and in both studies, when the individuals conveyed signals of compliment to the learner, greater motivation ensued, and the learner advanced deeper into the community with greater vigor and success.

Summary

In apprenticeships of the past, a master craftsperson meticulously supervised the work-related component and mentored the young apprentice into work and life while articulating context from the apprentice's education and training (Barlow, 1974; Brewer, 2011). In this, the master craftsperson was the more knowledgeable other and enhanced the legitimate peripheral participation process. Although clearly a supervisor, he or she was also a mentor. Today, however, because of the rapid growth of technology and changing needs of the workplace, the master craftsperson has often become too expensive and impractical to employ (Barlow, 1976; Brewer, 2011). Present-day apprentices in the United States typically serve the work-related component under the direction of a regular foreman as a supervisor in a particular career field or community of practice.

Nielsen's (2008a, 2008b) research, as well as Lave and Wenger's (1991) study, began to explain what happens during the work-related component of an apprenticeship. They ultimately defined scaffolding instruction and how developing a sense of belonging to a community of practice and acquiring a professional identity contribute to the learning process. Both studies found that the signals apprentices received from their community

of practice, often through the type of supervision received in the on-the-job component of apprenticeship, had a significant impact on overall motivation and work-related performance. However, neither of these qualitative studies gave quantifiable evidence to the benefits and losses associated with variations of supervision during an apprenticeship.

Fuller and Unwin (2008) highlighted that in expansive apprenticeships, masters, be they master doctors, lawyers, or plumbers, are often selected to serve as mentors due to their respect from the community and ability to provide a broad experience for the apprentice. Having the mentor/master in place sending positive signals to the apprentice (i.e., complimenting, urging the apprentice), adds value to the learning experience. It is not known, however, how much value can be gained from employing a master craftsperson as a mentor/coach supervisor. Lacking from the literature are quantitative studies regarding program completion, company longevity, and promotion which may depend on the type of supervision given during this process. Companies could benefit from having an understanding of this value in appropriating the proper funding for sponsoring apprenticeships and supervision enhancements. Government agencies that regulate apprenticeship in the United States could benefit from these findings in setting enhanced standards as a guide for sponsoring organizations.

To aid program developers and policymakers in guiding future apprenticeship models, this study seeks to determine if the type of supervision given during an apprentice's work experience enhances apprentice and company sponsor success. Chapter III will present the methodology and procedures used to collect and analyze the data determining if the apprenticeship experience is enhanced by the type of supervision provided. It will additionally explain the research population, variables, and design.

CHAPTER III

METHODOLOGY

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of an apprenticeship program. It compared the effectiveness of three training methods: those apprentices supervised solely by master craft instructors, those supervised solely by frontline foremen, and those supervised by a combination of master craft Instructors and frontline foremen throughout the apprenticeship experience. The study determined experience enhancement in terms of program completion, academic GPA, work-related GPA, company longevity, and sponsoring company promotion. This chapter describes the research methodology that was used to conduct the study. It provides a detailed explanation of the research population, research variables, research design, and research procedures. The chapter concludes with an explanation of how the data were collected and analyzed to answer the research questions.

Population

The research population consisted of all students that entered a single apprenticeship program in the southeast region of Virginia during the 2002, 2003, and 2004 years. The population specifically consisted of 877 students. The nature of this apprenticeship program assigned apprentices to be supervised in one of two methods while serving each of their eight independent work-related production placements. These workplace assignments allowed for three groups to be conveniently formed: those who were supervised entirely by master craft instructors ($N = 426$), those who were supervised entirely by frontline foremen ($N = 68$), and those who were supervised by a combination

of master craft instructors and frontline foremen ($N = 383$) throughout the complete apprenticeship experience. A series of independent chi-square and ANOVA tests were conducted to compare whether the three groups were similar with respect to age, gender, ethnicity, high school GPA, previous college GPA, and previous work experience. Finally, the study tracked these students for five years after graduating from the program to answer the research questions.

Research Variables

The independent variable in this study was supervision type. It is a categorical variable and was determined by the type of supervision given during the entire apprenticeship experience. The researcher measured five dependent variables to gain insight and analyze if the apprenticeship experience was enhanced by the type of supervision provided during the work-related component of the program. These included program completion, academic GPA, work-related GPA, company longevity, and company promotion.

Supervision Type

All students served work-related components to satisfy apprenticeship requirements. Each component lasted approximately six-months and was designed to give exposure to vital manufacturing processes and develop the technical knowledge and abilities needed for a productive career in the manufacturing industry. The school employed approximately 60 master craft instructors that served as on the job supervisors to the apprentice population. The expectation was for each apprentice to be supervised by a master craft instructor while serving all eight work-related components of the program. However, due to a shortage of master craft instructors, not all apprentices were

supervised by a master craft instructor during their apprenticeship. The nature of this assignment classified students into the three categories of supervision: (a) those supervised by only master craft instructors, (b) those supervised by only frontline foremen, and (c) those supervised by a combination of master craft instructors and frontline foremen throughout the experience.

Program Completion

The program consisted of 8000 hours, which included 1000 hours of related training and formal college coursework and 7000 hours of on the job experiences. Students either successfully completed the apprenticeship or dropped out prior to finishing. These data are categorical and are kept in the student's individual file by the school's retention manager.

Academic GPA

The academic program was divided into two major components, trade-related education and technical education curricula. The trade-related education curriculum consisted of all classroom and laboratory training that is required to directly support apprentice work-related knowledge and skills in manufacturing. These training courses may have varied depending on the trade in which the apprentice was serving, (e.g., pipe bending, arc welding, photogrammetry). The technical education curriculum was designed to provide each apprentice with the technical education (mathematics, science, technical writing, etc.) needed as a foundation for career development and continuing education. All apprentices took the same college academic coursework in the technical education curriculum. Coursework from both curriculums were represented on a student transcript and all apprentices were expected to pass all courses. Course grades were

determined by evaluating apprentice performance on all course quizzes and tests. Individual course grades were numerical, using the following scale.

GRADE	AVERAGE	MEANING
A	93-100	Excellent
B	85-92	Above average
C	77-84	Average
D	70-76	Below average
F	70 or below	Failure

An apprentice's academic GPA was computed by multiplying the semester credits earned in each course by the quality point value of each assigned grade, adding quality points for all courses taken during the semester, and dividing by the total number of semester credits attempted. A final academic GPA for all trade and academic courses was maintained and kept by the school's registrar via the student transcript (see Appendix B).

Work-related GPA

All students were evaluated and graded monthly on all tasks required to successfully complete the work-related component of an apprenticeship. Monthly shop grades were evaluated in accordance with five criteria: (a) technical knowledge and comprehension, (b) quality of work, (c) quantity of work, (d) leadership and initiative, and (e) conduct. The monthly grades for each apprentice were documented and stored both electronically and on the Work Related Evaluation Form (shown in Appendix A). Cumulative data were kept by the school's registrar reflecting each student's work-related GPA.

Company Longevity

Graduates could have terminated their employment with the company immediately after graduating, terminated sometime thereafter, or continue to be employed with the company five years after graduating – the time duration this study seeks to investigate. This also was an indicator in measuring the school's success. These data were kept in the individual's company file and were retrieved by the school's retention manager.

Company Promotion

Upon finishing the program, graduates continue employment with the sponsoring company as a 1st class journeyperson. Graduates either remained at this level or were promoted within the sponsoring company at some point after graduating. These data were kept in the individual's company file and were retrieved by the school's retention manager.

Research Design

This study was an ex post facto case study using data from all students attending a post-secondary apprentice school in the southeastern region of Virginia who enrolled between 2002 and 2004. It employed a non-randomized group comparison design comparing the effectiveness between the independent variable, training method 1 (apprentices supervised by master craft instructors), training method 2 (apprentices supervised by frontline foremen), and training method 3 (apprentices supervised by a combination of master craft instructors and frontline foremen). The dependent variables being measured included program completion, academic GPA, work-related GPA, company longevity, and company promotion.

An ex post facto study deals with retrospective data, conditions, or behaviors that have already transpired or that are after the fact (Ary, 2006; Cohen, 2000). Using an ex post facto research design for this study was justified given that it relies on preexisting data from subjects who differ in the supervision method during an apprenticeship (the categorical independent variable of having master craft instructors, frontline foremen, or mixtures) and seeks to determine what impact, if any, supervision method may have had on student outcomes (the dependent variables). Consequently, any differences between groups would have already occurred, thus making this a retrospective study.

Internal Validity

Creswell (2009) defined internal validity as the "experimental procedures, treatments of experiences of the participants that threaten the researcher's ability to draw correct inferences from the data about the population in an experiment" (p. 162). As this study was non-experimental with non-randomization of subjects into the three training methods, it was subject to threats of internal validity. Campbell and Stanley (1966) cited having a nonequivalent control group as threatening a study's internal validity, specifically in the areas of history, maturation, testing, and instrumentation. Ary et al. (2006) articulated weakness in ex post facto research design as the researcher can never be certain that groups were exactly alike before the treatment occurred. To strengthen the study, descriptive and inferential statistics were used to compare whether the three groups were similar with respect to age, gender, ethnicity, high school GPA, and previous work experience. Although this study was non-experimental and did not randomly assign or manipulate variables, it should be noted that "not all important questions in education can be answered with experimental research" (p. 355).

External Validity

External validity represents the extent to which a study's results can be generalized or applied to other people or settings. Creswell (2009) noted that threats to external validity occur when researchers "draw incorrect inferences from the sample data to other persons, other settings, and past or future situations" (p. 162). Campbell and Stanley (1966) explained this as "the possibility that the effects validly demonstrated hold only for that unique population from which the experimental and control groups were jointly selected" (p. 19). As this study was limited to apprentices that entered a specific apprenticeship program, the results of this study cannot be generalized to other sponsors of apprenticeship programs. The results obtained only represent the success of the students and sponsor from this particular school.

Procedures

The data used to determine if the apprenticeship experience was enhanced included the type of supervision, program completion, academic GPA, work-related GPA, company longevity, and company promotion. A master Excel data file was populated with the data fields depicted in Table 2. The database administrator ensured the protection and privacy of the participants and that the data received is in accordance with IRB's human subject policy. Performing this study posed minimal threats to apprentices involved. The names and any personal identifying data were excluded from the study. Before conducting this study, the researcher received permission from the school being studied and submitted all requests and documentations to the Human Subjects Committee at Old Dominion University. Protection of subjects was of the

utmost concern, ensuring that the procedures would not unduly harm participants and that each participants' privacy and anonymity were maintained.

Table 2

List of Variables

Variable	Description (Label)	Values
IV	Group Type	2 = Supervised by Master Craft Instructor 1 = Supervised by Frontline Supervisor 0 = Supervised by a Combination
DV	Program Completion	1 = yes; 0 = no
DV	Academic GPA	0.00 – 4.00
DV	Work-Related GPA	70 – 100
DV	Longevity: # yrs w/company	0 - 5
DV	Longevity: Status	1 = yes; 0 = no
DV	Promotion: Status	1 = yes; 0 = no
DV	Rapidity of Promotion	0 - 9
DV	Number of Promotions	0 - 5

Note: IV = Independent Variable; DV=Dependent Variable

The researcher collected data from the school's admissions manager on each apprentice's demographics including age, race, gender, high school GPA, previous college GPA, and previous work-related experience for all students enrolled between 2002 and 2004. These data were used to compare group similarity addressing the study's internal validity. Data were then collected from the school's registrar on each student's academic GPA and work-related GPA. Next, data on program completion, company longevity, and company promotion was collected from the school's retention manager.

Data Analysis

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program in terms of program completion, academic GPA, work-related GPA, company

longevity, and company promotion. After all data were entered into the master data Excel file, the file will be imported to IBM SPSS v20 for data cleaning and future statistical analysis. The researcher used a chi-square test for analyzing program completion. An ANOVA was used to determine significant differences between groups regarding academic GPA and work-related GPA. As company longevity and promotion were analyzed in several ways, a series of chi-square and ANOVA tests were used. Data from the five independent variables were analyzed in five separate computations to see if a significant difference existed to answer the study's research questions.

