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Basic Academic Skills and Post-Secondary Technical Education

A dissertation

presented to

the faculty of the Department of Educational Leadership and Policy Analysis

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education in Educational Leadership

by

Janet H. Latimer

December 2018

Dr. Don Good, Chair

Dr. Bethany Flora

Dr. Jeff Howard

Dr. James Lampley

Key Words: Basic academic competencies, WorkKeys, graduation rate, job placement status, post-secondary, technical education

ABSTRACT

Basic Academic Skills and Post-Secondary Technical Education

by

Janet H. Latimer

The purpose of this quantitative study was to determine if there is a significant difference in WorkKeys score, skills score, theory score, and job placement rates as compared by credential and program of study at a technical college in Tennessee. The study used existing data at a technical college. The population consisted of 445 students in seven programs from 2010-2016 who had participated in the WorkKeys online academic training modules.

The dependent variables for the study were WorkKeys score, skill score, and theory score. The independent variables were job placement status (related, non-related, not placed), program of study (Collision Repair/Motorcycle Repair, Computer Information, Welding/Machine Tool and Industrial/Residential Maintenance), and graduation credential (diploma, certificate, none).

Based on the data collected, it was found that there was a significant difference in the WorkKeys score by credential, skill score by credential, theory score by credential, WorkKeys score by job placement status, skill score by job placement status and theory score by job placement status. The job placement status was significantly affected by the program of study. Finally, the WorkKeys score was not affected by the program of study. The not placed status for the CIT program was higher than the other two categories (related and non-related) whereas the related status was the highest for the other three programs of study (WEL/MT, CRT/MOT, and IM/RBM).

DEDICATION

I would like to dedicate this body of work, first and foremost to my Lord and Savior. It has been through the grace of God and many prayers that I have reached this point and on most days with just enough light for the current step.

Secondly, I would like to dedicate this to my family. Without the support of my husband, Chuck, who stepped into so many roles at home and with our children, Maggie, Will and Daniel, over these past 6 years, I would not have been able to devote the time necessary to make this dream of mine a reality. Thanks for all the meals you cooked, loads of laundry you washed, and sporting events you attended alone.

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My final dedication is to my friend and mentor, Diana Wilkerson, who encouraged me to begin this journey in the first place. Your constant encouragement and “You GOTTA finish this” reminders helped get me through.

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CHAPTER 1

INTRODUCTION

Entrance requirements for students in diploma-level training programs at one Tennessee College of Applied Technology (TCAT) do not include any type of placement testing to assess college readiness; therefore, it is not clear upon enrollment whether individual students have the foundational skills necessary to successfully complete coursework. Due to this lack of entrance requirements, individual programs of study regularly admit students who do not successfully complete their chosen academic programs. Like academic courses at traditional universities, Career and Technical Education (CTE) programs, previously known as vocational education, are being challenged to develop more rigorous content (e.g. Shadden, 2011). This study examines what role, if any, testing and remediation play in the overall success of students as defined by scores, retention, graduation, and employment in their chosen fields of training for students enrolled in seven training programs at a technical college in West Tennessee. Certain admissions standards are set by Tennessee Board of Regents policy and others are put into place by the individual institutions (TBR, 2004). Satisfactory completion for any TCAT student is earned by completing occupational entry requirements, developing proficiency in course requirements, and completing a required Technology Foundations course.

TCATs offer a contextualized basic and allied skills development course called Technology Foundation which is required of most students. All programs with the exception of Practical Nursing integrate this content into their coursework (Complete College, 2010). The process of determining basic academic skill levels does not begin until a student has been officially enrolled into a program of study at a TCAT. After being admitted, students take the

Technology Foundations course to determine proficiency in math, reading, and locating information via a computerized pretest. Technology Foundations is a co-requisite course for every program of study except Practical Nursing. (Complete College America, 2010). Students who successfully complete the pretest are not required to complete any additional work concerning basic academic competencies because they are considered competent for their program of study. Students who score below the proficiency levels required for their specific program must attend weekly sessions in the Technology Foundations course, in which they receive computerized and instructor-guided practice lessons to help them reach the required levels. Both the students and the instructor provide input as to when students are ready to take the post-test. This is determined by scores in the Career Ready 101 remediation program. Students complete practice exercises and receive feedback in the form of scores for each level that they complete. Ideally, when students reach the desired level for their course of study, they are ready to take the post-test. Students may remain in the course for a minimum of a few days up to a several months. Unfortunately, some students never reach the required level. This study will compare outcomes as defined by graduation credential and job placement status among those groups of students.

The Colleges of Applied Technology comprise one of two types of higher education institutions governed by the Tennessee Board of Regents (TBR). The other type is comprised of 13 community colleges. According to the published mission statement, “the 27 Colleges of Applied Technology are the state’s premier providers of technical training for workers to obtain the technical skills and professional training necessary for advancement in today’s job market” (TCAT, 2014 para. #1). The 40 institutions offer programs of study in more than 200 teaching locations across the state.

The TBR was created in 1972 by the General Assembly to be the governing body of the state university and community college system of Tennessee. At that time, the member institutions of the system were the six state universities and 10 community colleges formerly governed by the Tennessee Board of Education. In 1983, the General Assembly placed the technical institutes and area vocational schools (now called Tennessee Colleges of Applied Technology) under TBR authority. The University of Tennessee (UT) system is a separate entity with its own Board of Trustees. On April 4, 2016, the Focus Act removed the six universities from the governance of the TBR and placed each of them under their own board of trustees. The governance, management, and control of the 13 community colleges and 27 colleges of applied technology remain with the TBR. The Focus Act further mandates that there should be collaboration between the TBR and the university boards (TBR, n.d.). The TBR and the UT Board of Trustees are coordinated by the Tennessee Higher Education Commission.

Tennessee is currently experiencing its own initiative to increase the number of college graduates. The potential for increased enrollment is a reality due to Governor Bill Haslam's program "Drive to 55" and the Tennessee Promise scholarship which offers two years of free tuition to the state's community or technical colleges. These programs create a challenge for TCATs to focus on retention and ultimately job placement for the new students who will be entering and graduating from a TCAT. Successful basic academic skills could play a role in increasing those rates. Entrance requirements for TCATs do not include basic skills assessments, yet satisfactory completion of coursework for vocational/technical students depends on the mastery of differing levels of basic academic competencies such as reading, math, and locating information. Ultimately, graduation rates may be affected by students' abilities to master basic skills.

Statement of the Problem

In order for the Tennessee Colleges of Applied Technology to fulfill their mission of serving as the state's primary provider of technical training, a strong foundation of basic academic competencies is necessary for the individual training programs to be successful. Poor basic skills or the lack of preparation in math, writing, and reading are often blamed for low completion and placement rates for students enrolled in vocational/technical institutions of higher education. Vocational education can be defined as a program of study requiring less than two years to complete. Other definitions include workforce training for existing and new businesses or industries (Warren, 2008). The terms *career and technical education* and *vocational education* are often used interchangeably. A variety of names and titles refer to public and private two-year institutions including community college, technical college, community-technical college, technical-community college, and finally, community and technical college. Although they possess diverse titles, two-year college mission statements typically include one or more of the following: two-year transfer and technical associate degree programs, workforce training for existing and new businesses and industries, remedial and continuing education, and adult services (Warren, 2008).

In Tennessee's public community colleges, 64% of recent high school graduates enrolling as first-time freshmen were signed up for at least one developmental or remedial course before entering a college-level program (Complete College America, 2010). More specifically, about 20,500 students took a developmental or remedial course in one of the 13 Tennessee community colleges during the fall semester of 2007. Of that group, 5,500 successfully completed a college level course in the fall of 2008, a success rate of less than 27%. This means that more than 73% of students were either still in developmental education or remediation after a year or they

stopped pursuing a postsecondary education. Tennessee's rates of placement into developmental or remedial courses and the rates of student success are consistent with those of other states. For many reasons, few students placed in developmental or remedial education complete those courses and enter a college program. As the age of the entering first-year student increases, the rate of successfully completing has the potential to drop even lower. At the TCATs, comparable rates of success are not available because developmental education and remediation is simply not offered as a set of courses to be completed before starting a program (Complete College America, 2010). Key to this study is the fact that students enrolling in most of the TCAT programs are not given a placement test prior to acceptance in a program. There is not a standardized placement assessment for TCAT students which is required of most community college students upon enrollment. After enrollment, each TCAT student is simply made aware that the Technology Foundations course is required.

Akinwumiju (2010) suggested ways that administrators and decision-makers might use information concerning technical education, basic academic skills testing, and remediation in planning and running programs designed to prepare graduates for employment, help them maintain employability, and finally, aid them in advancing in their occupations. Mitchley-McAvoy (2012) posited that academic preparedness plays a positive role in community college retention. Additionally, Rayno (2010) found significant differences between successful and unsuccessful nursing students in mathematics composite scores on a standardized entrance test – the Nurses Entrance Test (NET) that assesses basic skills such as math and reading. Furthermore, the question remains as to whether or not basic academic skill levels should be determined prior to enrollment and, if necessary, remediated for successful completion of a vocational/technical education program of study.

Completion of a program of study at a TCAT can last anywhere from 12 to 20 months and is recognized by the conferring of a diploma at the conclusion of the training program. (TBR, 2014). These diplomas are awarded to students who reach the highest level of training and proficiency. They are not based solely on the amount of time spent in training.

Students who reach a determined level of proficiency in their field of study that is typically lower than what is required for a diploma will earn a certificate. Diplomas are the highest level of academic achievement awarded by the Colleges of Applied Technology. Certificates are awarded on the basis of achievement and demonstrated proficiency in the area of training and not only on the basis of the amount of time spent in training (TBR, 2016).

Basic academic competencies are foundational to the success of vocational technical students in a post-secondary educational environment. It can be challenging for students without a strong foundational background to complete programs of study successfully. As a result of its mission, TCAT is challenged to provide the state of Tennessee with a skilled workforce by preparing students for careers in vocational settings. Students who enroll while lacking this strong foundation are given the opportunity, through Technology Foundations to remediate in basic academic competencies.

Purpose Statement

The purpose of this quantitative study was to determine if there is a significant difference in WorkKeys score, skill score, theory score, job placement status as compared by type of credential earned and program of study. The study will compare job placement status and program of study as well as evaluate the relationship between the average of three WorkKeys tests – specifically math, reading, and locating information – and program-specific theory and skill score, graduation credential, and job placement status of students in seven programs of

study at TCAT. High graduation and job placement rates are generally defined as indicators of TCAT's programmatic success. The higher each of these rates are for a particular program, the more successful the program as reported to Tennessee Higher Education Commission and Tennessee Board of Regents. This is based on benchmark percentages as set by THEC and TBR. Each academic program must maintain a graduation rate of 60 percent and a job placement rate of 70 percent in order for the campus to maintain it as an academic offering.

Basic academic competencies are defined as math, reading, and locating information scores as determined by WorkKeys. This is a system of job analysis, assessments, and skill gap analysis developed by ACT in the early 1990s for workplace skill assessment (Stone, 2007). Each of the eight initial assessments was designed to rate candidates' skill levels in a specific skill area. The eight areas are applied mathematics, reading for information, locating information, teamwork, applied technology, observation, listening, and writing (ACT, n.d.).

Research Questions

Individual programs of study regularly admit students who do not achieve success in persisting to graduation. One factor could be the lack of entrance requirements for TCATs. In order to explore a predictive model for students to increase chances of success within the TCAT system, eight research questions were designed to examine the differences in the WorkKeys score, final theory and skill scores, graduation credential, and job placement status for students who complete a basic academic skills course.

The following research questions guided the study:

RQ1. Is there a significant difference in WorkKeys score as compared by the type of credential (diploma, certificate, or none) earned by students?