The first section addressed program completion between subjects being supervised under conditions of the three supervision types. As both the dependent and independent variables were categorical, it used a separate chi-square test to determining significant differences at a .05 level of significance between group completion norms. The research question regarding differences in program completion between the three groups was addressed based on the results.

The second section addressed academic GPA between subjects being supervised by master craft instructors, frontline foremen, or a combination of the two. It used an ANOVA to determine significant difference at a .05 level of significance of the combined group-normed academic GPA for those students who were classified in any of the three supervision types. The research question regarding difference in academic GPA between the three groups was addressed based on the results.

The third section addressed work-related GPA between subjects being supervised under conditions of the three supervision types. It also use an ANOVA to determine significant differences at a .05 level of significance among the combined group-normed

work-related GPA for those students who were supervised by master craft instructors, frontline foremen, or a combination of the two. The research question regarding difference in work-related GPA between the three groups was addressed based on the results.

The fourth section addressed company longevity between groups being supervised under the three conditions. Longevity was analyzed in two ways: the status (still employed by the sponsoring company or not), and if not with the company, the length of time before leaving the company. Significant differences were determined at the .05 level for longevity status using a chi-square test. Company longevity (length of employment after graduating) used an ANOVA at a .05 level of significance among the combined group norms of those students who were supervised by master craft instructors, frontline foremen, or a combination of the two. The research question regarding difference in company longevity relative to status and length of stay between the three groups was addressed based on the results.

The fifth section addressed company promotion between subjects being supervised under conditions of the three supervision types. It was analyzed in three ways: promotion status (promoted or not), if promoted, the time at which the promotion occurred, and if promoted, the number of promotions within five years of completing the program. A chi-square test was used to determine if a significant difference existed in promotion status. Promotion timing and number of promotions used an ANOVA test to determine significant differences. The research question regarding differences in promotion between supervision types was addressed based on the results.

Summary

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. It compared the effectiveness of three training methods (apprentices supervised by only master craft instructors, those supervised by frontline foremen, and those who were supervised under a combination of master craft instructors and frontline foremen) in terms of apprentice and sponsor success. The research tracked the outcomes from program enterers in 2002, 2003, and 2004 to analyze program completion, academic GPA, work-related GPA, company longevity, and sponsoring company promotion. The study utilized descriptive statistics, chi-square test, and independent ANOVA to analyze the data. Although using historical records may limit some of the conclusions that can be drawn regarding apprentice or sponsor success, this ex post facto case study can provide information regarding the benefits, if any, the type of supervision has on apprentice and sponsor success. Chapter IV will report the findings of the study, including the statistical analysis used to address the five research questions regarding program completion, academic GPA, work-related GPA, five-year post-graduation company retention, and five-year post-graduation company promotions.

CHAPTER IV

FINDINGS

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of an apprenticeship program. This chapter describes the findings of this study in two phases. The first phase characterizes the demographic factors of the population and each of the three supervision groups. Descriptive statistics and a series of chi-square and ANOVA tests were used to compare whether the three groups were similar with respect to age, gender, ethnicity, high school GPA, previous college GPA, and previous work experience. The second phase characterizes the statistical analysis regarding the research questions and the program outcomes of this study. A series of independent chi-square and ANOVA tests were used to address the study's research questions regarding program completion, academic GPA, work-related GPA, company longevity, and company promotion.

Population Demographics and Group Comparisons

The school collects and stores student demographic data during the admissions process. For the purpose of this study, data were collected for all students entering the program in 2002, 2003, and 2004. To ensure anonymity, personally identifiable information was removed and each student was assigned a random number for data tracking purposes. All data consisting of both categorical and continuous scores were collected and recorded in an Excel spreadsheet.

Population Demographics

A total of 877 students entered the program during the years of this study. Of the 877 students having entered the program, male students accounted for 91.7% of the population (n = 804), while females represented 8.3% (n = 73). Regarding race, Whites represented 58% (n = 509), African Americans 40.2% (n = 352), Asians 1.0% (n = 9), and Hispanics 0.8% (n = 7). Previous work experience was characterized in three categories: those having no experience and not having any record of employment; those having non-related experience, employed but not related to manufacturing (e.g., fast food, department store clerk); and those having related experience, employed in a manufacturing environment. The work experience demographics of the population included 41% (n = 360) with no work experience, 39.7% (n = 348) with non-related work experience, and 19.3% (n = 169) with related work experience (see Table 3).

Table 3

Student Population Demographics: Gender, Race, and Work Experience

Variables	(N = 877) %	N
Gender		
Male	91.7	804
Female	8.3	73
Race		
White	58.0	509
African American	40.2	352
Asian	1.0	9
Hispanic	0.8	7
Work Experience		
No Experience	41.0	360
Non-related Experience	39.7	348
Related Experience	19.3	169

Of the 877 students having entered the program, the average age was 21.71 years (SD = 5.85). The average high school GPA was 2.57 (SD = 0.54), and previous college GPA was 2.39 (SD = 0.87). Descriptive statistics explaining the age, high school GPA, and previous college GPA for the student population in the study are shown in Table 4.

Table 4

Student Population Demographics: Age, High School GPA, and Previous College GPA

Characteristic	Student Population Demographics		
	N	*M*	*SD*
Age	877	21.71	5.85
High School GPA	858	2.57	0.54
Previous College GPA	105	2.39	0.87

Group Comparisons

After being supervised throughout their apprenticeship experience in one of the three methods, the population of 877 students conveniently formed three groups. Group 1 (n = 426) consisted of students who were supervised by only master craft instructors throughout their entire apprentice experience, Group 2 (n = 68) consisted of students who were supervised by only frontline foremen throughout their entire apprentice experience, and Group 3 (n = 383) consisted of students who were supervised by a combination of master craft instructors and frontline foremen throughout their entire apprentice experience. Of the 426 students in Group 1, male students accounted for 91.8% of the population (n = 390), while females represented 8.2% (n = 36). The demographics regarding race indicated that Whites represented 58% (n = 247), African Americans 40.6% (n = 173), Asians 0.7% (n = 3), and Hispanics 0.7% (n = 3). The work experience

demographics of Group 1 included 44.8% (n = 191) with no work experience, 37.8% (n = 161) with non-related work experience, and 17.4% (n = 74) with related work experience.

Of the 68 students in Group 2, male students accounted for 94.1% of the population (n = 64), while females represented 5.9% (n = 4). Regarding race, Whites represented 60.3% (n = 41), African Americans 38.2% (n = 26), Asians 1.5% (n = 1), and Hispanics 0.0% (n = 0). The work experience demographics of Group 2 included 39.7% (n = 27) with no work experience, 42.6% (n = 29) with non-related work experience, and 17.6% (n = 12) with related work experience.

Of the 383 students in Group 3, male students accounted for 91.1% of the population (n = 349), while females represented 8.9% (n = 34). Regarding race, Whites represented 57.7% (n = 221), African Americans 40% (n = 153), Asians 1.3% (n = 5), and Hispanics 1.0% (n = 4). The work experience demographics of Group 3 included 37.1% (n = 142) with no work experience, 41.2% (n = 158) with non-related work experience, and 21.7% (n = 83) with related work experience. Gender, race, and work experience demographic data for each group are shown in Table 5.

A series of independent Pearson's chi-square tests were conducted to distinguish if differences in gender, race, or previous work experience existed between the three supervision groups. The two variables used to measure gender differences were gender type with two levels (male or female) and supervision type with three levels (supervised by only master craft instructors, only frontline foremen, or a mixture of master craft instructors and frontline foremen). The results showed no significant differences between supervision type regarding gender, $\chi^2(2, N = 877) = .671, p = .715$. When taking into consideration race, the two variables used were race with four categories (White, African

Table 5

Demographics by Group: Gender, Race, and Work Experience

Variables	Master Craft Instructor Group ($n = 426$)		Frontline Foremen Group ($n = 68$)		Combination Group ($n = 383$)	
	n	%	*n*	%	*n*	%
Gender						
Male	390	91.5	64	94.1	349	91.1
Female	36	8.5	4	5.9	34	8.9
Race						
White	247	58.0	41	60.3	221	57.7
African American	173	40.6	26	38.2	153	40.0
Asian	3	0.7	1	1.5	5	1.3
Hispanic	3	0.7	0	0.0	4	1.0
Work Experience						
No Experience	191	44.8	27	39.7	142	37.1
Non related Experience	161	37.8	29	42.6	158	41.2
Related Experience	74	17.4	12	17.6	83	21.7

American, Asian, and Hispanic) and supervision type with its three supervision categories, only master craft instructors, only frontline foremen, or a mixture of master craft instructors and frontline foremen. The results showed no significant differences between groups relative to race, $\chi^2(6, N = 877) = 1.889, p = .930$. The two variables used to measure differences in work experience included the level of work experience with three categories (no experience, non-related experience, and related experience) and supervision type with the three supervision categories. The results showed no significant differences between groups relative to work experience, $\chi^2(4, N = 877) = 5.799, p = .215$.

Considering each group's age, high school GPA, and previous college GPA, group 1 ($n = 426$) consisted of students who were supervised by only master craft instructors throughout their apprentice experience. Of the 426 students, the average age was 21.1 years ($SD = 5.06$). Ten students were home-schooled and did not have a

reportable high school GPA. The 416 students that graduated from a secondary high school had an average high school GPA of 2.57 (SD = 0.54). Fifty-two (12%) of the students in the group supervised by only master craft instructors attended another college before entering their apprenticeship and had a previous college GPA of 2.44 (SD = 0.84).

Group 2 (n = 68) consisted of students who were supervised by only frontline foremen throughout their entire apprentice experience. Of the 68 students, the average age was 22.66 years (SD = 6.77). All of these students graduated from a secondary high school and had an average high school GPA of 2.53 (SD = 0.51). Six (9%) of the students in the frontline foremen group attended another college before entering their apprenticeship and had a previous college GPA of 2.56 (SD = 0.78).

Group 3 (n = 383) consisted of students who were supervised by a combination of master craft instructors and frontline foremen throughout their entire apprentice experience. Of the 383 students, the average age was 22.21 years (SD = 6.41). Nine students were home-schooled and did not have a reportable high school GPA. The 374 students that graduated from a secondary high school had an average high school GPA of 2.58 (SD = 0.55). Forty-seven (12%) in the group supervised by a combination of master craft instructors and frontline foremen attended another college before entering their apprenticeship and had a previous college GPA of 2.31 (SD = 0.93) (see Table 6).

Table 6

Descriptive Statistics by Group: Age, High School GPA, and Previous College GPA

Characteristic	Master Craft Instructor Group (n = 426)			Frontline Foremen Group (n = 68)			Combination Group (n = 383)		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Age	426	21.10	5.06	68	22.66	6.77	383	22.21	6.41
High School GPA	416	2.57	.54	68	2.53	.51	374	2.58	.55
Prev College GPA	52(12%)	2.44	.84	6(9%)	2.56	.78	47(12%)	2.31	.93

Several analysis of variance (ANOVA) tests were conducted to determine if differences existed between the groups in this study relating to age, high school GPA, and previous college GPA. The independent variable, supervision type, included three categories: those supervised by only master craft instructors, only frontline foremen, and a combination of master craft instructors and frontline foremen. The dependent variables were the normed results for each group with respect to age, high school GPA, and previous college GPA. The ANOVA results indicated no significant differences for both high school GPA and previous college GPA, high school GPA, $F(2, 855) = .306, p = .737$; and previous college GPA, $F(2, 102) = .409, p = .665$. However, the ANOVA results examining age was significant $F(2, 874) = 4.194, p = .015$. Levene's test indicated that the assumption of homogeneity of variances had been violated, $F(2, 874) = 6.561, p < .001$, and therefore, a one-way Welch ANOVA was conducted and a Games-Howell post hoc test was used to compare individual groups. As shown in Table 7, tests revealed a significant difference in the average age; those supervised entirely by master craft instructors were younger ($M = 21.1$, $SD = 5.06$) than those having a combination of master craft instructors and frontline foremen ($M = 22.21$, $SD = 6.41$), $p = .028$.