RQ2. Is there a significant difference in skill score as compared by the type of credential

(diploma, certificate, or none) earned by students?

RQ3. Is there a significant difference in theory score as compared by the type of credential (diploma, certificate, or none) earned by students?

RQ4. Is there a significant difference in WorkKeys score between job placement categories (related, non-related, or not placed)?

RQ5. Is there a significant difference in skill score between job placement categories (related, non-related, or not placed)?

RQ6. Is there a significant difference in theory score between job placement categories (related, non-related, or not placed)?

RQ7. Is there a significant difference in WorkKeys score as compared by program of study?

RQ8. Is there a significant relationship between job placement and program of study?

Significance of the Study

The importance of accurately assessing academic skills and properly advising community and technical college applicants upon college entry cannot be understated. According to Zachry and Schneider (2010), “the goal of developmental education is simple: prepare students to engage in college-level work, so they can earn a credential in their field of choice and leave school qualified for a greater range of jobs and salaries” (p. 13). How four-year and two-year schools achieve that can look very different. The open door of the community college too often becomes a “revolving door” when academic advisement is inadequate (Bowles, 2004).

The data for placement into developmental or remedial courses and the rates of student success in Tennessee are consistent with the rates of other states (Complete College America, 2010). Therefore, this study could be beneficial to administrators, instructors, and student

services officers of colleges of applied technology as they seek to increase enrollment, retention, graduation, and placement rates for their campuses. This study provides additional information on the topic of academic preparation at the vocational/technical level of higher education with particular emphasis on basic academic competencies.

Statewide, the Tennessee Colleges of Applied Technology boast an 84% placement rate, which is above the national average (TBR, 2014). These placement rates are important to the overall success of the colleges as reflected by the effort that is made to keep in contact with former students after they graduate and begin their careers. Not only does it help determine student success but also helps make the training more relevant to the needs of new students and industry. This information is collected through a yearly Employer Survey. Employers, faculty/staff, and others are involved to evaluate and improve ways of serving the students' needs. For example, according to the Council on Occupational Education (COE, 2017), placement status forms are mailed to graduates within 90 days of their completing courses of study. In addition, an alumni survey is mailed for further follow-up within a year of completion. Students are strongly urged to respond candidly to these questionnaires. These efforts to measure the success of the student could be enhanced if the basic academic skill level of the student is known and addressed through remediation and other measures. Therefore, students, academic programs, institutions, and ultimately the employers served by the institution will potentially benefit from a strong basic academic skills program within vocational, technical education. In summary, the results of this study may be helpful in fostering student success.

In addition, relatively little academic research exists on WorkKeys as a predictor of academic success (Bowles, 2004). Bowles examined differences in WorkKeys assessments of reading for information. Bowles focused on the feasibility of using results of ACT's WorkKeys

examinations for academic placement in standard mathematics, English, and reading courses at the two-year college. Bowles concluded that the correlations were not strong enough, and the success rate ranges were too broad to support the use of WorkKeys for placement into standard academic courses.

Definitions of Terms

Essential terms must be defined so that the study may be more clearly understood. The following terms are defined and hereinafter used:

Basic Academic Competencies – academic skills such as math, reading, writing, or computation. For the purpose of this study, this will be limited to math, reading, and locating information (ACT, n.d.).

Final numerical score- evaluation in the form of a number grade at the end of each course unit. Each student receives three grades per unit of study, which are divided into skill, theory, and worker characteristics.

Graduation Rate – the percentage of students in all of the 7 programs of study who persist to completion within a defined reporting period, as determined by the Tennessee Board of Regents. When a student completes all competencies required for a certificate or diploma in a full-time academic program of study within the published length of program, which is typically 12-20 months, they are eligible for graduation (COE, 2017).

Job placement rate- the percentage of students who are employed in the field of education pursued or in a related field, or has received a certificate or diploma and entered the military or continued his/her education within a 12-month reporting period (COE, 2017).

Vocational Education/Career and Technical Education Program – a two-year or less technical program, workforce training for existing and new businesses and industries, remedial and continuing education, or other adult services (Warren, 2008).

WorkKeys –a basic skills remediation program and assessment tool developed by American College Testing (ACT) for determining workplace readiness. This system attempted to fill a void so that those who wanted to enter the workforce rather than attend a 4-year college could be assessed (Lindon, 2010).

Delimitations and Limitations

Delimitations for this study include the use of existing data. Data entered by staff members at TCATs and reported by the Tennessee Board of Regents is assumed to be accurate. Additionally, data in the national ACT database regarding students who completed basic skills assessments and remediation through WorkKeys and KeyTrain, an interactive training system, is also assumed to be accurately maintained and reported.

This study is limited to students enrolled at a college of applied technology in West Tennessee during a six-year period who completed the WorkKeys online training module in the academic areas of Reading, Math and Locating Information. Therefore, results may not be generalizable to other institutions or geographic locations.

Overview of the Study

Chapter 1 of the study presents information regarding basic academic skills testing and remediation in vocational/technical education. Chapter 2 provides a review of existing literature on the subject of academic testing and remediation in vocational/technical training programs.

Topics including WorkKeys as well as retention, graduation, and placement rates for post-secondary technical education are covered. Chapter 3 provides an explanation of the research design and data analysis methods employed in the study. Chapter 4 presents the results of the data analysis, and Chapter 5 includes a summary of the study and recommendations.

CHAPTER 2

REVIEW OF LITERATURE

Basic academic skills' testing has been a part of technical education for decades (Shelby, 2005), but the question is posed regarding its significance in the overall success of students enrolled in vocational training programs of less than 2 years. Additionally, postsecondary remediation is a "hot button" topic on educational policy agendas, according to Bahr (2008). Basic academic competencies can be defined as math, reading, and locating information as determined by ACT WorkKeys. ACT WorkKeys is a job skills assessment system that helps with the selection, hiring, training, developing, and retraining process of workforce development. Through a series of tests, foundational and soft skills are measured. Additionally, the tests don't only give an indication of reading and writing competency. Instead they measure a range of hard and soft skills relevant to any occupation, at any level, across industries (ACT, 2018). Akinwumiju (2010) analyzed and interpreted a basic academic skillset, specifically reading, writing, and computation. He further associated these three areas with success in vocational and technical activities. Finally, he suggested ways in which administrators and decision-makers might use his results in the planning and operating of programs designed to prepare youth for employment, help them maintain their employability; and advance within their chosen careers. His suggestions for educators included comparing perceptions of basic skill needs with those of employers and employees or working towards interrelating the disciplines of mathematics and English with vocational education.

Career and Technical/Vocational Education

Vocational/technical education has been described by Novel (2008) as encompassing three curricula. They are occupational education, introductory technical education, and family and consumer sciences education. Occupational education, includes general labor market preparation with courses such as typewriting/keyboarding. Introductory technology education teaches general employment skills not specific to one occupational area as well as courses that teach skills and knowledge required to perform a specific skill, such as welding, nursing, or cosmetology. Lastly, family and consumer sciences education offers courses to prepare students for roles outside the paid labor market (Novel, 2008).

Vocational/technical education can be traced to ancient times. Shelby (2005) reviewed the foundation of vocational education through the work of McClure, Chrisman, and Mock (1985) who documented the beginnings of vocational education back to the Babylonian Code of Hammurabi. Apprenticeships were the only means of education available to those wishing to learn a trade, and apprenticeships for the Egyptians, Hebrews, Greeks, and Romans served as important steps toward today's programs of training and development.

In America the common school movement (1830-1860) played an important role in the foundation of vocational technical education. This, in turn, helped prepare a skilled workforce that was needed for the increasingly industrialized society (Webb, 2006). Additionally, there were a number of political, social, and economic factors that transformed not only education but also other institutions in the 19th century. The common school movement was also affected by the demands for larger and more urban populations, the extension of suffrage to the common man, and the increase in immigration.

The Morrill Act of 1862 that established the land-grant colleges proved to be a major step in the support of vocational education. Signed by Abraham Lincoln, the act allocated 30,000 acres of land for educational purposes to each state (Shelby, 2005). Later, the Smith-Hughes Act of 1917 has been seen as the turning point for vocational education as it was the first to provide annual appropriations for the teaching of vocational education in secondary schools. Limited to those programs under public supervision and control and those who served students that were at least 14 years old and below college level, federal funds were provided to participating states on the basis that the states match all funding dollar for dollar.

It was not until the 1960s that vocational education was funded at the college and university level. The Vocational Education Act of 1963 broadened the definition of vocational and technical education and increased federal funding to vocational education schools, vocational work-study programs, and provided additional funding for research and experimental programs (Shelby, 2005). Modern career and technical education programs operate outside the framework of traditional education programming by providing a separate funding stream, along with separate goals and accountability for career-technical educational programs (Novel, 2008).

The Higher Education Facilities Act of 1963 provided additional funding for classrooms, libraries, and laboratories in public institutions for higher education, while the Economic Opportunity Act of 1964 authorized funding to provide jobs through college work-study programs to those from low-income families, and vocational training for those in welfare programs. The next major change for vocational education, the Carl Perkins Education Act of 1984, amended the Vocational Education Act of 1963 and provided easier access to vocational training to all persons, including handicapped, disadvantaged, single parents, homemakers, and those who were in prison (Shelby, 2005).

Akinwumiju (2010) stated that vocational education in the United States has seen a transformation from its beginnings to now. This transformation has been from an agriculture-based economy to an information-based economy. All these changes demand different kinds of skills and the skill set has become highly academic. As a result, the shift towards information and service jobs calls for people with stronger academic backgrounds. Skilled employees need to be able to read, communicate, and process information.

Research such as Warren's (2015) considered the effects that both academic and vocational preparedness have on students' performance in a postsecondary CTE or apprenticeship program. He also studied the relationship between students' academic program performance and vocational attainment after program completion. He found that for every one unit increase in a math course, students were 1.022 times more likely to complete their vocational program of study. Novel (2008) focused on occupational education wherein a student takes a sequence of courses leading to a career pathway. He found that 60 percent of vocational concentrators matriculated to college and fewer than 15 percent completed an associates or bachelor's degree within the timeframe of his study. Previous research such as Shelby's 2005 study focused on attitude in regard to vocational education. The purpose of Shelby's project was to identify the attitudes and Myers-Briggs Type Indicator personality type of four groups toward vocational education and compare these differences between the genders. She found that academic teachers have a less positive attitude toward vocational education than vocational teachers, administrators, and counselors; when testing vocational education attitudes in light of their personality characteristics generated by the Myers-Briggs Type Indicator, Intuitive (N) personalities demonstrated a less positive attitude than those with a Sensing (S) personality; and females demonstrated a less positive attitude toward vocational education.

In addition, Warren (2008) examined faculty and administration perceptions of Kentucky's merger of the community college system and their vocational/technical training centers. An Image of Vocational Education Scale was selected to assess the attitudes of vocational teachers, academic teachers, counselors, and administrators at selected community college. He found that a gap exists between the perceptions of administrators and faculty. Administrators have a higher perception of the merger. Shelby referenced work from the 1960s, 1980s, and 1990s in determining the image of vocational education as viewed by heads of households, parents, employers, schoolteachers, and school administrators. He addressed the national attitude regarding the importance of a "college" education versus vocational training as well as attitudes at selected community colleges in Texas using the Image of Vocational Education Scale developed by Wenrich and Crowley in 1964 and a Myers-Briggs Type Indicator (MBTI) (Shelby, 2005). The results showed that there was no significant interaction between job and gender pertaining to the perception of vocational education. The findings show that academic teachers tend to have less positive attitudes toward vocational education than do vocational teachers, administrators, and counselors.

According to Warren (2008), "The problem was that if Kentucky's postsecondary education reform initiatives do not successfully address the community responsiveness demands and high expectations of an accountability-conscious public, serious consequences may await public, two-year colleges statewide" (p. 6). Warren states "... higher education contains little, if any, history of successful top-down initiatives, as faculty ownership is a key element of change in institutions of higher education" (p. 30). The results suggested that administrators viewed the merger more favorably than the faculty did. Faculty made 52 positive comments and 308 negative comments regarding the merger.

As with any educational endeavor, funding issues must be addressed. Baxter (2012) outlined reasons that career and technical education (CTE) professionals fought to ensure that Federal Perkins Funding would not be eliminated. “Since we were so busy staving off eliminations and were relying on Congress to save CTE funding, we didn't receive an increase and instead remained level funded” (p. 21). Baxter further explained that with unemployment remaining high and more people facing financial hardships, the number of students eligible for Pell Grants continues to climb. Baxter further outlined why funding was likely to get scarcer in the following year. Some of his key points were that the United States debt continues to climb; sequestration and Pell grant program will continue to grow.

Academic Preparedness

Workplace skills, also known as employability skills are “transferable core skill groups that represent essential function and enabling knowledge, skills, and attitudes required by the 21st century workplace” (Stone, 2007, p. 9). These workplace/employability skills include basic level education information and job-specific knowledge. Findings from case studies have suggested production workers need more of the types of skills traditionally offered in school (e.g., math, reading, and writing) as well as new skills not normally taught in conventional education curricula.

Another key element of academic preparedness is remediation. According to the National Center for Educational Statistics (2014), remediation is the most common approach used by colleges to assist students who possess weak academic skills. Remedial – also known as developmental-education – consists of courses and other services (such as tutoring) that are designed to foster skills generally acquired in high school. It is a central feature of American

higher education. Among freshman entering college in the fall of 2000 nearly 30% participated in remediation. Remediation is even more common at two-year (or community) colleges with 42% of entering freshman taking a remedial course (Martorell & McFarlin, 2011). Many researchers use the terms remedial and developmental interchangeably. However, Boatman and Long (2011) defined each separately in their nationwide study on the effects of postsecondary remedial and developmental courses. In Tennessee, developmental courses refer to courses that are just below college level while remedial courses contain lower-level material intended for students who are very underprepared (p. 5).

Bahr (2008) examined the long-term outcomes of 85,894 freshmen in 107 community colleges in California. He studied the academic outcome of those who remediated successfully, defined as achieve college level math skills, with those who achieve college level math skills without remediation and found that for students who remediate successfully in math, the goal is achieved. However, his study also reveals that 75.4% or 3 out of four, remedial math students do not remediate successfully and more than four out of five (81.5%) do not complete a credential or transfer. Similarly, Swords (2006) researched the effects of remediation on students in an online business course at a technical college who did not score the minimum required score on the English, reading and math portions of the ASSET test. Swords concluded that comprehensive studies courses do not necessarily assist the student in the completion of online business tech courses. Furthermore, some students were able to successfully pass the course even though they did not meet the benchmarks for the ASSET and chose not to enroll in the remediation course. Of the 52 students who did not score the minimum on the ASSET, 29 chose not to do remediation, yet 19 percent of them successfully completed their course. Conversely, Lenker (2015) determined that a new version of ALEKS, a math remediation online course, increased

college math placement due to personalized web-based tutorials based on the student's first attempted test. His results showed the students benefitted. Their GPA in a subsequent math course was up from 2.11 for those who did not complete the remediation course to 2.81 for those who did not.

Despite the prevalence of remediation, substantial controversy surrounds its use. Martorell and McFarlin (2011) noted that there was support for the fact that remediation helps poorly prepared students succeed in college by allowing them an opportunity to reach the levels of their peers. According to this view, underprepared students are better served in remedial courses than they would be floundering in college-level courses. In contrast, opponents argue that any benefits of remediation are outweighed by its high cost. Estimates from 2001 suggested public colleges spent \$1 billion per year on remediation and some argued that the costs are even higher. A concern about cost explains in part why some states have cut funding for remediation programs (Martorell & McFarlin, 2011). Other results suggested that remedial and developmental courses produce different outcomes for students at varying levels of preparedness (Boatman & Long, 2011).

Research shows that what students learn and how they learn it through remediation is pertinent to their educational process and ultimate success or failure. For example, Bahr (2008) shows that the fundamental principle of remediation is equality of opportunity, and one definitive manner in which this can be demonstrated is equality of outcomes. In other words, students who remediate successfully in math should exhibit academic outcomes that are comparable to those of students who do not require remediation in math, all else being equal. According to Kenner and Weinerman (2011), adult learners returning to the academic field come with established metacognitive strategies. According to Knowles, Holton and Swanson (1998) an adult learner is

one who “by virtue of simply having lived longer, has accumulated more experiences than they had as youths. But they also have had different kinds of experiences. This difference in quantity and quality of experience has several consequences for adult education” (p. 66). In most cases, these strategies may not be conducive to collegiate learning and could even be detrimental. The longer adult learners have been away from the academic environment, the more deeply ingrained these strategies tend to be and the more difficult they are to dislodge. Additionally, Kenner and Weirnerman’s 2011 research showed that, in order to dislodge these ineffective strategies, it is critical to provide new strategies in such a way that they are in direct competition with the adult learners’ existing strategies.

Much adult learning theory comes from the organizational development (OD) field where the focus on learning theory is viewed as a way of providing employees with the tools they need to perform better in the workplace (Kenner & Weirnerman, 2011). In the 1950s and 1960s, OD practitioners created new learning models because traditional higher education pedagogical models did not translate well into the workplace-training environment. One such practitioner, Malcolm Knowles, coined the term *andragogy* to recognize the needs and features of this distinct learning population and to separate adult learning theory from traditional pedagogy. Building upon theories from organizational development, Knowles (1998) identified five principles that characterize adult learners:

- a. The need to know. Adult learners need to know why they need to learn something before undertaking it.
- b. The learners’ self-concept. Adults have a self-concept of being responsible for their own decisions for their own lives.

c. The role of the learners' experiences. Adults come into an educational activity with both a greater volume and a different quality of experience from youths.

d. Readiness to learn. Adults become ready to learn those things they need to know and be able to do in order to cope effectively with their real-life situations.

e. Orientation to learning. In contrast to children's and youth's subject-center orientation to learning adults are life-centered in their orientation to learning (pp. 64-67).

While more than 30% of college students in 2009 were adult learners, many aspects of the higher education system was not designed with these students in mind (Tannehill, 2009). Programs offered to non-traditional students varied by institution as well as in the support provided to them while they are seeking their degrees. Institutions of higher learning have begun to respond to the adult learner through a number of initiatives including providing different services, offering a variety of class delivery formats both on campus and online, and increasing the application of andragogy into the delivered instruction. Williams (2011), in her study about the experiences of older adult dislocated workers in community colleges, focused on Malcolm Knowles' Andragogy theory of adult learning. Williams noted that the decisive shift in adult learning has been greatly influenced by the model of andragogy. Williams further notes that learning is a process and community college student services offices are geared to traditional students continue along a step-wise educational pathway. Yet older adult students typically have breaks in education, established personal and professional commitments outside of college including family, partners, financial obligations, and civic duties. According to Kolb's (1981,

1984) model, the most effective learning requires four different learning abilities: concrete experience, reflective observation, abstract conceptualization, and active experimentation.

As Knowles, Holton, and Swanson (1998) had done, Kolb (1984) conceptualized learning as a process. Experiential learning, as defined by Kolb, is the process of knowledge creation through experience. These four learning abilities are formulated into a learning cycle. Four learning roles are assigned to the transitions between the four learning abilities: the reflector role, the theorist role, the pragmatist role, and the activist role. There is no designated "starting point" for the cycle; however, learning is most effective when the student goes through all points, regardless of where he or she begins (Petkus, 2000). The strength of the model includes its focus on the experiential nature of learning and the inclusion of reflection. Yet critics of Kolb claimed the model views learning as straightforward, purely cognitive, and neglectful of outside influences such as hegemony on the learning process (Williams, 2011).

WorkKeys

In 1992 ACT, Inc. the testing corporation that is best known for its college readiness assessment by the same name, developed an assessment tool for determining workplace readiness, the WorkKeys System. The objective for those who took the ACT's college readiness assessment test was to enter a four-year postsecondary institution (Lindon, 2010). WorkKeys is a group of assessments that was developed by ACT in Iowa City, Iowa, during the early 1990s (Stone, 2007). This system attempted to fill a void for assessment of those who wanted to enter the workforce rather than attend a four-year college. The WorkKeys assessment system is also designed to provide skills assessments for more than a single industry. WorkKeys has been described as a way for employers "to identify the skills employees need to be successful and to

determine where additional training will help build a higher performance workforce” (p. 52). This credential was selected by the Tennessee Board of Regents as the basic academic skills assessment to be used by all 27 TCATs statewide. For example, at TCAT-Paris new enrollees will be evaluated after enrollment using WorkKeys and offered remediation if they do not reach a skills level of five in each of the three areas of math, reading, and locating information (TCAT-Paris, 2014).

The eight initial assessments were designed to rate candidates’ skill levels in a specific skill area. The assessment areas are applied mathematics, reading for information, locating information, teamwork, applied technology, observation, listening, and writing. They have all been available since the mid-1990s (ACT, n.d.). Correspondingly, *Career Ready 101* is a comprehensive, easy-to-use curriculum to help individuals master the work readiness skills they need to be successful in the WorkKeys assessments. This internet-based learning system also includes courses in career awareness and exploration, career preparation and foundational work skills among others as measured by the WorkKeys job skills assessment systems. It is a computer-based, self-directed system for improving WorkKeys scores (ACT, n.d.).

All of these components are part of ACT’s Work Readiness System. ACT WorkKeys has helped millions of people in high schools, colleges, professional associations, businesses, and government agencies build their skills to increase global competitiveness and develop successful career pathways (ACT, n.d.). Additionally, successful completion of ACT WorkKeys assessments in applied mathematics, locating information, and reading for information can lead to earning ACT’s National Career Readiness Certificate (NCRC), a portable credential earned by more than 2.3 million people across the United States (ACT, n.d.).

Stone (2007) compared success by race, age, and gender in regard to WorkKeys assessments for reading for information, locating information, and applied mathematics. The results showed differences in the applied mathematics scores with older test takers scoring significantly lower than their younger counterparts. In addition, Stone found that older test takers did not score as well on the reading for information or locating information exams. Significant differences were also found in scores in all three WorkKeys assessments when broken down by race and there were significant differences by gender in the Math assessment (2007).

In 2010, Lindon published research that utilized WorkKeys as a measure of community and technical college student success. He noted there is little research comparing student performance between high scores on the WorkKeys assessments and course grades once a student enters the community and technical college. He found that there were weak correlations between WorkKeys assessment scores and grades of C or better in college level reading and math courses. His findings also indicated weak correlations between WorkKeys assessment scores in reading for information and applied mathematics and cumulative grade point averages.

The ACT admissions test continues to be a national standard for college readiness. Of ACT-tested graduates in 2014, 86% aspired to postsecondary education. Of the national 2013 ACT-tested graduating class 87% aspired to enroll in postsecondary education, compared to 69% who actually did enroll. If that gap had been fully closed, an additional 314,831 of the nation's 2013 ACT-tested graduates would have enrolled in postsecondary education (ACT, n.d.). Of the 2014 ACT tested high school students, only 6% across the nation stated a vocational-technical career aspiration as opposed to 44% who indicated pursuing a bachelor's degree. Not all are prepared nor do they follow through with the university degree. Currently, 29 states have state-

funded partnerships with ACT to offer WorkKeys Assessments to high school students (Act, n.d.). This number is up from seven in 2007 (Stone, 2007).

Three of the eight WorkKeys assessments are explained in further detail below.