Table 7

Group Comparison Relative to Age

Group Comparisons	Mean Differences	Std. Error	Significance
Group Supervised by CI's vs Group Supervised by FF's	1.504	.858	.192
Group Supervised by CI's vs Group Supervised by Combo	1.054*	.411	.028
Group Supervised by FF's vs Group Supervised by Combo	.450	.884	.867

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* The mean difference is significant at the 0.05 level

Analysis of Research Questions

The five research questions for this study were addressed using a series of descriptive statistics, independent chi-square tests, and ANOVAs throughout the entire study. Significant differences were determined at the .05 *p*-value.

Research Question 1

The first research question (RQ_1) stated: *Is there a difference in program completion between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* The overall completion rate for the population was 54%; i.e., of the 877 apprentices that entered the program during the study years, 472 completed the program. Of the 426 apprentices that were supervised by only master craft instructors, 151 completed the program, yeilding a proportion of 35% completing the program. Of the 68 apprentices that were supervised by only frontline foremen, 51 completed the program, producing a completion proportion of 75% . Furthermore, of the 383 apprentices that were supervised by a combination of master craft instructors and frontline foremen, 270 completed the program, with a proportion of 71% completing the program. Figure 3 shows a clustered bar chart for the frequency and percentage of completion for the overall population and for each type of supervision method.

A chi-square analysis was conducted to test for differences in frequency distributions in program completion rates between supervision types. The two variables were (1) program completion with two levels (complete and not complete) and (2) supervision type with three levels (supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen). Distributions in

completion rates significantly differed by supervision type, $\chi^2(2, N = 877) = 112.992, p < .001$. Cramer's V indicated a medium effect size ($V = .36$).

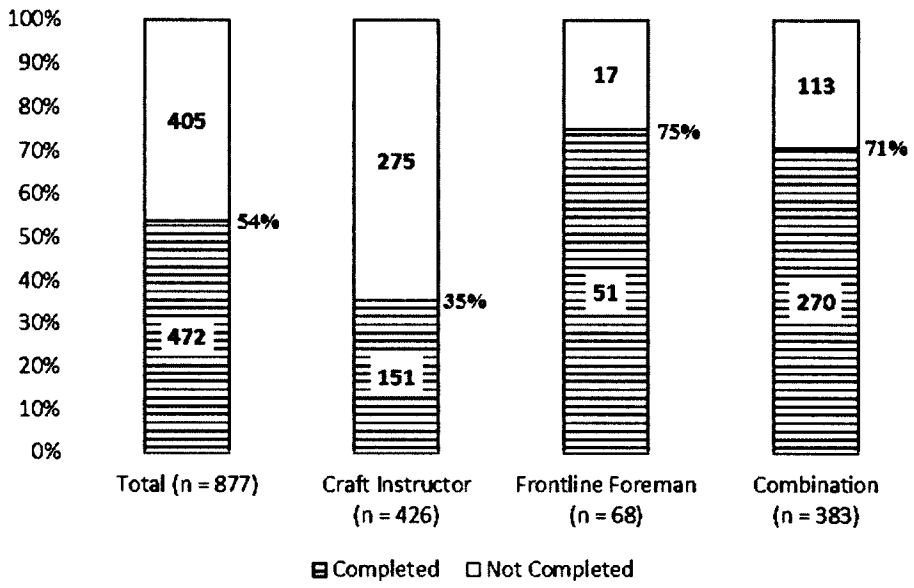

Figure 3. Completion within Supervision Type

As a significant difference was found between completion and supervision type, multiple follow-up comparisons were conducted to evaluate the difference between each type of supervision. To reduce the likelihood of a Type I error, this study used the Bonferroni adjustment method at the .05 level of significance for all three supervision types. The overall alpha of .05 was divided by the number of cases within the crosstabulation (i.e., .05 divided by 6) to establish a modified alpha of .008. Significant differences were determined between those supervised by master craft instructors and frontline foremen, Pearson $\chi^2(2, N = 494) = 37.96, p < .001$, and master craft instructors and a combination, Pearson $\chi^2(2, N = 809) = 99.21, p < .001$. However, the difference was not significant between the groups supervised by frontline foremen and those supervised by a combination, Pearson $\chi^2(2, N = 451) = .57, p = .45$. The calculated chi-square, p values, and Cramer's V results for each comparison are shown in Table 8. It

can therefore be inferred that there was a difference in program completion between the three groups, with a greater proportion of apprentices completing the program under the supervision of either frontline foremen or a combination of frontline foremen and master craft instructors compared to apprentices supervised by only master craft instructors.

Table 8

Chi-Square Post Hoc Results between Supervision Type Regarding Completion

Group Comparison	Pearson χ^2	*p* value	Cramer's *V*
Group Supervised by CI's vs. Group Supervised by FF's	37.96*	.000 (.008)	.280
Group Supervised by CI's vs. Group Supervised by Combo	99.21*	.000 (.008)	.350
Group Supervised by FF's vs. Group Supervised by Combo	.57	.45 (.008)	.036

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* *p* value ≤ alpha

Research Question 2

The second research question (RQ_2) stated: *Is there a difference in academic Grade Point Average (GPA) upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* The number of apprentices that completed the program totaled 472. The overall academic GPA for the population was 2.84 with a standard deviation of 0.67. The average academic GPA for the graduates who were supervised by only master craft instructors was 2.95 with a standard deviation of 0.67. The average academic GPA for the graduates who were supervised by only frontline foremen was 2.91 with a standard deviation of 0.68. And, the average academic GPA for the graduates who were supervised by a combination of master craft instructors and

frontline foremen was 2.77 with a standard deviation of 0.66. Descriptive statistics explaining the overall and group academic GPA's are shown in Table 9.

Table 9

Descriptive Statistics of Academic GPA

	Academic GPA (0.00 – 4.00)		
	N	*M*	*SD*
Master Craft Instructors	151	2.95	0.67
Frontline Foremen	51	2.91	0.68
Combination	270	2.77	0.66
Overall Population	472	2.84	0.67

An inspection of a boxplot revealed no outliers in the data and academic GPA's were normally distributed for each group, as assessed by visual inspection of Normal Q-Q Plots. A one-way ANOVA was conducted to compare GPA's of apprentices across supervision types. The dependent variable was the normed academic GPA for each group. The assumptions of homogeneity of variances was verified using Levene's Test, $F(2, 469) = .165, p = .848$. The ANOVA revealed significant differences in GPA between supervision groups, $F(2, 469) = 3.78, p = .023, \eta^2 = .016$.

Follow-up tests were conducted to evaluate pairwise differences among the group means using Tukey's HSD. The results indicated that those apprentices who were supervised by only master craft instructors had a significantly higher academic GPA ($M = 2.95, SD = .67$) than those supervised by the combination of master craft instructors and frontline foremen ($M = 2.77, SD = .66$), $p = .022$, 95% CI [.02, .34]. The difference in academic GPA between the master craft instructor group ($M = 2.95, SD = .67$) and frontline foremen group ($M = 2.91, SD = .68$) was not significant, $p = .915$, 95% CI [-.21, .30]. The difference between frontline foremen group ($M = 2.91, SD = .68$) and the

combination group ($M = 2.77$, $SD = .66$) was also not significant, $p = .374$, 95% CI [-.10, .37]. Table 10 shows the mean differences, standard error, and the significance for each group comparison. It is worth noting that a Hochburg GT2 post hoc test was also conducted and reveled the same results as the Tukey's test. According to Field (2009), the Hochburg test should be used when the number of participants differ in each group, as is the case in this study ($n = 151$, $n = 51$, $n = 270$).

Table 10

ANOVA Post Hoc Results between Supervision Type Regarding Academic GPA

Group Comparisons	Mean Differences	Std. Error	Significance
Group Supervised by CI's vs Group Supervised by FF's	.043	.107	.915
Group Supervised by CI's vs Group Supervised by Combo	.179*	.067	.022
Group Supervised by FF's vs Group Supervised by Combo	.136	.101	.374

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* The mean difference is significant at the 0.05 level

Research Question 3

The third research question (RQ_3) stated: *Is there a difference in work-related GPA upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* The number of apprentices that completed the program totaled 472. The overall work-related GPA for the population was 91.78 with a standard deviation of 3.74. The average work-related GPA for the graduates who were supervised by only master craft instructors was 90.2 with a standard deviation of 3.53. The average work-related GPA for the graduates who were supervised by only frontline foremen was 94.0 with a standard deviation of 3.56. And, the average work-related GPA for the graduates who

were supervised by a combination of master craft instructors and frontline foremen was 92.24 with a standard deviation of 3.56. Descriptive statistics explaining the overall and group work-related GPA's are shown in Table 11.

Table 11

Descriptive Statistics of Work-related GPA

	Work-Related GPA (80 – 100)		
	N	*M*	*SD*
Master Craft Instructors	151	90.20	3.53
Frontline Foremen	51	94.00	3.56
Combination	270	92.24	3.56
Overall Population	472	91.78	3.74

A boxplot was created to show the distributions of the work-related GPA for the three supervision types: master craft instructors, frontline foreman, and the combination groups. Four outliers were discovered within the master craft instructor and frontline foreman groups (shown in Figure 4). After establishing that the outliers were neither the result of data entry error or measurement error, the outliers were determined to be genuinely unusual data points. As a result, the decision was made to run a one-way ANOVA with and without the outliers included in the analysis to decide whether the two results differed sufficiently. According to Maxwell and Delaney (2004), a one-way ANOVA is fairly robust to deviations from normality regarding Type I errors. Engagement scores were normally distributed for each group, as assessed by visual inspection of Normal Q-Q Plots.

The independent variable, supervision type, included three levels: those supervised by only master craft instructors, only frontline foremen, and a combination of master craft instructors and frontline foremen. The dependent variable was the group

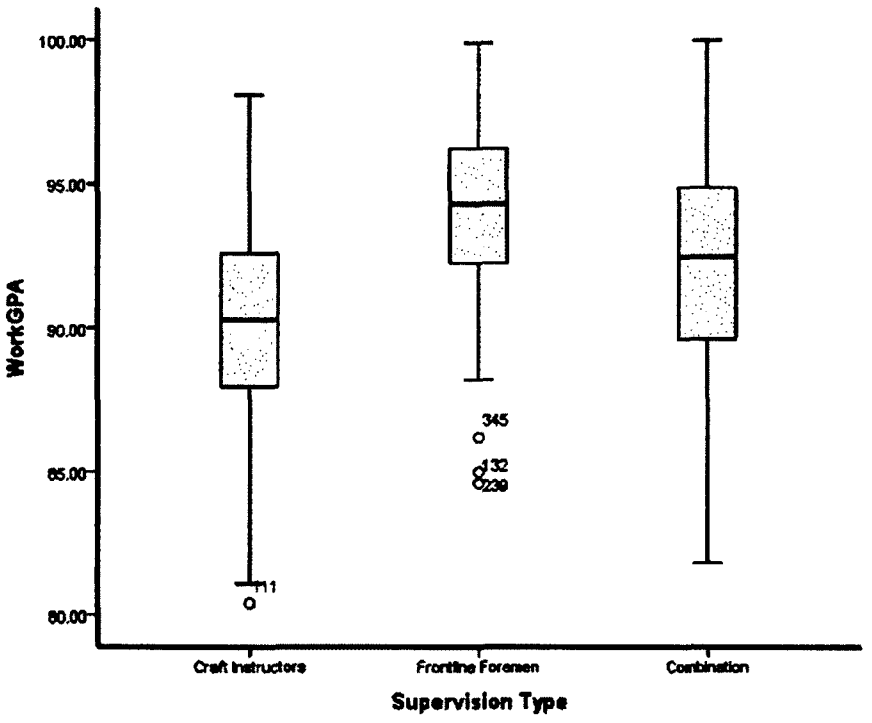

Figure 4. Work-related GPA for Supervision Type

normed work-related GPA. In analyzing the data with and without the outliers, there was homogeneity of variance and the ANOVA's were significant. Removing the outliers resulted in homogeneity of variance being verified as assessed by a Levene's Test of, $F(2, 465) = 2.438, p = .088$, and the ANOVA was significant at $F(2, 465) = 31.28, p < .000, \eta^2 = .119$. Leaving the outliers in the analysis also resulted in homogeneity of variance being verified, $F(2, 469) = .359, p = .699$. The ANOVA was again significant, $F(2, 469) = 26.60, p < .000, \eta^2 = .102$. After conducting the one-way ANOVA with and without the outliers, the work-related GPA's were found to be significantly different for those apprentices who were supervised between the three groups.