Reading for Information

The WorkKeys reading for information assessment measures the skills people use when they read and use written text in order to perform job duties (ACT, n.d.). The written texts could include memos, letters, directions, signs, notices, bulletins, policies, and regulations. Reading for information materials does not include information that is presented graphically such as in charts, forms, or blueprints.

There are five score levels of difficulty (3-7) in reading for information, and the score levels build on each other. At the more complex score levels tasks can also involve more application and interpretation. Reading for information is the only WorkKeys exam that has been correlated to grade level (ACT, n.d.).

Applied Mathematics

The WorkKeys applied mathematics assessment measures the skills people use when they apply mathematical reasoning, critical thinking, and problem-solving techniques to work-related problems. The test questions require the examinee to set up and solve the types of problems and do the types of calculations that actually occur in the workplace. This test is designed to be taken with a calculator and a formula sheet that is provided. While individuals may use calculators and conversion tables to help with the problems, they still need to use mathematics skills to evaluate and solve them. There are five score levels of difficulty, which

build on one another. Score level 3 is the least complex and score level 7 is the most complex (ACT, n.d.).

Locating Information

Locating information is the skill people use when they locate, synthesize, and use information from workplace graphics such as charts, graphs, tables, forms, flowcharts, diagrams, floor plans, maps, and instrument gauges (ACT, n.d.). The WorkKeys locating information assessment measures the skills people use when they work with workplace graphics. Examinees are asked to find information in a graphic or insert information into a graphic. They also must compare, summarize, and analyze information found in related graphics (ACT, n.d.). There are four score levels of difficulty. Score level 3 is the least complex and score level 6 is the most complex (Stone, 2007).

Basic Academic Competencies

Different types and methods of basic competency testing play a role in determining if programs of basic competency training are successful in many vocational and technical institutions of higher education. The state of Tennessee has allocated significant amounts of money during the past two decades to fund the developmental studies program in the state's colleges and universities. In the Tennessee Board of Regents Policy Brief on Access, it was reported that 60% of students who were enrolled in the system tested into at least one developmental studies course (Yates, 2010). This report cited that this rate exceeded national estimates that 28% of first-time college students would be required to take developmental courses. The numbers were more profound at two-year community colleges where 74% of

students required some level of developmental education. The high percentage of students in developmental studies has become a significant cost issue for both the TBR system and the students enrolled at its institutions.

The goal of Pan's 2012 research was to address three problems in the instruction of basic skills students. The first was low success rate, the second was that many are taught with drill and memorization, and the third was that many instructors need more knowledge on how to make their courses engaging. Pan's qualitative study found that the majority of basic skills students valued reading and writing but lacked confidence to practice them. They were reluctant readers and writers and seldom engaged in social interaction around texts. Providing appropriate and relevant texts that are interesting to the students is critical in order to engage them in academic literacy and connect reading and writing. Pan also aimed at contributing to research on culturally relevant texts that engage or disengage the students.

In 2013, Hargens examined the demographic variables and various methods of intervention available at the community college to assist the underprepared vocational math students in achieving success. His findings show that of 1,156 students in the study, 56 percent were aged 24 or younger and were underprepared in math. Of those, 30 percent were severely underprepared. Using a logistic regression analysis, his research suggested that approximately 68% of the variance in academic success could be predicted with a combination of demographic variable such as age, gender, socioeconomic status and level of math preparedness. This includes activities such as successfully completing a developmental math course, utilizing tutoring services, utilizing computer-aided math software, and participating in a consistent student support program.

Similarly, Lavonier (2014) evaluated the effectiveness of two instructional approaches—strategic reading and traditional, textbook-based instruction— for remedial reading courses at a community college. The findings showed that both methods of instruction are equally appropriate for the remedial reading course.

England's 1993 study examined the relationship of placement systems to the performance and persistence over 2 years of 4,285 first-time, full-time, degree-seeking students with skill deficiencies in reading, writing, and mathematics. He found that ethnicity proved to be the most important moderator variable. He also noted that although retention rates were not a specific object of the investigation, 50 % of the population was retained with Hispanics being retained at the highest rate (54.6%). Concerns about the declining basic skills competence of high school graduates and college students and the effect that inadequacy has had on the economy as well as the performance of higher education institutions have resulted in an expansion of the prevalence and scope of these programs and the involvement of governmental agencies in their implementation, design, and evaluation.

England (1993) recognized that Texas students must pass the official TASP test before receiving any type of degree, exceeding 60 college-level hours, or registering for an upper-level (junior level or above) course. He further noted that, while colleges and universities must continuously remediate skill-deficient students after they have been identified, they are required to do so in only one deficient skill area at a time. England also noted that open admissions policies are one factor driving the need for more remediation courses at the post-secondary level. The Colleges of Applied Technology in Tennessee also have open admissions policies, which means students are accepted and enrolled regardless of their grade point average and sometimes regardless of their place of residence. Additionally, England's research revealed that pressure

from employers who are "frustrated about hiring college graduates unable to write and read" contributed to the growth in remedial programs in colleges and universities" (p. 18). He also noted that because of their prevalence, importance, and cost, the success of postsecondary remedial education programs should be evaluated. England did not report a single instance where participation in a developmental program was associated with lower rates of retention. His work further indicated that students in developmental programs tend to improve their grades in college-level courses and usually demonstrate gains in basic skills as measured on pre- and post-tests.

According to Hargens (2013), developmental or remedial math courses are designed to help students improve their math skills before registering for the college-level math courses required for graduation. At some institutions, students are required to enroll in the course to which they are assigned based on their placement test scores. In other institutions students are free to enroll in the classes they select regardless of their entrance exam scores even if their previous academic history indicates they should complete developmental education (Hargens, 2013). Neither scenario is true with the Colleges of Applied Technology; students are accepted and enrolled into programs prior to completing their WorkKeys assessment (TCAT-Paris Student Handbook, 2014).

Hirsch (2011) examined, through a qualitative case study, an accelerated career technical education (CTE) diesel mechanics certificate program at a technical community college in California that embedded basic skills education in regular classes in a community college. This was a pilot program. Of the 30 students who were still enrolled in the program understudy at the end of August 2010, (out of an initial 32 who matriculated in April of the same year), 100% graduated nearly six months later on February 3, 2011. Of these graduates, 18 of them, or 60%,

persisted to take follow-up courses leading to an Associate of Science Degree. Hirsch stated that, by studying a program that integrated basic skills education within an accelerated career technical education program, one could determine what aspects of a contextualized program might contribute to better course completion. Hirsh's study investigated a hypothesis that examined whether students would find meaning in these skills by providing basic skills training in the context of applied career technical training.

The purpose of Hirsh's 2011 study was to learn about student success factors, especially whether a generalized sense of self-efficacy developed in conjunction with the course. Understanding success factors, including the building of self-efficacy, allowed the development of a theory of action and construction of a logic model that may assist future course designers in learning from this program and implementing features that may lead to similar success in future programs.

Findings from Hirsh's 2011 study suggested that combining basic skills training that is contextualized with core course material and opportunities to apply learning in real time may be part of the reason for its success. Hirsh defined "contextualized" as basic skills being taught in the context of the course materials in the career technical field of study. According to the Hirsh, since 2009, only a few studies completed on basic skills education have focused on remedial education delivered in the traditional manner, which is sometimes referred to as "skills and drills." Lacking is research about basic skills taught in the context of specific job skills training. Additionally, he noted a negative effect on students' attitudes and expectations when enrolled in "stand-alone" remedial courses (another phrase for basic skills). On the other hand, Uwono Koike (2010) discovered that some students chose to take the stand-alone remedial courses as a way to brush up on math skills even if they qualified to take college math.

Damon (2010) identified the possibilities for success in career and technical education when integrating an academic standards and accountability system into an already existing competency-based curriculum. The use of interview, observation, and document analysis were used in this study and served to triangulate the data. Damon pointed out that one strength of many CTE teachers has been their ability to bring their career area experience into the classroom and incorporate it into the training program for their students. However, the adoption of an academic standards and accountability systems has challenged them to integrate academic content into their competency-based curriculum. Typically, CTE teacher training programs do not include core academic content. Curriculum integration has been a daunting task for CTE teachers.

The 2010 research conducted by Akinwumiju was directed towards analyzing and interpreting the basic academic skills of reading, writing, and computation associated with success in seven different areas of vocational education: health, agriculture, distance, home economics, business, trade & industry, and technology. The findings show that graduates who participated in the 1982 follow-up survey performed consistently better than state norms in all basic skill areas across the vocational education fields of study. He found that graduates were strong in the areas of whole number operations, reading, decimal operations, language usage and grammar. They were weakest in measurement, mechanics (writing) and general mathematics.

Akinwumiju (2010) used a longitudinal approach. The data for the research came from three major sources: 1) the 1981 Basic Skills Survey, 2) the 1982 Employer's Survey, and 3) the 1982 Graduate Follow-Up Survey. His evidence indicated that there are differences in the mean scores of employees on the Basic Skills Test across the seven program areas. Further analysis revealed that the differences were not statistically significant for six of the seven skill areas, but

there were significant differences in the mean scores of employees across the seven program areas in grammar. Post hoc comparison tests revealed that no two program areas were significantly different.

Retention Rates

Multiple studies have been conducted on retention rates. Keeping the student engaged and learning at a level to complete the course is typically the goal for any post-secondary institution. For example, Hirsh (2011) proposed that understanding success factors, including the building of self-efficacy developed in conjunction with a course of study, allowed for the development of a theory of action and construction of a logic model that may assist in designing courses with higher completion rates in the future. He utilized Bandura's self-efficacy theory and constructivism theory as posited by John Dewey, Jean Piaget, and Lev Vygotsky.

West (2005) studied the relationships between age, student enrollment status, gender, ethnicity, size of institution attended, and prior educational level in relation to the student's completion of a program of study. The findings revealed that a student's enrollment status, and ethnicity, as well as the size of the center attended were significant predictors of completion.

The focus of West's 2005 study was on the effect of these demographics for the students at the Tennessee Technology Centers (now Colleges of Applied Technology). The multi-institutional study examined the number of factors regarded by other educators, researchers, and policy makers as influential to the retention and completion of the two-year technical students. The purpose was to determine if these factors were significant predictors of program completion. The author included seven research questions in her attempt to address these issues. Her research did not find that prior educational level was a significant predictor of completion of a program of study at a Tennessee Technology Center (now College of Applied Technology).

Similarly, Mitchley-McAvoy (2012) focused on the statistically significant relationship between known persistence and early withdrawal factors and retention rates. This study investigated Iowa community college retention rates utilizing student response data to understand more fully why community college students persist or withdraw early. The findings and conclusions indicated that Iowa community college students do not always respond to known persistence and early withdrawal. She focused on this area of study because low retention rates were an issue in the Iowa community college system; the rate was a 36 % average for a three-year period (2005-2007). When examining demographics, she found the factors most likely to have a negative influence on retention rates were African-American, unmarried and without dependents. The student demographics most likely to have a negative influence on enrollment were first generation and full-time students. The student characteristic that had the highest negative influence was being academically unprepared. Additionally, she found that fewer students were enrolling in developmental coursework with approximately 77% of students indicating they had not completed developmental coursework.

Bryan (2013) investigated the effectiveness of supplemental instruction (SI) as a means to address the existing high attrition and low graduation rates evidenced at a rural southern community college. The research problem addressed the high attrition rates in barrier courses and low graduation rates evidenced at the community college. Bryan also compared subgroups of adult learners and traditional students in supplemental instruction. She found that there was no significant difference in GPA, overall course grade or graduation rate between students who voluntarily participate in supplemental instruction and those who do not. She advocated that this study may contribute to social change by helping decision makers properly assess the value of SI to both traditional and nontraditional students, benefiting all who attended the studied site, as

well as indirectly affecting the community. This study addressed the social aspect of supplemental instruction, which, according to Bryan, is an area of basic skills in vocational education that had not been previously explored.