Follow-up tests were conducted to evaluate pairwise differences among the group means using Tuckey's HSD test since equal variances were tenable. The results indicated that those apprentices who were supervised by only master craft instructors had a

significantly lower work-related GPA (M = 90.2, SD = 3.53) than those supervised by frontline foremen (M = 94.0, SD = 3.56), p < .000, 95% CI [-5.1, -2.4], and those supervised by a combination (M = 92.24, SD = 3.56), p < .000, 95% CI [-2.9, -1.2]. Apprentices supervised by frontline foremen had a significantly higher work-related GPA (M = 94.0, SD = 3.56) than those supervised by master craft instructors (M = 90.2, SD = 3.53), p < .000, 95% CI [2.4, 5.1], and those supervised by a combination (M = 92.24, SD = 3.56), p = .005, 95% CI [.4, 3.0]. And, those apprentices who were supervised by a combination of master craft instructor and frontline foremen (M = 92.24, SD = 3.56) were significantly higher than those who were supervised by only master craft instructors (M = 90.2, SD = 3.53), p < .000, 95% CI [.4, 3.0] with a confidence interval of .4 to 3.0, but significantly lower than apprentices who were supervised by only frontline foremen (M = 94.0, SD = 3.56), p = .005, 95% CI [-3.0, -.4]. Table 12 shows the mean differences, standard error, and the significance for each group comparison relative to work-related GPA. It is worth noting that a Hochburg GT2 post hoc test was also conducted and revealed the same results as the Tuckey's test. According to Field (2009), the Hochburg

Table 12

ANOVA Post Hoc Results between Supervision Type Regarding Work-related GPA

Group Comparisons	Mean Differences	Std. Error	Significance
Group Supervised by CI's vs Group Supervised by FF's	-3.749*	.575	.000
Group Supervised by CI's vs Group Supervised by Combo	-2.027*	.361	.000
Group Supervised by FF's vs Group Supervised by Combo	1.722*	.542	.005

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* The mean difference is significant at the 0.05 level

test should be used when the number of participants differ in each group, as is the case in this study ($n = 151$, $n = 51$, $n = 270$).

Research Question 4

The fourth research question (RQ_4) stated: *Is there a difference in company longevity within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* Longevity was determined in two ways: (a) the status of an apprentice five years after completing the program (i.e., either still working for the sponsoring company or not), and (b) the number of months before leaving after graduating. The number of apprentices that completed the program totaled 472. The study revealed that 80% of the apprentice graduates were still working for the sponsoring company after five years of completing the program, meaning that of the 472 graduates that finished the program, 378 were still with the company. Considering longevity by group, of the 151 graduates supervised by only master craft instructors, 125 were still with the company, yielding a proportion of 83%. Of the 51 graduates supervised by only frontline foremen, 35 were still with the sponsoring company, yielding 69%. And, of the 270 graduates supervised by a combination of master craft instructors and frontline foremen, 218 (81%) were still with the sponsoring company after five years (see Figure 5).

A chi-square test for association between supervision type and longevity status after five years was first conducted to evaluate if an overall difference existed. The two variables were longevity status with two levels (still with the company or not with the company after five years) and supervision type with three levels (supervised by master

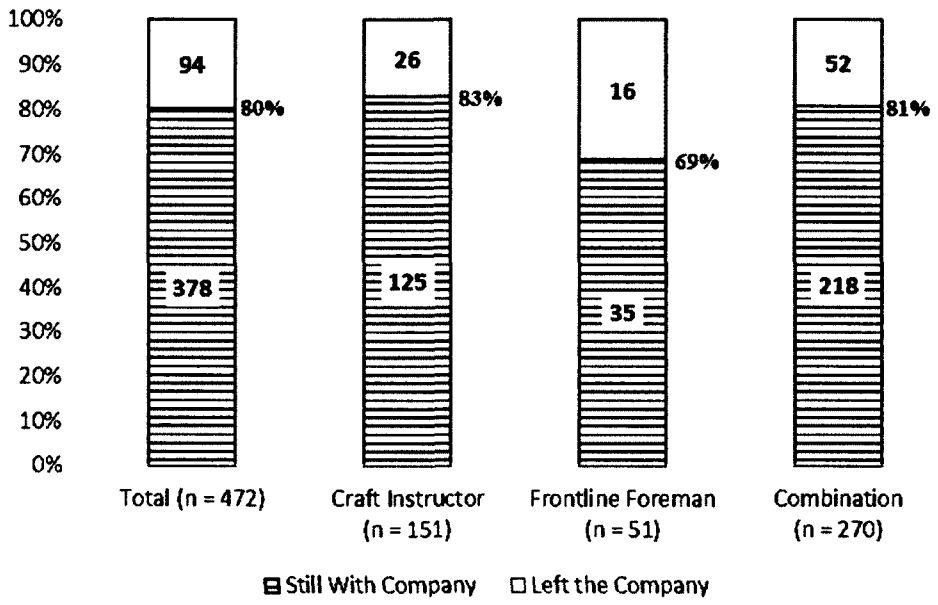

Figure 5. Company Longevity after Five Years

craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen). Supervision type and longevity relative to status were not found to be significantly different, $\chi^2(2, N = 472) = 4.959, p = .084$. Cramer's V indicated a small effect size, $V = .102$.

The fourth research question additionally addressed the difference in the average length of stay between groups for those graduates that chose to leave after graduating from the program. Looking only at the graduates that left the sponsoring company among the overall population, 94 left the company and did so at an average of 24 months ($SD = 17$) after completing the program. The group that was supervised by only master craft instructors throughout their entire apprentice experience had 17 leave after 28 months ($SD = 16$). Those having only frontline foremen left after 22 month ($SD = 18$), and those with a combination of master craft instructors and frontline foremen also at 22 months ($SD = 17$). Table 13 gives a description of the average length of time with the company before leaving.

Table 13

Descriptive Statistics of Length of Time with Company before Leaving

	Left the Company within 5-Years			
	# Grads / # Left	%	*M* Months before leaving	*SD*
Master Craft Instructors	151 / 26	17	28	16
Frontline Foremen	51 / 16	31	22	18
Combination	270 / 52	19	22	17
Overall Population	472 / 94	20	24	17

An inspection of a boxplot revealed no outliers in the data. An assessment of the Normal Q-Q Plots revealed a normal distribution for each group when plotting each data point by group. A one-way ANOVA was conducted to evaluate the relationship between the type of supervision and longevity relative to the length of stay with the sponsoring company before leaving. The independent variable, supervision type, included three levels: only master craft instructors, only frontline foremen, and a combination of master craft instructors and frontline foremen. The dependent variable was the normed longevity for each group (i.e., the number of month with the company before leaving). The assumptions of homogeneity of variances was verified using Levene's Test, $F(2, 91) = .380$, $p = .685$. The ANOVA comparing longevity across supervision type was not significant, $F(2, 91) = 1.107$, $p = .335$. The longevity between groups regarding the length of time a graduate stayed with the sponsoring company after graduating was not found to be significantly different.

Research Question 5

The fifth research question (RQ_5) stated: *Is there a difference in company promotion within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft*

instructors and frontline foremen? For this study, promotion was defined as when an employee moves from a frontline worker to a middle-skill salaried occupation. It was determined in three ways: (a) by the status of a graduate five years after completing the program (i.e., either promoted by the sponsoring company or not promoted); (b) if promoted, the group normed number of months since being promoted within the five-year time period from completion; and (c) if promoted, the group normed number of times promoted after graduating.

The number of apprentices that completed the program totaled 472. When analyzing the status of promotion in the overall population, 68% were promoted within the study's time-period of five years, meaning that of the 472 graduates that finished the program, 319 were promoted. Promotion by group revealed that of the 151 graduates supervised by only master craft instructors, 120 were promoted, yielding a proportion of 79%. Of the 51 graduates supervised by only frontline foremen, 37 were promoted by the sponsoring company, yielding 72%. And, of the 270 graduates supervised by a combination of master craft instructors and frontline foremen, 162 (60%) were promoted by the sponsoring company within five years (see Figure 6).

A chi-square test for association between supervision type and promotion status within five years was conducted to evaluate if an overall difference existed. The two variables were promotion status with two levels (promoted or not promoted) and supervision type with three levels (supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen). Supervision type and promotion status were found to be significantly different, Pearson $\chi^2(2, N = 472) = 17.4, p < .001$. Cramer's V indicated a small effect size, $V = .192$.

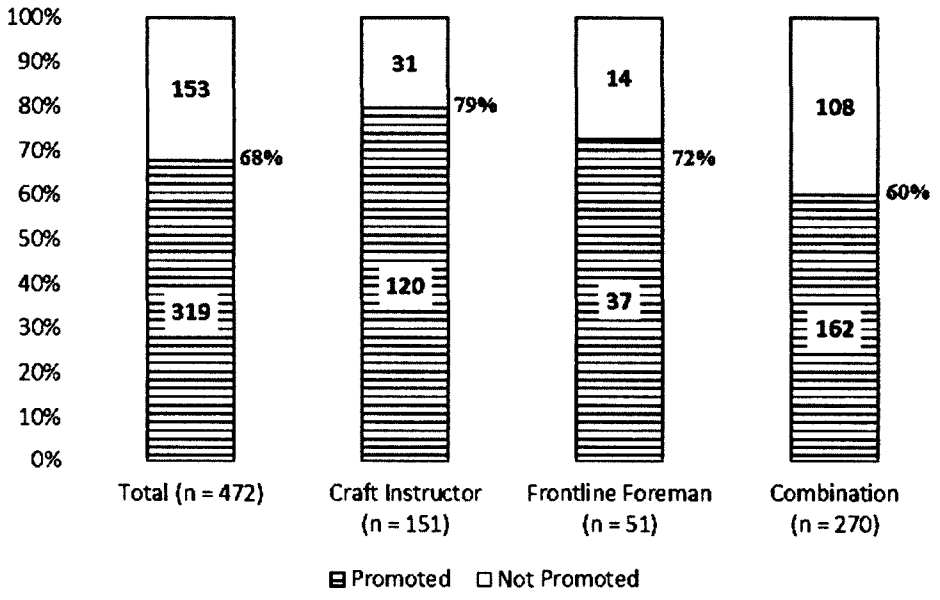

Figure 6. Company Promotion after Five Years

As a significant relationship was found between supervision type and promotion status, multiple follow-up comparisons were conducted to evaluate the difference between each type of supervision. To reduce the likelihood of a Type I error, this study again used the Bonferroni adjustment from the .05 level to the .008 level for all three supervision types. Post hoc testing revealed a significant difference in the promotion status between the group supervised by only master craft instructors (promoted at 79%) and the combination group (promoted at 60%), $\chi^2(2, N = 421) = 16.6, p < .001$. Although the master craft instructor group (promoted at 79%) was promoted at a higher percentage than the frontline foremen group (promoted at 72%), the difference was not significant, $\chi^2(2, N = 202) = 1.06, p = .304$. Cramer's V indicated a medium effect size, $V = .199$. The differences between the frontline foremen group and the combination group was also not significant, $\chi^2(2, N = 321) = 2.87, p = .090$. Therefore, it can only be inferred that there was a difference in promotion status within five years of finishing the program

between the graduates who were supervised by master craft instructors and those supervised by the combination, where a greater percentage of graduates were promoted having only master craft instructors as supervisors throughout their apprentice experience. The calculated chi-square, *p* values, and Cramer's *V* results for each comparison are shown in Table 14.