Pietras (2010) conducted a quantitative study questioning the validity of the existing survey methods used at a community college in Pennsylvania to evaluate academic advising and counseling. This was a study about how satisfaction with advising services affected GPA and retention at a community college in Pennsylvania. Pietras' study did not support a positive correlation between satisfaction with advising services and either GPA or retention.

The purpose of Rayno's 2010 quantitative correlational retrospective research study was to examine the possible relationships between each of the independent variables of academic preparedness (as measured by NET mathematics and reading scores, GPA and introductory science course grades, age, gender, and ethnicity) and the dependent variable of successful completion of a Fundamentals of Nursing course. The population consisted of 354 nursing students at a community college in Pennsylvania who had taken a course on the fundamentals of nursing. The findings show that the higher the GPA and introduction to science course grades, the more likely the student was to pass the Fundamentals of Nursing course. This project considered academic preparedness in a health-care related field. It focused heavily on student attrition rates and the underlying reasons. The subjects were given the Nurses Entrance Test (NET) that tests basic skills such as math and reading. She found no significant difference in mathematics and reading composite scores from the NET and the pass/fail rate for the Fundamentals of Nursing course (Rayno, 2010). The results showed that the assumption that the NET scores were predictive of the student passing the course was not supported. However, the

evidence shows that there was a positive correlation between a student's GPA and the fundamentals course grade yet gender and age were not predictors.

Academic Success

An effort exists in vocational/technical education for students, educators, employers, and communities to understand that the same skills needed to enter college and be successful are the same skills needed to enter the workforce and be successful (Stone, 2007). Carnevale, Jayasundara, and Hanson (2012) noted that employers deem listening and oral communication as the most important basic skills; although the ability to read, exercise teamwork, and the fostering of interpersonal skills are crucial. Turner (2000) identified potential workplace skills needed in the preparation of today's college graduate for the workforce. Oral and written communication, computer skills, math skills, critical thinking, decision-making, ability to work in teams, problem-solving, interpersonal skills, and assertiveness were the workplace skills chosen for analysis. He found that 29 percent of the career services staff at the four-year colleges identified math skills and assertiveness as a strength while 14 percent thought oral and written communication were strengths. Oral communication (89 percent) and written communication (71 percent) were most desired by employers. Finally, graduates ranked written communication (71 percent) as the most desired and math as the lowest (49 percent).

Brand, Valent, and Browning (2013) noted that in today's society students must be able to relate what they are taught in the foundational or career-specific curriculum to their potential work environments. They further indicated that career and technical education (CTE) is an educational strategy for providing youth with the academic, technical, and employability skills and knowledge to pursue postsecondary training or higher education. Upon completion

CTE students should be prepared to enter a career path prepared for ongoing learning. CTE is eliminating vocational education that consisted of low-level courses and job training. It is being replaced with academically rigorous, integrated, and sequenced programs that align with and lead to postsecondary education.

In 2007 Governor Phil Bredesen addressed a lack of academic preparation in Tennessee by examining the low levels of achievement in Tennessee high schools and the resulting high numbers of high school graduates who are not prepared for college (Yates, 2010). To combat this problem, the developmental studies program was instituted in TBR institutions (TBR, n.d.). As a result, any credit hours awarded for remedial or developmental programming would be net additions to the credit hours required for graduation. Litigation in 1984 (Geier vs. Alexander) was settled with a number of stipulations that included the provision of developmental education programs in TBR institutions and the development and implementation of a plan designed to address retention, performance, and progression (Yates, 2010).

Beginning in 2014, Governor Bill Haslam challenged the educators, business leaders, and non-profit organizations in Tennessee with a critical new mission: “Drive to 55” which encourages those in positions of educational influence to strive for 55% of Tennesseans to be equipped with a college degree or certificate by the year 2025 (Drive to 55, 2014). The governor of Tennessee notes on the home page of the *Drive to 55* website that “It’s not just a mission for higher education, but a mission for Tennessee’s future workforce and economic development” (para. 2).

Carnevale et al. (2012) developed research using transcript data and wage records to track career pathways. They have identified two areas where further research and development is needed. They are: 1) to establish a learning and earning exchange that can bring transparency to

the relationship between Career and Technical Education (CTE) and the labor market, and 2) linking high school instruction and postsecondary CTE by investing in specific CTE programs of study that integrate high school and postsecondary curriculums with employer-based training.

Because college remediation is an important example of a later-life intervention, understanding whether remediation actually helps students develop economically valuable skills is informative about which view of human capital formation is more accurate (Martorell & McFarlin, 2011). Half of all workforce vacancies through 2027 are likely to demand serious occupational skills that require both academic and learning on the job (Lerman, 2013).

Chapter Summary

The research outlined in this literature review revealed a need within the vocational and technical education curriculum to develop basic skills programs to assist students, especially adult learners, to succeed in the classroom and when they join the workforce. It would be a mistake, therefore, to assume that institutions – at any skill level – should focus only on developing occupational skills (Carnevale et al., 2012).

Whether the skills are integrated into core coursework as outlined by Hirsh (2011) or taught as standalone programs, research has shown that the need exists for to boost retention and graduation rates which can be affected by basic skills. Mitchley-McAvoy (2012) posited that academic preparedness plays a role in community college retention as she investigated Iowa community college retention rates using student response data to understand why Iowa students persist or withdraw early.

Carnevale and his colleagues (2012) noted that the American postsecondary career and technical education system is unique, flexible, and underutilized. Unlike other countries, the

American CTE system provides inroads to further education and college degrees, promotes career mobility as an avenue for lifelong learning, and provides retraining for workers who have seen their jobs moved overseas or outmoded by technological advancements.

Higher education policymakers are ultimately the ones who can make changes and alter admission practices to enhance the community or technical college learning experience for the population of students underprepared in basic academic skills. Hargens (2013) noted that the true success of the underprepared vocational student would be determined by the student's ability to persist and graduate. She further stated that if this occurs on a national level, President Obama's 2010 goal of increasing community college graduates by 5 million by the year 2020 might be met (2013).

The findings from the current body of research that have been explored in this literature review leave opportunities for further research in the role that basic skills and academic preparedness play on graduation and job placement status. Much of the current academic literature on student success rates is based on the community college model.

CHAPTER 3

RESEARCH METHODOLOGY

Entrance requirements for students in diploma-level training programs at TCAT do not include any type of placement testing; therefore, it is not clear if incoming students have the foundational skills necessary to successfully complete coursework. This lack of entrance requirements for Tennessee Colleges of Applied Technology (TCAT) could be a reason that student completion continues to negatively impact the graduation rates, numerical final scores, and job placement status for individual programs of study. Basic academic skills testing has been a part of technical education for decades (Shelby, 2005), but the question remains as to how large a role testing and remediation play in the overall success of the student as defined by their grades, retention, graduation, and, ultimately, employment in their fields of training. Much current academic literature on student success rates is based on the community college model. The technical college differs from community colleges and universities in admissions procedures with regard to requirements or the lack of requirements for placement testing. TCATs have an open admissions policy, therefore placement testing and Grade Point Average (GPA) are not considered at the time of enrollment.

A quantitative study was conducted at a selected vocational/technical college that is under the governance of the Tennessee Board of Regents (TBR). The college was established in 1965 as a regional vocational school. It became affiliated with and was placed under TBR jurisdiction in 1983. The college, located in the upper northwest corner of Tennessee, serves a five-county region. This study will focus on numerical final scores, graduation, and placement status of groups of students who were tested for basic academic competency in three areas, math, reading and locating information.

Research Questions and Null Hypotheses

The following research questions were addressed to determine if there are significant differences between the WorkKeys score, numerical final skill and theory scores, graduation credential, program of study, and job placement status of students who completed a basic skills remediation program upon enrollment and those who did not.

RQ1. Is there a significant difference in WorkKeys score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀1: There is no significant difference in WorkKeys score as compared by type of credential (diploma, certificate or none) earned by students.

RQ2. Is there a significant difference in skill score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀2: There is no significant difference in skill score as compared by credential (diploma, certificate, or none) earned by students.

RQ3. Is there a significant difference in theory score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀3: There is no significant difference in theory score as compared by credential (diploma, certificate or none) earned by students.

RQ4. Is there a significant difference in WorkKeys score between job placement categories (related, non-related, or not placed)?

H₀4: There is no significant difference in WorkKeys score between job placement categories (related, non-related, or not placed).

RQ5. Is there a significant difference in skill score between job placement categories (related, non-related, or not placed)?

H₀5: There is no significant difference in skill score between job placement categories (related, non-related, or not placed).

RQ6. Is there a significant difference in theory score between job placement categories (related, non-related, or not placed)?

H₀6: There is no significant difference in theory score between job placement categories (related, non-related, or not placed).

RQ7. Is there a significant difference in WorkKeys score as compared by program of study?

H₀7: There is no significant difference in WorkKeys score as compared by program of study.

RQ8. Is there a significant relationship between job placement and program of study?

H₀8: There is no significant relationship between job placement and program of study.

Population

The population for this study consisted of all former students enrolled from 2010-2016 in 4 subgroups representing seven training programs at a Tennessee College of Applied Technology. The training programs were Collision Repair, Computer Information Technology, Welding, Industrial Maintenance, Machine Tool Technology, Motorcycle/ATV Repair, and Residential Building Maintenance. Collision Repair and Motorcycle/ATV Repair is one subcategory. Welding and Machine Tool Technology is a second category and Industrial Maintenance and Residential Building Maintenance are combined to make a third subcategory.

Computer Information Technology is the fourth group. The students were enrolled from 2010 to 2016. The college maintains an average annual yearly census of 560 unduplicated diploma seeking students in 12 different training programs. However, the population for this study was 445 students in seven training programs.

Instrumentation

Two instruments were used in this study. The first was a diagnostic test measuring the students' foundational skill set in math, reading, and locating information in the form of the WorkKeys assessment. The second was the Student Information Management Systems (SIMS) database, which is the student records management system for the Tennessee College of Applied Technology. ACT, Inc. houses test results for the group of students who were given the pretest upon enrollment. SIMS included student records such as program of study, numerical grades, completion, and job placement. This information is reported three times each year to the Tennessee Board of Regent's Office of the College of Applied Technology and also to the Council on Occupational Education, a regional accrediting agency. The reliability and validity of the information was verified by both organizations.

The WorkKeys assessment is an ACT product that has been created by experts in the field of academic pretesting. The validity of the test, according to the ACT website, is that of "criterion" validity which refers to the correlation between test results and outcomes. According to the ACT website, "the fundamental inference to be drawn from test scores in most applications of testing in employment settings is one of prediction. The test user (e.g., an employer) wishes to make an inference from test results to some future job behavior or outcome"

(para. 6). The results for the population already existed because the students had been taking the test as part of their first trimester of course work in all seven technical training programs.

Data Collection

Approval was obtained by East Tennessee State University's Institutional Review Board prior to any data collection. Because this project utilized existing data, that is part of the students' permanent record, the president of the college agreed to grant authorization to access and use data collected and maintained by the college regarding the subjects.

This data are protected information under the Family Educational Rights and Privacy Act (Buckley Amendment). Tennessee Board of Regents policy on confidentiality of student records indicates that it is the responsibility of all state institutions to protect the confidentiality of personally identifiable educational records of students and former students (TBR, 2017).

This data were obtained from the annual Tennessee Board of Regents and Council on Occupational Education annual reports. The TCAT's Student Records Coordinator manually removed all student identifiable information from the report before being accessed by the researcher.

Sets of scores were collected which included self-reported demographics from WorkKeys. This information was obtained from the Technology Foundations instructor after all information that may identify individuals had been redacted. WorkKeys includes the test results for the group of students who were given the pretest upon enrollment. SIMS contains student records such as numerical scores, completion, and job placement.

Data Analysis

Information from two existing student databases was extrapolated and analyzed using *Statistical Package for Social Sciences (SPSS)* programming to present readers with comparative, descriptive data. Descriptive and informational statistical methods were used to report the distribution and relationship among the variables. Analysis of Variance (ANOVA) were used to address Research Questions 1, 2, 3, 4, 5, 6, and 7 since they compare differences in means between two or more groups. Chi-square tests of independence were used to address Research Question 8 to discover if there was a significant relationship between the two categorical variables. All data were analyzed at the .05 level of significance. See Table 1 for the independent and dependent variables for each research question.

Table 1
Independent and Dependent Variables for Research Questions

Research Question	Independent Variables	Dependent Variables
1	Credential earned: Diploma certificate, or none	WorkKeys Score: Average of reading, math, and locating information
2	Credential earned: Diploma certificate, or none	Skill score
3	Credential earned: Diploma certificate, or none	Theory score
4	Job placement status: Related, non-related, or not placed	WorkKeys score: Average of reading, math, and locating information
5	Job placement status: Related, non-related, or not placed	Skill score
6	Job placement status: Related, non-related, or not placed	Theory score
7	Program group: Collision Repair, Motorcycle Repair; Computer Information; Welding, Machine Tool; and Industrial Maintenance, Residential Maintenance	WorkKeys score: Average of reading, math, and locating information
8	Program group: CRT/MOT; CIT; WEL/MT; and IM/RBM	Job placement status: Related, non-related, or not placed

Chapter Summary

The research design of this quantitative study utilized existing data from two sources. This design determined the relationship between basic academic skills levels (WorkKeys), program-specific skill score, program-specific theory score, graduation credential, and placement status as they are related to vocational/technical students in higher education settings.

These data were collected from within the college and all information that may identify individuals was removed prior to data collection. The analysis of the data included an analysis of variance (ANOVA) and a series of chi-square tests to determine whether there were any significant differences in the skill and theory scores, graduation credential, and job placement status of students in relation to their WorkKeys scores. This methodology was used to delineate the research design, population to be studied, procedures for collecting data, research questions, null hypotheses to be tested, and the data analysis.

CHAPTER 4

FINDINGS

The purpose of this quantitative study was to determine if there is a significant difference in WorkKeys score, skill score, theory score, and job placement status as compared by credential and program of study. The study used data retrieved from a WorkKeys database and SIMS (Student Information Management System) at a technical college. The population consisted of 445 students in seven programs of study from 2010-2016 who had participated in the WorkKeys online academic training modules.

The study compared job placement status and program of study as well as evaluated the relationship between the average of three WorkKeys tests – specifically math, reading, and locating information – and program-specific theory and skill score, graduation credential, and placement status of students in seven programs of study at TCAT. The study focused on WorkKeys scores as an indicator of exit credential type, skill grade, theory grade, and job placement status. The courses were Computer Information Technology, Collision Repair Technology, Motorcycle/ATV Repair, Machine Tool Technology, Industrial Maintenance, Residential Building Maintenance and Welding Technology. The programs were combined into four subcategories: Computer Information (CIT), Collision Repair/Motorcycle and ATV Repair (CRT/MOT), Industrial Maintenance/Residential Maintenance (IM/RBM) and Welding/Machine Tool Technology(WEL/MOT). The population for the Computer Information class consisted of 73, Collision Repair/Motorcycle and ATV was 120, Machine Tool/Welding was 116, and Industrial Maintenance/Residential Maintenance was 136 as shown in Figure 1.

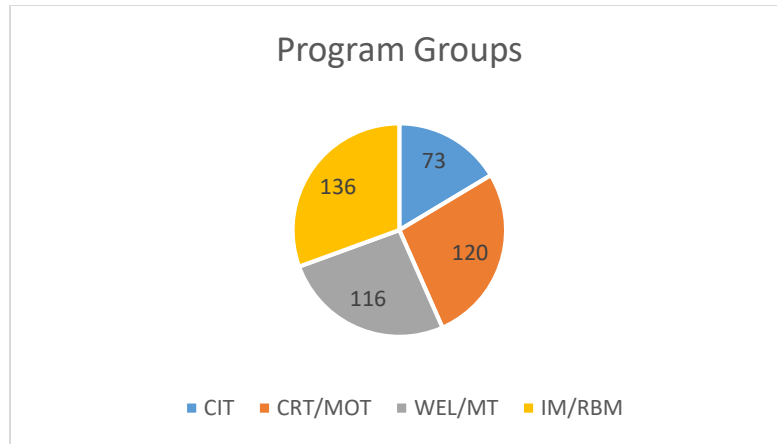


Figure 1. Program Groups

The hypotheses in this study were tested using a series of univariate analysis of variance (ANOVAs) and chi-square. A series of ANOVAs were selected for Research Questions 1-7 because it tests whether significant differences exist among three or more population means categorized by a single independent variable with measures on different subjects. (Witte & Witte, 338). Research Question 8 was tested using chi square because it measures relationships between nominal data.

Research Question 1

Is there a significant difference in WorkKeys score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀1: There is no significant difference in WorkKeys scores as compared by credential (diploma, certificate, or none) earned by students.

A one-way analysis of variance was conducted to evaluate the relationship between WorkKeys scores and credential earned by the student. The independent variable, credential, included three levels: diploma, certificate and none. The dependent variable was the WorkKeys score (an average of Math, Reading and Locating Information). The ANOVA was significant,

$F(2, 442) = 11.336, p < .001$. Therefore, the null hypothesis was rejected. The strength of the relationship between types of credential and WorkKeys score, as assessed by η^2 , was medium (.049).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the three groups. A Dunnett's C procedure was selected for the multiple comparisons because equal variances were not assumed ($p, <.001$). Students who earned no credential scored significantly below both the diploma ($p < .001$) and certificate ($p <.001$) groups. However, there was no significant difference between the diploma and certificate groups ($p = .84$). The 95% confidence intervals for the pairwise differences, as well as the means and standard deviations for WorkKeys scores by credential are reported in Table 2. See Figure 2 for the boxplot of the three groups and their WorkKeys scores.

Table 2

95% Confidence Intervals of Pairwise Differences in WorkKeys Score by Credential

Credential	N	M	SD	Diploma	Certificate
Diploma	256	5.26	1.05		
Certificate	118	5.32	.79	-.30 to .17	
None	71	4.65	1.26	.22 to .99	.28 to 1.06

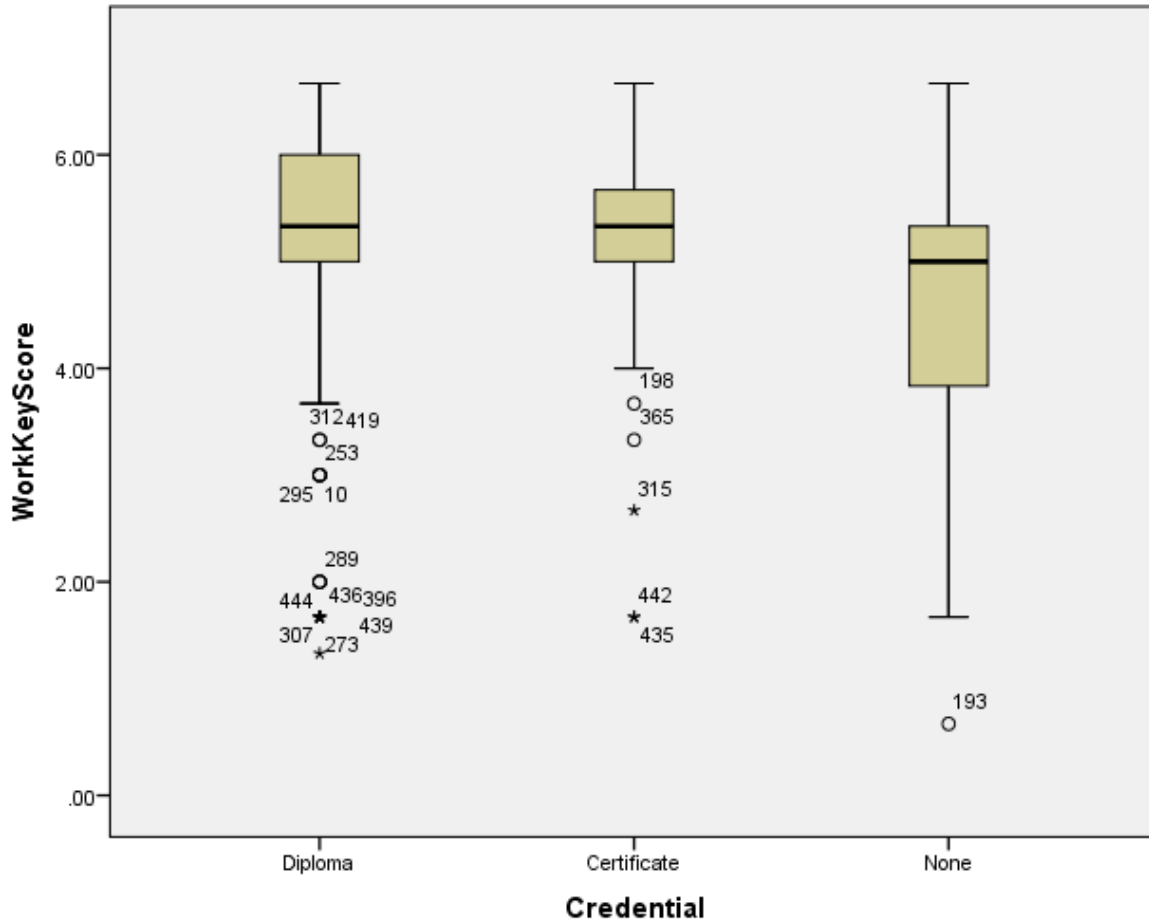


Figure 2. WorkKeys Score by Credential

Research Question 2

Is there a significant difference in skill score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀2: There is no significant difference in skill score as compared by type of credential (diploma, certificate, or none) earned by students.

A one-way analysis of variance was conducted to evaluate the relationship between skill score and credential earned by students. The independent variable, the credential, included three

levels: diploma, certificate, and none. The dependent variable was the skill score. The ANOVA was significant $F(2,436) = 58.608, p < .001$. Therefore, the null hypothesis was rejected. The strength of the relationship between credential and skill score, as assessed by η^2 , was large (.212).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate the pairwise difference among the means of the three groups. A Dunnett's C analysis was selected for the multiple comparisons because equal variances ($p, <.001$) were not assumed. There was a significant difference in the means between all three groups. Students who earned a diploma had higher skill scores, followed, respectively, by those who earned a certificate and those who did not earn a credential. The 95% confidence intervals for the pairwise differences, as well as the means and standard deviations for the three credential levels are reported in Table 3. See Figure 3 for the boxplot of the three groups and their skill scores.