Table 14

Chi-Square Post Hoc Results between Supervision Type Regarding Promotion Status

Group Comparison	Pearson Chi-square	*p* value (Alpha)	Cramer's *V*
Group Supervised by CI's vs. Group Supervised by FF's	1.06	.304 (.008)	.072
Group Supervised by CI's vs. Group Supervised by Combo	16.60*	.000 (.008)	.199
Group Supervised by FF's vs. Group Supervised by Combo	2.87	.090 (.008)	.199

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* *p* value ≤ alpha

Looking only at the apprentice graduates that were promoted by the sponsoring company and analyzing how soon promotions came, it is important to note that some apprentices were promoted to a salaried, middle-skill position prior to graduating from the program allowing group averages to exceed five years since being promoted. In the overall population, 319 were promoted within five years of completing the program and they had been promoted for an average of 4.9 years (*SD* = 1.2). This would indicate that they were promoted on average within the first 2 months of completing the program. The group that was supervised by only master craft instructors saw 120 promotions at an average of 5.5 years (*SD* = 2.3). Those having only frontline foremen had 37 promotions at an average of 4.6 years (*SD* = 1.7), and those with a combination of master craft

instructors and frontline foremen saw 162 promotions at an average of 4.5 years (*SD* = 2.0). Table 15 gives a description of the average amount of time since being promoted within the five-year time period.

Table 15

Descriptive Statistics of Years since Being Promoted

	# Grads / # Promoted	%	*M* Years Promoted	*SD*
Master Craft Instructors	151 / 120	79.5	5.5	2.3
Frontline Foremen	51 / 37	72.5	4.6	1.7
Combination	270 / 162	60.0	4.5	2.0
Overall Population	472 / 319	67.6	4.9	2.1

A boxplot was created to show the distributions of the group normed number of years since being promoted for the three supervision types: master craft instructors, frontline foreman, and the combination groups. Four outliers were discovered (see Figure 7). After establishing that they were neither the result of data entry error or measurement error, the outliers were determined to be genuinely unusual data points. As a result, the decision was made to run a one-way ANOVA with and without the outliers included in the analysis to decide whether the two results differed. Engagement scores were normally distributed for each group, as assessed by visual inspection of Normal Q-Q Plots.

A one-way ANOVA was conducted to evaluate group differences in the length of time having been promoted after finishing the program. The independent variable, supervision type, included three levels: those supervised by only master craft instructors, only frontline foremen, and a combination of master craft instructors and frontline

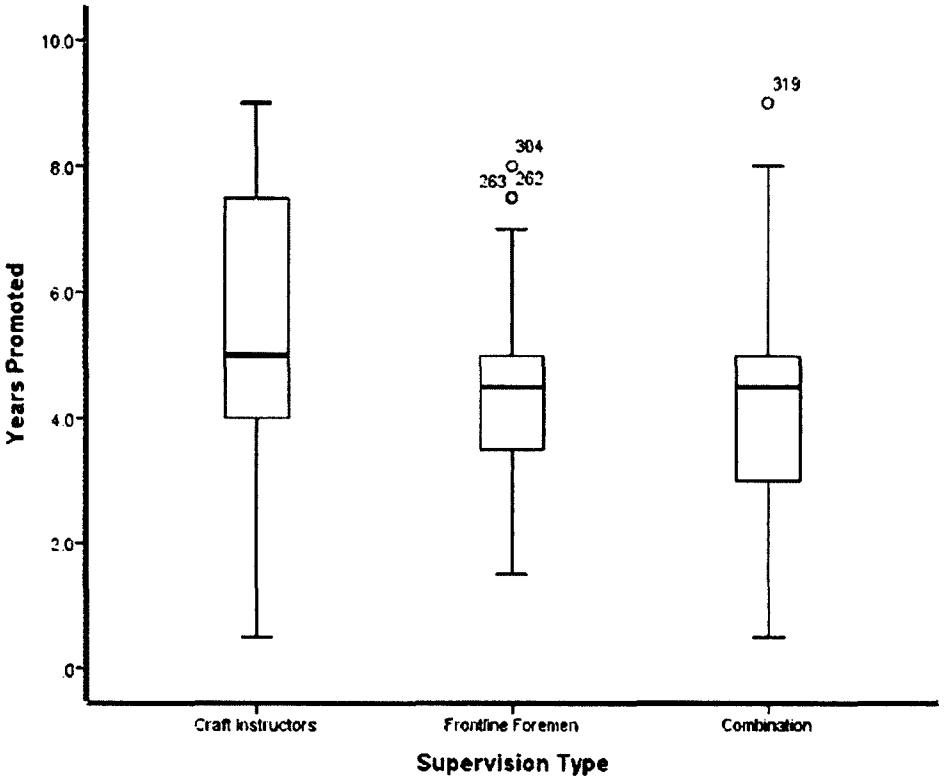

Figure 7. Years Promoted by Supervision Type

foremen. The dependent variable was the group average of the number of months since being promoted within five years after graduating. The assumptions of homogeneity of variances was tested and found to have been violated using Levene's Test, $F(2, 316) = 9.453, p < .000$. As a result of the unequal variances and the outliers identified in the boxplot, a one-way Welch ANOVA was conducted with and without the outliers included in the analysis to evaluate if differences existed between the type of supervision and number of years since being promoted. A Welch ANOVA with the outliers removed indicated a significant group difference, Welch's $F(2, 103) = 8.967, p < .000, \eta^2 = .057$. Leaving the outliers in the analysis also produced a significant result, Welch's $F(2, 107) = 7.373, p = .001, \eta^2 = .049$. Therefore, in both analyses, the number of years promoted was significantly different for those apprentices who were supervised between the three

groups. Follow-up tests were conducted (leaving the outliers in) to evaluate pairwise differences among the group means using the Games-Howell post hoc analysis since equal variances were not obtained according to the Levene's Test. Those promoted graduates that were supervised by only master craft instructors had a longer length of time having been promoted ($M = 5.5$, $SD = 2.3$) compared to those supervised by both (a) the combination group ($M = 4.5$, $SD = 2.0$), $p = .001$, 95% CI [-.69, .88], and (b) those supervised by only frontline foremen ($M = 4.6$, $SD = 1.7$), $p = .001$, 95% CI [.04, 1.73]. Although the length of time having been promoted was longer for those supervised by master craft instructors, it should be noted that this also represents the amount of time between graduating and being promoted, thus being promoted sooner, with some promotions occurring while the apprentice was still in training. Table 16 displays the mean difference, standard error, and significance level for each group.

Table 16

ANOVA Post Hoc Results between Supervision Type Regarding Promotion Rapidity

Group Comparisons	Mean Differences	Std. Error	Significance
Group Supervised by CI's vs Group Supervised by FF's	.888*	.355	.038
Group Supervised by CI's vs Group Supervised by Combo	.987*	.262	.001
Group Supervised by FF's vs Group Supervised by Combo	.099	.327	.951

CI = Master Craft Instructors; FF = Frontline Foremen; and Combo = Combination of CI's and FF's
* The mean difference is significant at the 0.05 level.

There were opportunities where graduates gained more than one promotion during the five-year time period after graduating (e.g., one, two, three times). Therefore, looking only at the apprentice graduates that were promoted by the sponsoring company and analyzing the average number of times the individuals within each group became

promoted, in the overall population of 319 promoted graduates, the average number of times a promotion occurred within the five-year study period was 1.56 (*SD* = .64). The 120 graduates who were promoted within the group that was supervised by only master craft instructors saw an average number of times promoted of 1.52 (*SD* = .565). Those having only frontline foremen had a group average of 1.59 promotions (*SD* = .60). Those with a combination of master craft instructors and frontline foremen had a group average of 1.59 promotions (*SD* = .70) within the five-year time period. Table 17 gives a description of the number of promotions within the five-year time period for the overall population and each group.

Table 17

Descriptive Statistics of Number of Promotions

	Number of Times Promoted by Company within 5-Years		
	# Grads / # Promoted	*M* # of Times Promoted	*SD*
Master Craft Instructors	151 / 120	1.52	.565
Frontline Foremen	51 / 37	1.59	.60
Combination	270 / 162	1.59	.70
Overall Population	472 / 319	1.56	.64

A boxplot was created to show the distributions of the group normed number of times being promoted for the three supervision types: master craft instructors, frontline foreman, and the combination groups. One outlier was discovered (shown in Figure 8). After establishing it was neither the result of a data entry or measurement error, the outlier was determined to be genuinely unusual. As a result, a decision was made to run a one-way ANOVA with and without the outlier included in the analysis to decide whether

the two results differed sufficiently. Engagement scores were normally distributed for each group, as assessed by visual inspection of Normal Q-Q Plots.

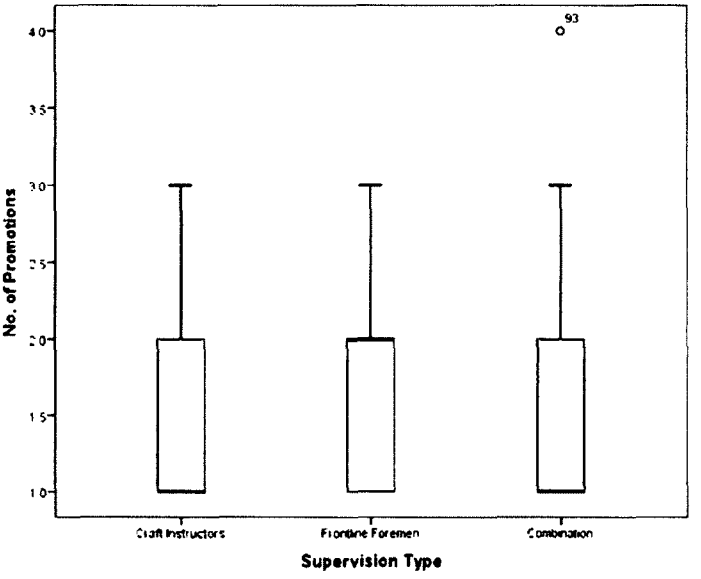

Figure 8. Number of Times Promoted by Supervision Type

A one-way ANOVA was conducted to evaluate the differences in the average time to promotion between supervision groups. The independent variable, supervision type, included three levels: only master craft instructors, only frontline foremen, and a combination of master craft instructors and frontline foremen. The dependent variable was the normed number of promotions for each group within the five-year time frame after graduating. The assumptions of homogeneity of variances was tested and found to have been violated using Levene's Test, $F(2, 316) = 4.152$, $p = .017$. As a result, a Welch ANOVA was conducted, which did not indicate a significant group difference in average time to promotion, Welch's $F(2, 104) = .584$, $p = .560$.

Summary

The problem of this study was to determine if apprentice success was enhanced by the type of supervision given during the work-related component of an apprenticeship program. Five research questions were developed to guide this study. The questions

were addressed using two statistical methods throughout the entire study: Pearson's chi-square and one-way ANOVA. The first research question used a chi-square test to examine differences between group completion norms. The statistical findings revealed that the group supervised by only master craft instructors completed the program at a significantly lower percentage than the other two groups. The second research question addressed academic GPA between supervision groups. The academic GPA for the group supervised by only master craft instructors was significantly higher than the combination group. The third research question examined differences in work-related GPA between groups. The findings indicated that the master craft instructor group had a significantly lower work-related GPA than both of the other two groups. The fourth research question used a chi-square and ANOVA to address company longevity between groups. The differences regarding longevity were not significant. The fifth research question also used a chi-square and ANOVA to address company promotion between groups. The findings showed that the master craft instructor group on average was promoted significantly sooner during the 5-year period after graduating than the group supervised by the combination of master craft instructors and frontline foremen. Chapter V will present the summary, conclusions, and recommendations.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. Five research questions were identified examining the effects of the supervision being offered while on the job on program completion, academic GPA, work-related GPA, five-year post-graduation company longevity, and five-year post-graduation company promotions. This chapter summarizes the study, presents conclusions based of the findings, and makes recommendations for further research.

Summary

To remain competitive in the global community, U.S. companies need to consider new strategies for developing a workforce. According to Burrowes, Young, Restuccia, Fuller, and Raman (2014), although there are gaps in low, middle, and high skill occupations, middle-skill workers are of greatest concern as they make up the largest part of the U.S. labor market. However many industries are unable to find prepared workers to fill these jobs. In manufacturing, middle-skill jobs often include production foremen, managers, and business and financial support specialists such as planners, cost estimators, and quality analysts that require an education beyond high school but not a four-year degree (Burrowes et al., 2014; Carnevale, 2010; Lerman, 2012). The lack of education and skills in these areas, however, may be keeping employers from hiring and the U.S. economy from growing.

A nation-wide study by Casner-Lotto (2009) found that successful companies were making unique investments in developmental programs to up-skill front-line

workers into their middle-skill needs. The report specifically spotlighted apprenticeship as an exemplary model and recommended more partnerships between industry and community colleges to strengthen the U.S. economy and help them compete globally. According to Lerman (2010), when it comes to actual apprenticeships in the United States, programs are primarily funded, developed, and operated by the independent organizations or businesses, often called sponsors, which choose to implement such programs. It is the individual employer who often needs to weigh the expenditures and the drawbacks with the advantages in the decision and effort to build and sustain an apprenticeship program. This includes whether to offer an apprenticeship in general, but also the extensiveness of the internal components, all of which are overhead costs to the sponsor. From a sponsoring company's standpoint, important factors in weighing the quality of a program and ultimately the decision to invest can include the quality of the graduate (through program completion and GPA), how long the graduate maintains employment with the sponsoring company (longevity), and the amount the sponsoring company utilizes the graduate (promotion).

According to Filliettaz (2010), one of the most important internal components within an apprenticeship is supervision, where supervisors often act as gatekeepers to the community. The Filliettaz study showed that supervision was a significant contributor to apprentice and company success. To aid sponsors, program developers, and policymakers in designing future apprenticeship models, this study seeks to determine if the type of supervision provided during an apprentice's work experience enhanced apprentice and company success. According to Lerman (2009), research on apprenticeship is sparse in general and primarily focuses on returns to government

agencies in tax revenues. This study is significant because of the need for more information about apprenticeship in general, but also for identifying the internal components that might be contributing to a more prepared middle-skill workforce as well as a company's ability to be profitable if they choose to implement an apprenticeship program. Additionally, by identifying ways to better prepare a workforce, the US might more easily meet its 21st century workforce challenges.

The problem of this study was to determine if the apprentice experience was enhanced by the type of supervision given during the work-related component of an apprenticeship program. To guide the study, the following research questions were established.

RQ_1: Is there a difference in program completion between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_2: Is there a difference in academic Grade Point Average (GPA) upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_3: Is there a difference in work-related GPA upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_4: Is there a difference in company longevity within five years of completing the program between apprentices who were supervised by master craft

instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

RQ_5: Is there a difference in company promotion within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?

There were several limitations to the study. First, the geographic scope of this study was limited to graduates of one participating apprenticeship program during the years 2002, 2003, and 2004. Therefore, the results obtained only represent the success from that school and from the apprentices that were admitted during that time period. Additionally, the variables used in this study (program completion, academic and work-related GPA, five-year company longevity, and five-year promotion) only begin to reflect the complexities of apprentice and company enhancements with its workforce.

The study was a non-experimental, ex post facto case study investigation of program success through the type of supervision given during the work-related component of an apprenticeship. It tracked 877 students who enrolled in a post-secondary apprentice school for five years after graduating from the program. Apprentices were conveniently identified in three groups: those who were supervised entirely by master craft instructors, those supervised entirely by frontline foremen, and those who were supervised under a combination of master craft instructors and frontline foremen. Demographic data including age, gender, race, high school and previous college GPA, and previous work-related experience were collected and analyzed to determine group similarities. Data were next collected on each student's program

completion, academic GPA, work-related GPA, longevity, and promotion. A series of chi-square and ANOVA tests were used to analyze differences between the three groups. The final conclusions were drawn regarding the problem statement and research questions.

Conclusions

After being supervised throughout their apprenticeship experience in one of the three methods, the population of 877 students were conveniently categorized into three groups: either supervised (a) entirely by master craft instructors, (b) entirely by frontline foremen, or (c) a mixture of master craft instructors and frontline foremen. A series of independent Pearson's chi-square and ANOVA tests were conducted to distinguish group similarities regarding age, gender, race, previous high school and college GPA's, and previous work experience. The results showed no significant differences between supervision type regarding gender, race, high school and college GPA's, and previous work experience. However, age was found to be significant, where those supervised entirely by master craft instructors were younger ($M = 21.1$, $SD = 5.06$) than those having a combination of master craft instructors and frontline foremen ($M = 22.21$, $SD = 6.41$).

The study revealed descriptive data regarding the entire population entering the program. Fifty-four percent ($n = 472$) of the students completed the program with an average academic GPA of 2.72 and a work-related GPA of 91.78. Upon completion, 100% were employed by the sponsoring company, and 80% ($n = 378$) were still with the company after five years. Sixty-eight percent ($n = 120$) of the completers were promoted to a middle-skill occupation within an average of two months of completing the program.

The first research question asked: *Is there a difference in program completion between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* In examining descriptive statistics, the completion rate for all 877 entering participants was 54%, where 472 participants completed the program. This completion rate is worthy of noting as, according to Symonds (2011), only about 40% of Americans obtain either an associate's or bachelor's degree by their mid-20s. The results of a chi-square test with pairwise post hoc comparisons revealed significant differences between groups being supervised by (a) master craft instructors and frontline foremen, and (b) master craft instructors and the combination of master craft instructors and frontline foremen. Therefore, it can be concluded that the completion rate was significantly lower for the group supervised by only master craft instructors (completing at 35%, $n = 151$) from both the frontline foremen only group (completing at 71%, $n = 51$) and the combination group (completing at 75%, $n = 270$).

The second research question asked: *Is there a difference in academic Grade Point Average (GPA) upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* The descriptive statistics revealed that the overall academic GPA for the population was 2.84 ($SD = 0.67$). The average academic GPAs by group were 2.95 ($SD = 0.67$) for the master craft instructor only group, 2.77 ($SD = 0.66$) for the combination of master craft instructors and frontline foremen group, and 2.91 ($SD = 0.68$) for the frontline foremen only group. A one-way ANOVA was conducted to evaluate the difference between the type of supervision and academic GPA. The average

academic GPA for the group supervised by only master craft instructors ($M = 2.95$, $SD = 0.67$) was significantly higher than those supervised by a combination of master craft instructors and frontline foremen ($M = 2.77$, $SD = 0.66$). Therefore, it can be concluded that apprentices who were supervised by master craft instructors had a significantly higher academic GPA than those supervised by a mixture of master craft instructors and frontline foremen upon completion of program.

The third research question asked: *Is there a difference in work-related GPA upon completion of program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* Descriptive statistics revealed that the overall average work-related GPA for the population was 91.78 with a standard deviation of 3.74. Study findings indicated the group averages for the graduates who were supervised by only master craft instructors was 90.2 ($SD = 3.53$), a combination of master craft instructors and frontline foremen 92.24 ($SD = 3.56$), and only frontline foremen 94.0 ($SD = 3.56$). After conducting a one-way ANOVA with pairwise post hoc testing to evaluate the difference between the type of supervision relative to work-related GPA, significant differences were found among all three groups: (a) the graduates having only master craft instructors had a significantly lower work-related GPA than those in the other two groups; (b) the graduates having a combination of master craft instructors and frontline foremen had a significantly higher work-related GPA than the master craft instructor only group, but significantly lower than the frontline foremen only group; and (c) the frontline foremen group had a significantly higher work-related GPA than the other two groups. Therefore, it can be concluded that there was a significant difference in work-related GPA upon completion

of program between apprentices who were supervised under all three conditions: master craft instructors (averaging the lowest), frontline foremen (averaging the highest), and a mixture of master craft instructors and frontline foremen (averaging higher than those having master craft instructors but lower than the frontline foremen group).

The fourth research question asked: *Is there a difference in company longevity within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* The data regarding longevity was analyzed in two ways. First, data were analyzed to determine if there was a difference in group status (employed or not employed) of graduates after five years of completing the program. Next, looking only at those graduates that left the company within the five-year time frame, the study analyzed if there was a difference between the groups in the average time in months spent working for the sponsoring company before leaving.

Analysing the longevity status of the population, or the percentages of graduates still with the company after five years of completing the program, decriptive statistics revealed that in the overall population of 472 graduates, 378 (80%) were still with the sponsoring company five years after graduating. When comparing longevity status among the three supervision groups, descriptive statistics showed that 83% (n = 125) of graduates who were supervised by only master craft instructors, 81% (n = 218) supervised by a combination of master craft instructors and frontline foremen, and 69% (n = 35) supervised by only frontline foremen were still with the sponsoring company after five years. After conducting a chi-square test for association between supervision type and longevity status (employed or not employed), the difference was not found to be

significant. Therefore, it can be concluded that longevity regarding the status (employed or not employed) was not significantly different between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen.

Analysing only the graduates that left the sponsoring company and the average length of time in months at which they stayed after graduating, the results were similar to longevity status. Decriptive statistics revealed that in the overall population (472), 94 graduates left the company and did so at an average of 24 months after completing the program. Analyzing the length of stay by group, the study revealed that those graduates supervised by only master craft instructors left the company after an average of 28 months, those with a combination of master craft instructors and frontline foremen after 22 months, and those having only frontline foremen also after 22 months. After conducting a one-way ANOVA test for association between supervision type and the length of stay in months from completers that left, as with longevity status, the difference was not statistically significant. Therefore, it can be concluded that longevity regarding the length of stay within five years of completing the program was not significantly different between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen.

The fifth research question asked: *Is there a difference in company promotion within five years of completing the program between apprentices who were supervised by master craft instructors, frontline foremen, or a mixture of master craft instructors and frontline foremen?* In this study, a total of 472 apprentices completed the program. Promotion outcomes were determined in three ways: (a) by the status of a graduate

(promoted or not promoted) within five years after completing the program; (b) if promoted, the number of months since being promoted within the five-year time frame (the rapidity of promotion); and (c) if promoted, the number of times promoted after graduating.

When analyzing the status of promotion (promoted or not promoted), of the 472 overall graduates, 67% (n = 319) were promoted within the five-year time frame. The rest were still employed, but remained in the position from which they had graduated five years prior. Those graduates that were supervised by only master craft instructors were promoted by the sponsoring company at 79% (n = 120), those supervised by a combination of master craft instructors and frontline foremen 61% (n = 162), and those supervised by only frontline foremen 72% (n = 37) within five years. A chi-square test for association between supervision type and promotion status within five years was conducted and found to be significant. Pairwise post hoc testing showed that a significant difference existed between those supervised entirely by master craft instructors (79%, n = 120) and those supervised by a combination of master craft instructors and frontline foremen (61%, n = 162). Therefore, it can be concluded that there was a significant difference in promotion status (promoted or not promoted) within five years of completing the program between apprentices who were supervised by master craft instructors and a mixture of master craft instructors and frontline foremen, where those supervised by only master craft instructors were promoted at a significantly higher percentage.

Examining only the apprentice graduates that were promoted by the sponsoring company and analyzing the duration of the promotion, the overall population of promoted

graduates had been promoted an average of 4.9 years within 5 years of graduating. This would indicate that they were promoted on average within the first two months of completing the program. The group that was supervised by only master craft instructors saw an average of 5.5 years, meaning that on average they were promoted six months prior to finishing the program. Those having a combination of master craft instructors and frontline foremen had been promoted for 4.5 years, an average of six months after graduating; and, those having only frontline foremen were promoted for an average of 4.6 years, an average of five months after graduating. A one-way ANOVA with follow-up post hoc testing was conducted to determine if there was a difference between the type of supervision and promotion regarding the length of time having been promoted within the five-year time frame. The tests revealed statistically significant pairwise differences between the mean scores for those apprentice graduates that were supervised by only master craft instructors to those supervised by both groups (i.e., frontline foremen group and combination of master craft instructor and frontline foremen group). Therefore, it can be concluded that there was a significant difference in promotion rapidity (the number of months having been promoted) within five years of completing the program between apprentices who were supervised by master craft instructors and the other two groups, where those supervised by only master craft instructors were promoted significantly sooner.