Table 3

95% Confidence Intervals of Pair Wise Differences in Skill Score by Credential

Credential	N	M	SD	Diploma	Certificate
Diploma	256	91.67	4.79		
Certificate	118	89.32	6.08	-3.85 to -.84	
None	65	80.83	13.97	-15.06 to 6.62	4.13 to 12.86

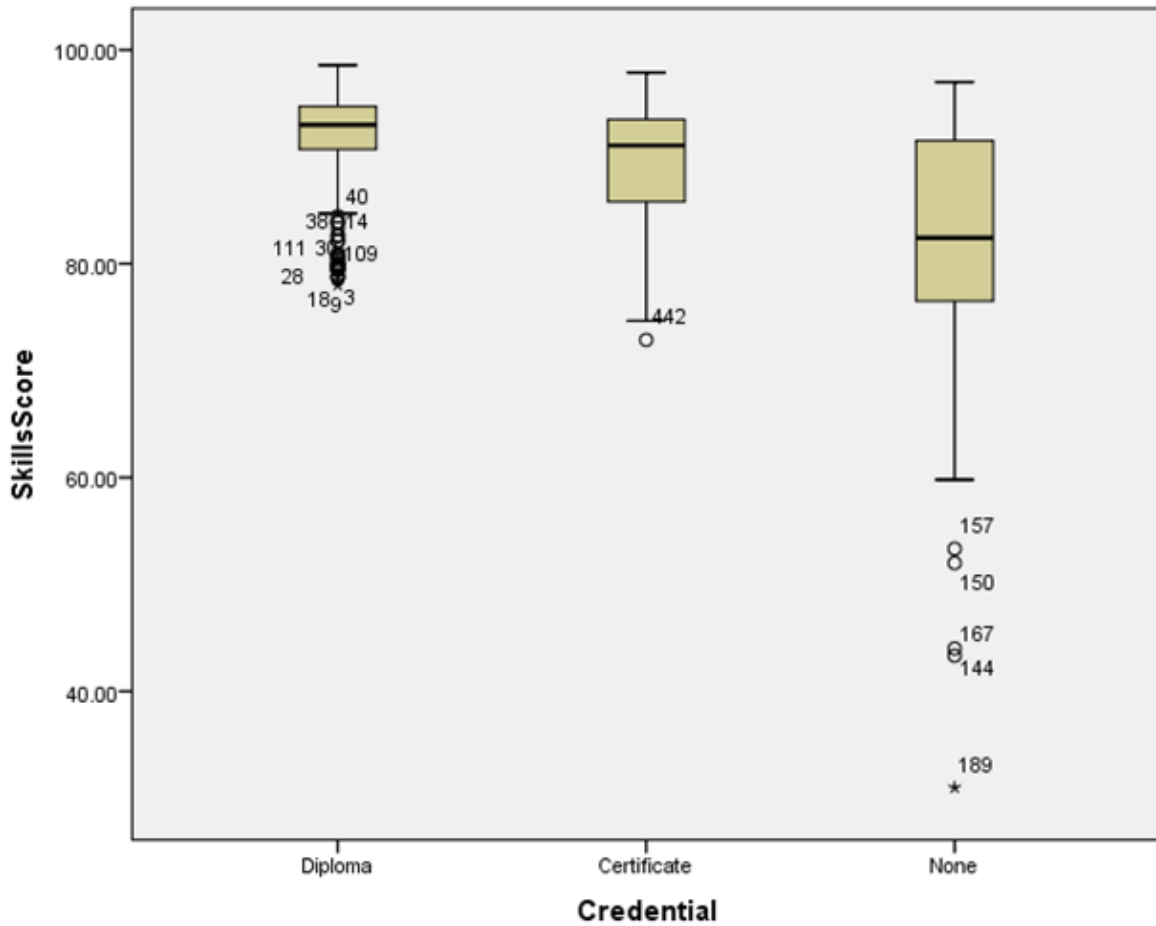


Figure 3. Skill Score by Credential

Research Question 3

Is there a significant difference in theory score as compared by the type of credential (diploma, certificate, or none) earned by students?

H₀3: There is no significant difference in theory score as compared by type of credential (diploma, certificate, or none) earned by students.

A one-way analysis of variance was conducted to evaluate the relationship between theory score and credential earned by the students. The independent variable, the credential, included three levels: diploma, certificate, and none. The dependent variable was the theory score. The ANOVA was significant, $F(2,435) = 59.807$, $p < .001$. Therefore, the null hypothesis was rejected. The strength of the relationship between credential and theory score, as assessed by η^2 , was large (.216).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the three groups. A Dunnett's C procedure was selected for the multiple comparison because equal variances ($p, <.001$) were not assumed. There were significant differences in the means between all three groups ($p < .001$). The students who earned diplomas and certificates earned higher theory scores than those who earned nothing. Those who earned a diploma also earned significantly higher scores than those who earned a certificate. The 95% confidence intervals for the pairwise differences, as well as the means and standard deviations for the three credential groups are reported in Table 4. See Figure 4 for the boxplot of the three groups and their theory score.

Table 4

95% Confidence Intervals of Pair Wise Differences in Theory Score by Credential

Credential	N	M	SD	Diploma	Certificate
Diploma	256	92.28	3.71		
Certificate	118	90.64	5.60	-3.0 to .31	
None	64	82.66	12.66	5.79 to 13.46	3.99 to 11.97

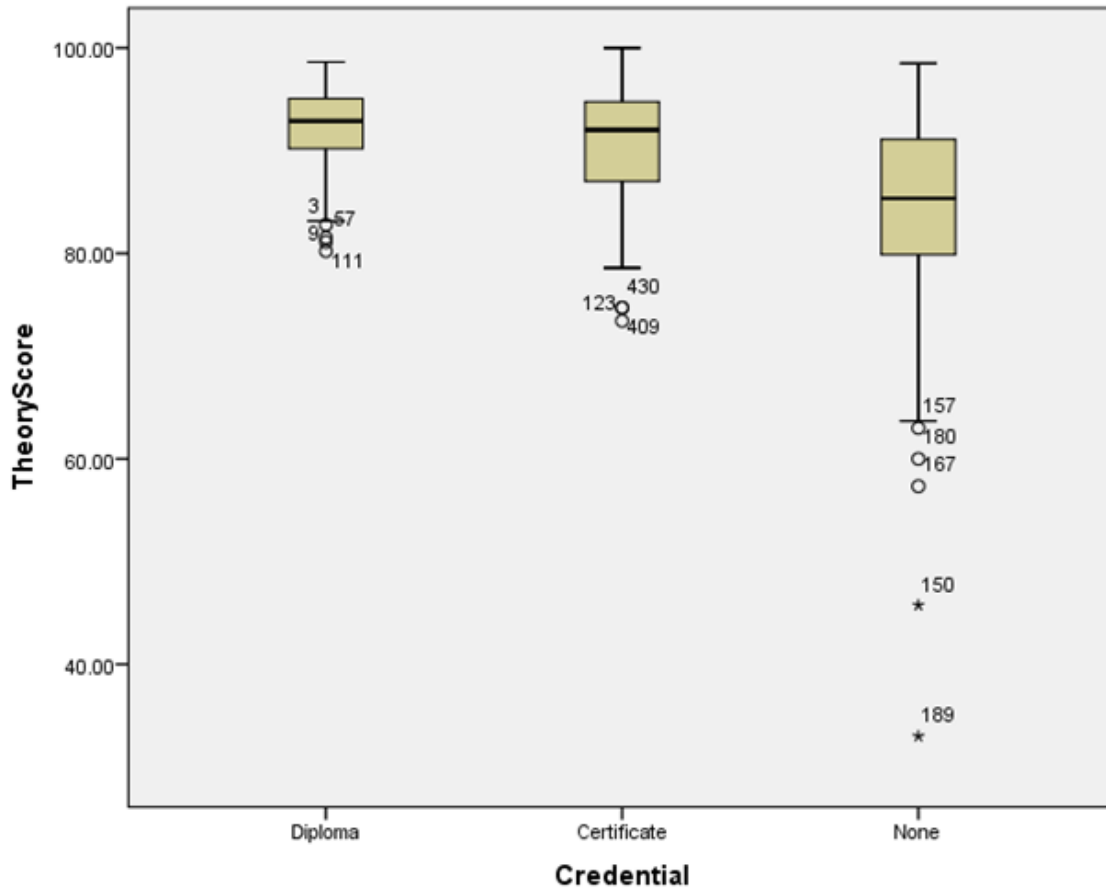


Figure 4. Theory Score by Credential.

Research Question 4

Is there a significant difference in WorkKeys score between job placement categories (related, non-related, or not placed)?

H₀4: There is no significant difference in WorkKeys score between job placement categories (related, non-related, or not placed).

A one-way analysis of variance was conducted to evaluate the relationship between job placement status of students and WorkKeys score. The independent variable, job placement status, included three levels: related, non-related, and not placed. The dependent variable was the WorkKeys score. The ANOVA was significant, $F(2, 442) = 3.344$, $p = .036$. Therefore, the null hypothesis was rejected. The strength of the relationship between the job placement status and the WorkKeys score, as assessed by η^2 , was small (.015).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the three groups. A Fisher's Least Significant Difference analysis showed that there is no significant difference in the two groups, non-related and not placed ($p = .649$) and related and non-related ($p = .065$). However, there were significant differences between the related and not-placed ($p = .028$). Students who were employed in a related job position had significantly higher WorkKeys scores than those who were not placed. The 95% confidence intervals for the pairwise difference as well as the means and standard deviations for the three job placement categories are reported in Table 5. See Figure 5 for the boxplot of the three categories and their WorkKeys scores.

Table 5

95% Confidence Intervals of Pair Wise Differences in WorkKeys Score by Job Placement

Job Placement	N	M	SD	Related	Non-Related
Related	242	5.29	1.07		
Non-Related	44	4.98	1.16	-.65 to .02	
Not Placed	159	5.06	.96	-.44 to -.03	-.27 to .43

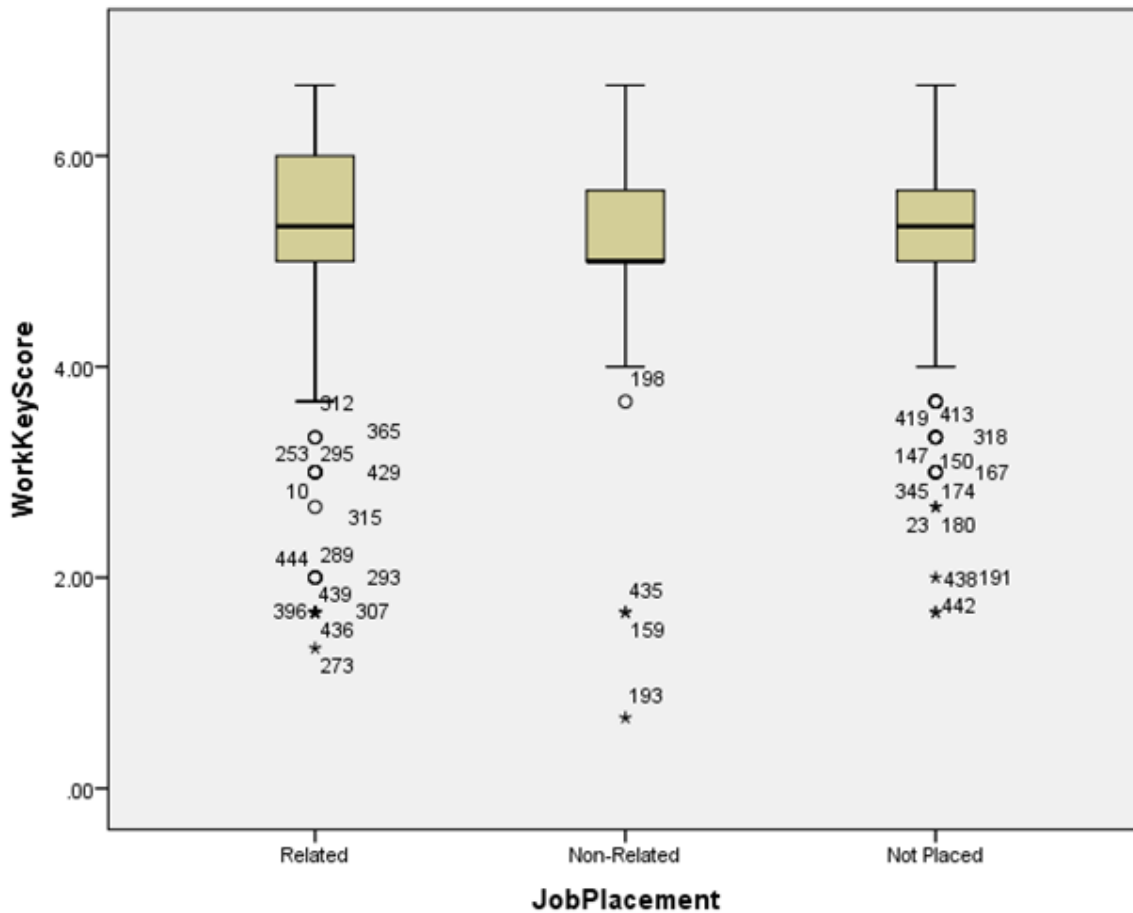


Figure 5. WorkKeys score by Job Placement

Research Question 5

Is there a significant difference in Skill score between job placement categories (related, non-related, or not placed)?