Finally, the research question analyzed the graduates that were promoted and determined if there was a significant difference in the average number of times promoted between groups. In the overall population of graduates that were promoted, on average they were promoted 1.56 times. The group that was supervised by only master craft

instructors saw an average of 1.52 times, those having a combination of master craft instructors and frontline foremen had 1.59 promotions, and those having only frontline foremen were also promoted an average of 1.59 times. A one-way ANOVA was conducted revealing no significant differences between the types of supervision regarding the number of times being promoted within the 5-year time frame. Therefore, it can be concluded that the number of promotions were not significantly different for those apprentices who were supervised by master craft instructors, frontline foremen, or a combination of master craft instructors and frontline foremen.

Overall, the problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. The findings from each of the research questions of this study determined that differences existed between supervision type regarding important outcomes. Significant differences existed between supervision types in all outcome variables except longevity (RQ_4). Completion rates (RQ_1) for apprentices supervised by only master craft instructors throughout their entire apprenticeship experience were significantly lower than those in the other two groups. Looking at work performance, the average work-related GPA (RQ_3) was also significantly lower for the group supervised by only master craft instructors. Inversely, academic GPA, longevity, and promotion revealed more positive outcomes from being supervised by only master craft instructors. Academic GPA's (RQ_2) were on average higher for the completers having been supervised only by master craft instructors and significantly higher from the combination group. Longevity and promotion are particularly important to a sponsoring company when determining the rationale for funding a program as these variable begin to provide

the returns for the expenditures. Of those that completed, the percentage of graduates still working with the sponsoring company after five years (RQ_4) was higher for those having a master craft instructor when compared to their counterparts in the other two groups (combination and frontline foremen). Analyzing the length of stay from those that chose to leave within the five year time frame, graduates supervised by only master craft instructors also stayed with the company longer on average than those in the other two groups. Regarding promotion (RQ_5), significant differences were found between those apprentices having been supervised by only master craft instructors and the combination group, where the master craft instructor group was promoted at significantly higher percentages and promoted significantly sooner within the five year time frame of this study (see Table 18).

This study being a non-experimental ex post facto study, it cannot draw causal inferences from supervision type to the dependent variables. It can only be stated that differences existed between groups having been supervised under the three conditions and does not begin to identify which method is more superior to the other. Although beyond the scope of this study, the findings did create a belief that the master craft instructors could be acting more aggressively than frontline foremen in protecting the sponsoring company's long-term return on investment. Although additional research is needed, master craft instructors could be weeding-out the weaker apprentices before completing the program and instilling company loyalty to those worthy of completing, thus allowing their population of graduates to be more efficient and knowledgeable than the other two groups. Further inquiry is needed to draw such inferences, however this belief would agree with the research by Filliettaz (2010) where he explained that

Table 18

Comprehensive Outcomes to Research Questions

		Master Craft Instructors Group	Frontline Foremen Group	Combination Group
RQ_1	Program Completion	35% Significantly lower than both groups	71%	75%
RQ_2	Academic GPA	2.95 Significantly higher than combination group	2.91	2.77
RQ_3	Work-related GPA	90.2 Significantly lowest	94.0 Significantly highest	92.2
RQ_4	Longevity: Status	83%	69%	81%
		----------No Significant Differences----------		
	Longevity: Length of Stay	28 months	22 months	22 months
		----------No Significant Differences----------		
RQ_5	Promotion: Status	79% Significantly higher than combination group	72%	60%
	Promotion: Rapidity	-6 month Significantly sooner than both groups	5 month	6 months
	Promotion: Quantity	1.52	1.59	1.59
		----------No Significant Differences----------		

supervisors act as gatekeepers to the occupational community and treat newcomers either positively or negatively based on their perceptions of the apprentice's ability.

Finally, this researcher encourages caution in drawing broad conclusions related to this study's findings. For instance, stopping at just completion and GPA could give credence that being supervised entirely by master craft instructors is a disadvantage. After all, a higher number of apprentices that entered the program that were supervised by master craft instructors did not complete; and the difference was significant.

However, considering longevity and promotion, the completers supervised by master craft instructors outperformed the completers in the other two groups. Again, this study only begins to suggest supervision type as a contributing factor in the differences found in the dependent variables. Realizing that companies fund apprenticeships to produce the best workforce possible, and ultimately to have a better competitive edge, and that it does not pay for a sponsoring company to fund a program only to lose its quality graduates after graduating or have them remain at low entry level positions, this study only revealed supervision as a variable needing additional study, therefore the following recommendations are provided.

Recommendations

The problem of this study was to determine if the apprenticeship experience was enhanced by the type of supervision given during the work-related component of a program. As existing research has shown the positive value of apprenticeship on relevant post-secondary skill attainment from an educational or governmental perspective, this study addressed the more long-term benefits to the individual and sponsor of an apprenticeship program. Having summarized the study and its conclusions, the following recommendations are given.

1. The current study used a non-experimental, ex post facto case study investigation to answer its research questions and employed a convenient nonrandomized sample comparison design. It only began to tell a story that something might be happening by more than chance. More evidence is needed for the knowledge community in identifying successful apprenticeship models. Rigorous research using true experimental design with high quality statistical analysis should be

undertaken to investigate the effectiveness of supervision on long-term outcomes such as longevity and promotion. Qualitative studies are needed to identify the deep voice from the community on the benefits of apprenticeship in general, but also the specific internal components contributing to desirable outcomes. By conducting additional research, studies can surface the trusted evidence needed in the research community as well as the independent training providers and sponsors funding apprenticeship programs in the United States.

2. The geographic scope of the current study was limited to apprentices that entered one apprenticeship program during the years 2002, 2003, and 2004. Therefore, the results can only be inferred to this school and not generalized to other two- or four-year institutions of higher education or other sponsored apprenticeship programs. For this reason, it is recommended that the study be replicated on a broader scale. The U.S. DOL alone registers more than 19,000 programs serving over 410,000 apprentices across the nation (Employment and Training Administration, 2015). Lerman (2012), citing a recent National Household Education Survey, explained that over a million apprentices could potentially be in programs not registered with the federal government. Extrapolating Lerman's figures to the programs already registered with the DOL, there may be more than 65,000 apprenticeship programs throughout the United States. These programs and their arena offer a platform to conduct needed research.
3. The nature of this study being an ex post facto case study, it conveniently categorized apprentices into three groups: those supervised by (a) only master craft instructors, (b) a combination of master craft instructors and frontline

foremen, and (c) only frontline foremen. While the groups having only master craft instructors and only frontline foreman were easily identifiable regarding their exposure to the type of supervision (i.e., all or none), the group having a combination of master craft instructor and frontline foreman was not easily identifiable (i.e., the actual ratio of the mixture). The data from the sponsoring company in this study was not specific enough to categorize apprentices beyond this level of detail. For this reason, it is recommended that the study be either repeated using more specific data regarding supervision type exposure or altered in such a way to correlate supervision type to beneficial outcomes. The latter could be done using survey research asking apprentice graduates to rate their perception of supervision type received throughout the work-related experience, then measuring the outcomes for significant differences.

4. This study broadly measured success through the dependent variables: program completion, academic and work-related GPA, company longevity, and promotion. As these variables only begin to reflect the complexities of apprentice and sponsor success in the workforce, additional research should be conducted to identify other important outcomes. Delphi studies including leaders and/or apprentices from the business community could be used to capture the variables that truly influence the expansion of apprenticeship. Once important variables are validated, further rigorous independent investigations can be conducted to determine the return on investment from existing programs.
5. Filliettaz (2010) explained that supervisors working with apprentices act as gatekeepers to the occupational community and often restrict full participation to

those apprentices that are less competent. The findings of the current study determined that significant differences existed between having a master craft instructor to both completion of the apprenticeship and work-related GPA. More specifically, those apprentices who were supervised by only master craft instructors throughout their entire apprenticeship completed the program at significantly lower percentages and their average work-related GPA (as determined by the master craft instructors) was significantly lower than those in the other two groups. As it is not known what could be causing these differences, it is recommended that further research be conducted. Do master craft instructors act more aggressively than frontline foremen in identifying if an apprentice is worthy of continuing in the program? If so, is this by design? And, what might be the benefits of such an internal component?

6. As company sponsors fund apprenticeship programs to produce the best workforce possible, and ultimately to have a better competitive edge over competitors, it does not pay for a sponsoring company to fund a program only to lose its quality graduates after graduating or have them remain at a low entry-level job. As this study surfaced positive differences between the supervision groups regarding longevity and promotion from apprentices supervised by master craft instructors, it did not consider other external variables that could be contributing to the disparity. For instance, it did not take into account the apprentice's occupational area (e.g., welding piping, electrical). Nor did it consider the rise and fall of the economic times. Therefore, caution should be taken regarding making any broad inferences to a causal affect. It is thus

recommended that further research be conducted investigating the possible causes contributing to promotion other than supervision.

7. Lave and Wenger's (1991) study explained learning to be situational, in that authentic learning occurs more as individuals join legitimate communities of practice. They identified membership in a workplace community as vital to a newcomer and it was often determined by the forms of participation to which newcomers were given access. Therefore, it is recommended that further research be conducted investigating the level of legitimacy perceived by the apprentice and the long-term successes that might result. Does having a supervisor that acts as an instructor (a master craft instructor) add or subtract from a learner's feeling of legitimacy, and how might that affect self-efficacy? How might having an over-the-shoulder instructor while at the worksite affect the full potential of development within the community? How important is it to be free to take chances, make mistakes, and discover in the developmental process? Is the freedom to discover more prevalent when being supervised by a frontline foreman or a master craft instructor?
8. On a broad scale, this study contributes to a body of knowledge that is under-researched in general but clearly from the perspective of the sponsor. Besides analyzing internal components leading to success such as the type of supervision, this study unveiled descriptive data about this specific program that is worthy of further investigation. The program comprised 42% minorities. Fifty-four percent of the students completed the program with an average GPA of 2.72. Upon completion, 100% were employed by the sponsoring company, and 80% were still

with the company after five years. Sixty-eight percent of the completers were promoted to a middle-skill occupation within an average of two months of completing the program. The descriptive statistics in this case study were a success story in themselves. Research comparing the apprenticeship model of development where learners are embedded in a career while receiving college academics to the traditional route of college-then-work should be conducted (Halpern, 2009).

9. Finally, a review of the literature revealed that US apprenticeship, besides being regulated by the Department of Labor (DOL), does not have a governing body that guides and directs its efforts. According to Lerman (2012), most apprenticeships in the United States are not registered with the federal government and operate independently by sponsors that choose to provide such training programs. Further research should investigate and explain why this is so. According to the Department of Labor's website, its mission is "to foster, promote, and develop the welfare of the wage earners, job seekers, and retirees of the United States; improve working conditions; advance opportunities for profitable employment; and assure work-related benefits and rights" (DOL, 2015, para. 1). While this is clearly an honorable and noble mission, the essence of this mission is solely focused on the wage earner, not the wage provider – the sponsor of a program. The DOL measures success in decreasing the number of application for unemployment benefits, not necessarily in this country's ability to compete globally. According to the International Economic Development Council (IEDC, 2010), workforce development programs primarily focus on low

skill job entry with the intent to eradicate poverty. This could explain the trend for many businesses resisting registering their mid-level skill apprenticeships with the DOL and choosing to operate independently. Interestingly, according to its website, the Department of Commerce's mission is to "promote job creation, economic growth, sustainable development and improved standards of living for all Americans by working in partnership with businesses, universities, communities and our nation's workers" (DOC, 2015, para. 1). Might the essence of this agency be more appropriate for apprenticeship to reside? More research is needed to investigate which governmental agency is best to act as the advocate for apprenticeship in the United States. Is the Department of Commerce a more suitable agency than the Department of Labor? Which agency is more in-line with what is needed for business to compete globally? Does the Department of Education have a role to play relative to apprenticeship? Furthering research in any or all of these areas can provide data for government, business, and industry in expanding apprenticeship in the United States.

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APPENDIX A

Work Related Evaluation Form

APPRENTICE EVALUATION FORM

Evaluation Period:

Name: Term: DEPT:

Please indicate the type of work performed by the apprentice during the month by selecting from the drop down list for each category

Location:

Pipe Size(s)	Material Type(s)	Joint Type(s)	Type of Work

Additional Comments (Type of Work):

Please select from the drop dow n list under eac h question for the response that best fits the apprentices performance in each c ategory for each half of the month.

Technical Knowledge and Comprehension

1st HALF	1.) At what level would you rate the apprentice on technical knowledge of the trade?	
-0.8	Decisions are sometimes faulty and unsound.	Decisions are sometimes faulty and unsound.
	2.) How well does the apprentice understand job requirements and processes?	
2nd HALF	Demonstrates competency in basic methods, processes and procedures of the	Demonstrates competency in basic methods, processes and procedures of the tr
-0.8	3.) What level of supervision is needed for the apprentice to accomplish assigned tasks?	
	Requires occasional supervision	Requires occasional supervision

Quantity of Work

1st HALF	1.) At what level would you rate the apprentice on his/her ability to meet production schedules and targets?	
0.0	Meets production schedules and targets.	Meets production schedules and targets.
2nd HALF	2.) Does the apprentice use his/her time so that assigned tasks are completed in a timely manner?	
0.0	Completes a reasonable amount of work in a timely manner	Completes a reasonable amount of work in a timely manner

Quality of Work

1st HALF	1.) What level would you rate the apprentice on workmanship?	
0.8	Workmanship satisfactory.	Workmanship satisfactory.
	2.) At what level would you rate the apprentice for accuracy?	
2nd HALF	Accuracy is usually within allowable tolerances.	Accuracy is within allowable tolerances.
1.7	3.) At what level would you rate the apprentice for mistakes and rework required?	
	Errors and rework kept to a minimum	Errors and rework kept to a minimum

Responsibility and Initiative

1st HALF	1.) At what level would you rate the apprentice on his/her willingness to accept/seek responsibility?	
0.8	Takes charge of assignments and resolves problems and discrepancies indepen	Takes charge of assignments and resolves problems and discrepancies independe
	2.) When given goals/assignments, does the apprentice perform as expected?	
2nd HALF	Follows through on assignments to satisfactory completion of goals.	Follows through on assignments to satisfactory completion of goals.
0.8	3.) What level of guidance is required to get the apprentice to complete assigned tasks?	
	Performs at an acceptable rate with time will improve	Performs at an acceptable rate with time will improve

Conduct

1st HALF	1.) How would you rate the apprentice on his/her ability to comply with company attendance policy?	
1.3	Rarely late or absent; plans most occurrences.	Rarely late or absent; plans most occurrences.
	2.) Does the apprentice follow all shipyard safety policies and procedures?	
	Follows procedures; wears proper protective equipment; uses correct, appropri	Follows procedures; wears proper protective equipment; uses correct, appropria
2nd HALF	3.) Is the apprentice where he/she is supposed to be and doing what he/she is assigned to do?	
	Works without close supervision; eager to learn / grasp new tasks; pleasant to w	Works without close supervision; eager to learn / grasp new tasks; pleasant to w
1.3	4.) How conscientious is the apprentice with care and handling of the tools and equipment?	
	Rarely has lost or damaged tools/equipment	Rarely has lost or damaged tools/equipment

Additional comments:

Supervisor		Date		GRADE	83
Craft Instructor		Date			

APPENDIX B

Academic Transcript

Academic Transcript

Apprenticeship Served: Marine Designer
Learner Name:
Department No.:
Date of Birth:
Address:

Social Security No.:
Personnel No.:
Started Apprenticeship:
Completed Apprenticeship:
High School Graduation Date:

Semester Date: Transfer Credits

Course No.	Title	Credit	Grade	Quality Points
C221 (CHM 111)	College Chemistry I	4	T	0
C222 (CHM 112)	College Chemistry II	4	T	0
E110 (EGR 110)	Engineering Graphics	3	T	0
E111 (ENG 111)	College Composition I	3	T	0
E112 (ENG 112)	College Composition II	3	T	0
E120 (EGR 120)	Introduction to Engineering	2	T	0
E125 (EGR 125)	Intro to Engineering Methods	4	T	0
E126 (ENG 125)	Introduction to Literature	3	T	0
E140 (EGR 140)	Engineering Mechanics-Statics	3	T	0
H122 (HIS 122)	United States History II	3	T	0
H215 (HLT 295)	Stress Management	2	T	0
M173 (MTH 173)	Calculus with Analytic Geometry I	4	T	0
M174 (MTH 174)	Calculus with Analytic Geometry II	4	T	0
P220 (PHI 220)	Ethics	3	T	0
P241 (PHY 241)	University Physics I	4	T	0
P242 (PHY 242)	University Physics II	4	T	0
S100 (SDV 100)	College Success Skills	1	T	0
	Total:			0
	SEM GPA:			
	Cumulative Credits and GPA:	0		

Semester Date: Spring/Summer 2011

Course No.	Title	Credit	Grade	Quality Points
C111	Technical Communications I	3	A	12
C211	Introduction to Computers	3	A	12
D111	Drafting	3	A	12
M111	Technical Math I	3	A	12
M112	Technical Math II	3	A	12
N111	Ship Construction I	2	A	8
	Total:	17		68
	SEM GPA:			4.00
	Cumulative Credits and GPA:	17		4.00

Semester Date: Fall 2011

Course No.	Title	Credit	Grade	Quality Points
B122	Business Operations and Leadership	3	A	12
N222	Ship Construction II	3	A	12
P221	Physical Science I	3	A	12
	Total:	9		36
	SEM GPA:			4.00
	Cumulative Credits and GPA:	26		4.00

Semester Date: Winter 2012

Course No.	Title	Credit	Grade	Quality Points
B112	Problem Solving	4	A	16
M121	Mechanics	3	A	12
P222	Physical Science II	4	A	16
	Total:	11		44
	SEM GPA:			4.00
	Cumulative Credits and GPA:	37		4.00

Academic Transcript

Academic Transcript

Apprenticeship Served: Marine Designer **Social Security No.:**
Learner Name: **Personnel No.:**

Semester Date: Spring/Summer 2012

Course No.	Title	Credit	Grade	Quality Points
M163 (MTH 163)	Precalculus I	3	A	12
	Total:	3		12
	SEM GPA:			4.00
	Cumulative Credits and GPA:	40		4.00

Semester Date: Fall 2012

Course No.	Title	Credit	Grade	Quality Points
E201 (ECO 201)	Principles of Economics I Macroeconomics	3	A	12
M165 (MTH 164)	Precalculus II	3	A	12
	Total:	6		24
	SEM GPA:			4.00
	Cumulative Credits and GPA:	46		4.00

Semester Date: Winter 2013

Course No.	Title	Credit	Grade	Quality Points
M173 (MTH 173)	Calculus with Analytic Geometry I	4	A	16
O233	Shipbuilding Operations	2	A	8
	Total:	6		24
	SEM GPA:			4.00
	Cumulative Credits and GPA:	52		4.00

Semester Date: Spring/Summer 2013

Course No.	Title	Credit	Grade	Quality Points
M174 (MTH 174)	Calculus with Analytic Geometry II	4	A	16
	Total:	4		16
	SEM GPA:			4.00
	Cumulative Credits and GPA:	56		4.00

Semester Date: Fall 2013

Course No.	Title	Credit	Grade	Quality Points
M279 (MTH 279)	Ordinary Differential Equations	4	A	16
	Total:	4		16
	SEM GPA:			4.00
	Cumulative Credits and GPA:	60		4.00

Semester Date: Winter 2014

Course No.	Title	Credit	Grade	Quality Points
M277 (MTH 277)	Vector Calculus	4	B	12
	Total:	4		12
	SEM GPA:			3.00
	Cumulative Credits and GPA:	64		3.94

Semester Date: Spring/Summer 2014

Course No.	Title	Credit	Grade	Quality Points
E140 (EGR 140)	Engineering Mechanics-Statics	3	A	12
	Total:	3		12
	SEM GPA:			4.00
	Cumulative Credits and GPA:	67		3.94

Semester Date: Fall 2014

Course No.	Title	Credit	Grade	Quality Points
C232	Technical Communications II	3	A	12
E245 (EGR 245)	Engineering Mechanics-Dynamics	3	B	9
	Total:	6		21
	SEM GPA:			3.50
	Cumulative Credits and GPA:	73		3.90

Semester Date: Winter 2015

Course No.	Title	Credit	Grade	Quality Points
E246 (EGR 246)	Mechanics of Materials	3	A	12
E247 (EGR 247)	Mechanics of Materials Laboratory	1	A	4
N250	Introduction to Marine Engineering and Naval	3	B	9
	Total:	7		25
	SEM GPA:			3.57
	Cumulative Credits and GPA:	80		3.88

VITA

J. Scott Christman
Graduate Studies
Old Dominion University

EDUCATION

M.S.	**1994, Occupational and Technical Education** Old Dominion University, Norfolk, VA
B.S.	**1994, Occupational and Technical Studies, Technical Education** Old Dominion University, Norfolk, VA
B.S.	**1993, Mechanical Engineering Technology** Old Dominion University, Norfolk, VA
A.S.	**1990, Mechanical Engineering** Thomas Nelson Community College, Hampton, VA
A.S.	**1987, Machine and Tool Operations** Thomas Nelson Community College, Hampton, VA
Diploma	**1987, Industrial Operations** Newport News Apprentice School, Newport News, VA

EMPLOYMENT HISTORY

2005-Present	**Manager, Student Services,** **The Newport News Apprentice School:** Newport News, VA
1997 – 2005	**Academic Instructor, Newport News Apprentice School:** Newport News, VA
1995 - 1996	**Public School Teacher, South Junior High School,** Morgantown, WV
1995 - 1997	**Curriculum Development Consultant, Newport News Apprentice School,** Newport News, VA
1993 - 1994	**Teaching Assistant, Occupational and Technical Studies, Instructor,** Old Dominion University, Norfolk, VA
1991 - 1991	**Operations Supervisor, Newport News Shipbuilding** Newport News, VA
1982 - 1990	**Apprentice Trades, Newport News Shipbuilding** Newport News, VA

PUBLICATIONS

Christman, S. (2012). Preparing for success through apprenticeship. *Technology and Engineering Teacher, 72*(1), 22-28.

Verma, A., Hughes, J., & Christman, S. (2004). *Enhancing instruction in lean manufacturing through development of simulation activities in shipbuilding operations*. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition, Salt Lake City, Utah.

RESEARCH

Christman, S. (1994). *Female enrollment in technology education in Virginia during the 1993/1994 school year* (Master's thesis). Old Dominion University, Norfolk, VA.

PRESENTATIONS

Christman, S. (2014). *Rethinking apprenticeship.* Paper presented at the 72nd Annual American Apprenticeship Round Table Conference, Pascagoula, MS.

Christman, S. (2013). *Preparing for a career through apprenticeship.* Paper presented at the 71st Annual American Apprenticeship Round Table Conference, Virginia Beach, VA.

Christman, S. (2012). *First year experience: Adding value to apprenticeship.* Paper presented at the 70th Annual American Apprenticeship Round Table Conference, Virginia Beach, VA.

Christman, S. (2005). *Lean manufacturing in shipbuilding.* Paper presented at the Fourth Annual North Carolina State University Conference on High Performance Work Teams, Phoenix, AZ.

Christman, S. (1996). *Shipbuilding apprenticeships: Meeting the demand.* Paper presented at the Society of Naval Architects and Marine Engineers, Ship Production Symposium, Annual Conference, San Diego, CA.

Christman, S. (1996). *Living with the Cabecar Indians of Central America.* Paper presented at the Technology Education Interdisciplinary Seminar, West Virginia University, Morgantown, WV.