H₀5: There is no significant difference in Skill score between job placement categories (related, non-related, or not placed).

A one-way analysis of variance was conducted to evaluate the relationship between job placement status of students and their Skill score. The independent variable, job placement status included three levels: related, non-related, and not placed. The dependent variable was Skill score. The ANOVA was significant, $F(2, 436) = 23.358$, $p < .001$. Therefore, the null hypothesis was rejected. The strength of the relationship between job placement status and Skill score, as assessed by η^2 , was medium (.097).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate pairwise differences among the means of the three groups. A Dunnett's C procedure was selected for the multiple comparison because equal variances ($p, <.001$) were not assumed. There was a significant difference among the related and not placed ($p < .001$), and related and non-related ($p = .005$) but there was not a significant difference ($p = .587$) among the non-related and the not placed students. The students who were placed in related job positions had significantly higher skill score than those who were not placed and those who were placed in a non-related position. The 95% confidence intervals for the pairwise differences as well as the means and standard deviations for the three job placement categories are reported in Table 6. See Figure 6 for the boxplot of the three categories and their skill score.

Table 6

95% Confidence Intervals of Pair Wise Differences in Skill Score by Job Placement

Job Placement	N	M	SD	Related	Non-Related
Related	242	91.68	4.64		
Non-Related	44	87.68	6.48	-6.47 to -1.53	
Not Placed	153	86.38	11.17	3.05 to 7.55	-1.89 to 4.49

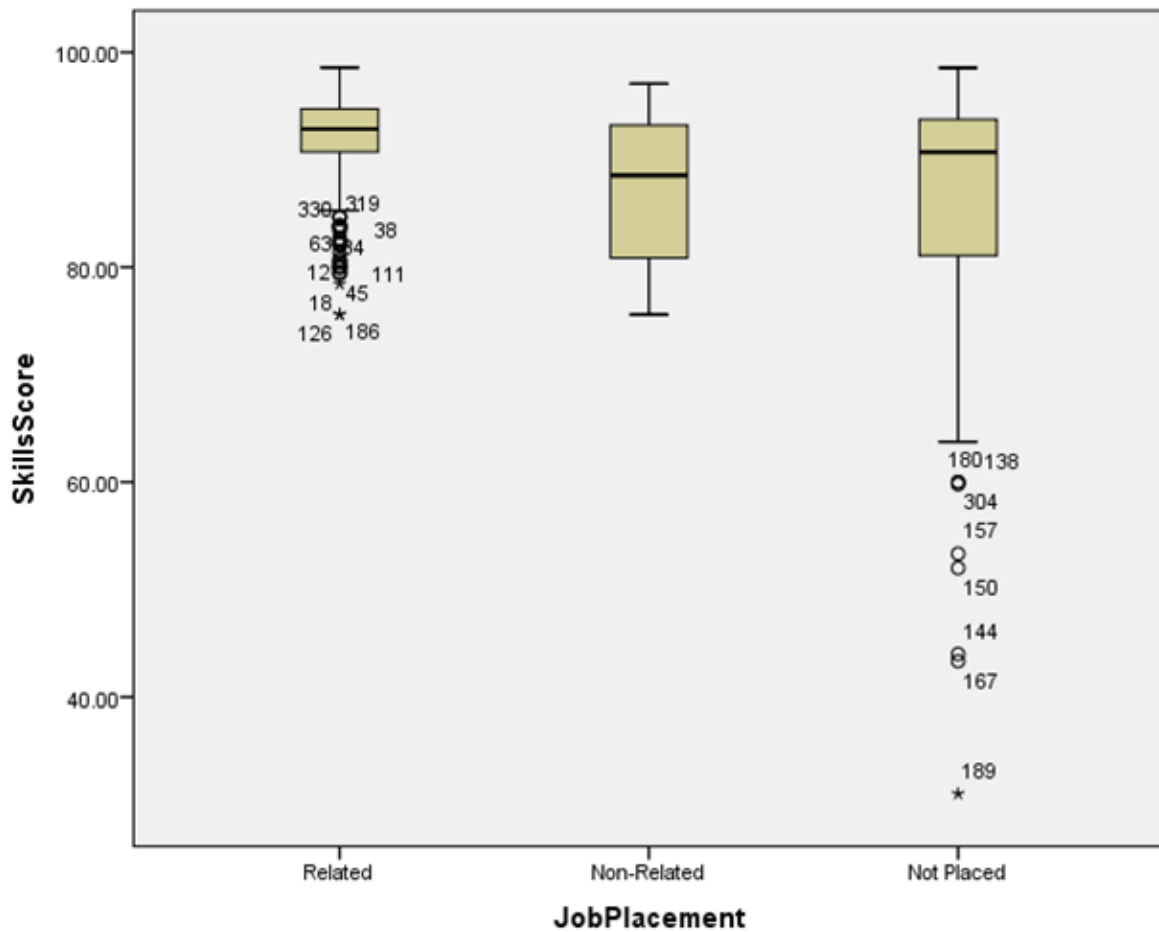


Figure 6. Skill Score by Job Placement

Research Question 6

Is there a significant difference in theory score between job placement categories (related, non-related, or not placed)?

H₀6: There is no significant difference in theory score between job placement categories (related, non-related, or not placed).

A one-way analysis of variance was conducted to evaluate the relationship between job placement categories and theory score. The independent variable, job placement categories, included three levels: related, non-related, and not placed. The dependent variable was the theory score. The ANOVA was significant $F(2, 435) = 23.154, p < .001$. Therefore, the null hypothesis was rejected. The strength of the relationship between the job placement categories and the theory scores, as assessed by η^2 , was medium (.096).

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate the pairwise difference among the means of the three groups. A Dunnett's C procedure was selected for the multiple comparisons because equal variances were not assumed ($p, < .001$) There was no significant difference in the means between the related and non-related categories ($p = .069$) and no significant difference between the non-related and the not placed categories ($p = .120$). There was, however, a significant difference in the related and not placed categories ($p < .001$). The theory scores for students who were placed in a related job were significantly higher than those of students who were not placed. The 95% confidence intervals for the pairwise difference as well as the means and standard deviations for the three job placement categories are reported in Table 7. See Figure 7 for the boxplot of the three categories and their theory score.

Table 7

95% Confidence Intervals of Pair Wise Differences in Theory Score by Job Placement

Job Placement	N	M	SD	Related	Non-Related
Related	242	92.33	4.11		
Non-Related	44	89.87	4.75	-.61 to 4.31	
Not Placed	152	87.58	9.92	2.74 to 6.75	-.30 to 4.86

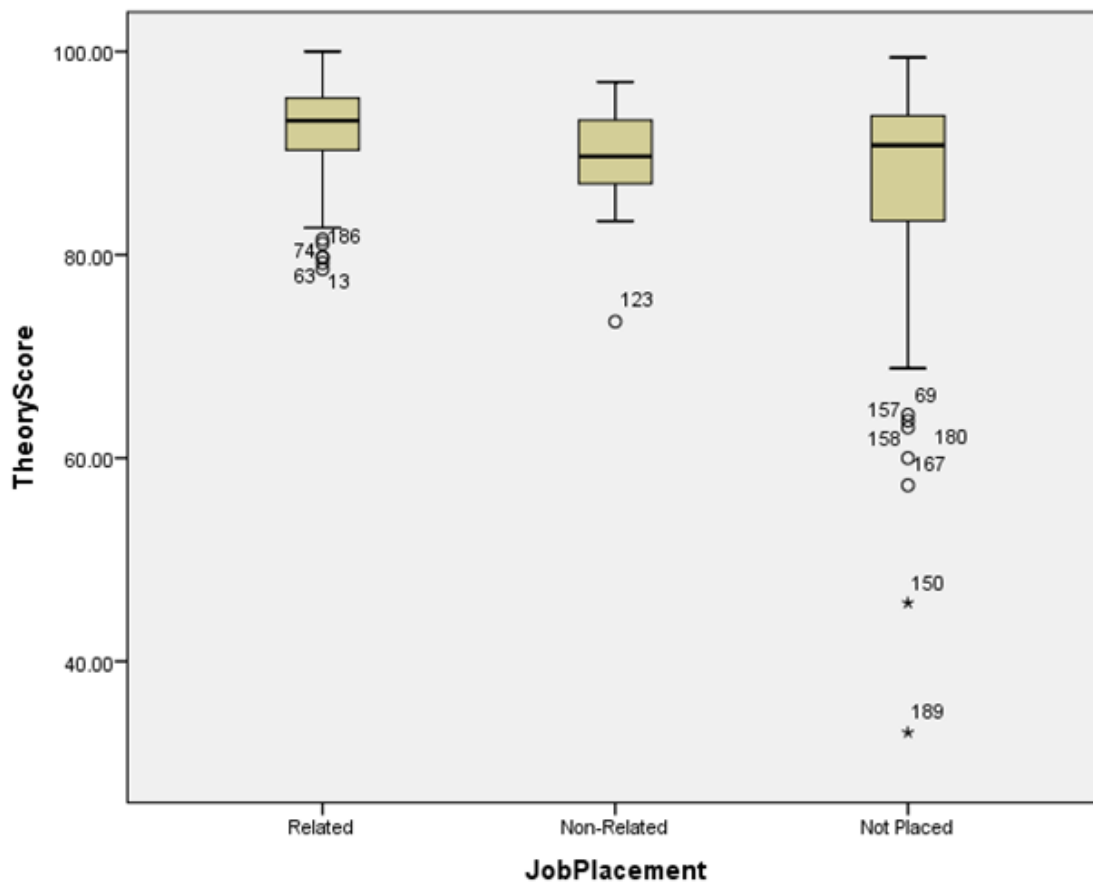


Figure 7. Theory Score by Job Placement

Research Question 7.

Is there a significant difference in WorkKeys score as compared by program of study?

H₀7: There is no significant difference in WorkKeys score as compared by program of study.

A one way analysis of variance was conducted to evaluate the relationship between programs of study and WorkKeys score. The independent variable, program of study, included four subcategories of combine courses: CRT/MOT, CIT, MT/WEL, and IM/RBM. The dependent variable is the WorkKeys score. The ANOVA was not significant, $F(3, 441) = .776$, $p = .508$. Therefore, the null hypothesis was retained. The strength of the relationship between the programs of study categories and the WorkKeys score as assessed by η^2 was small (.005). The results indicate that the WorkKeys scores are not affected by the type of program. The means and standard deviations for the four subcategories of programs are reported in Table 8. See Figure 8 for the boxplot of the four programs of study and their WorkKeys score.

Table 8

Means and Standard Deviations of WorkKeys Score by Program of Study

Program of Study	N	M	SD
CRT/MOT	120	5.28	.80
CIT	73	5.14	1.11
IM/RBM	116	5.09	1.13
WEL/MT	136	5.20	1.13

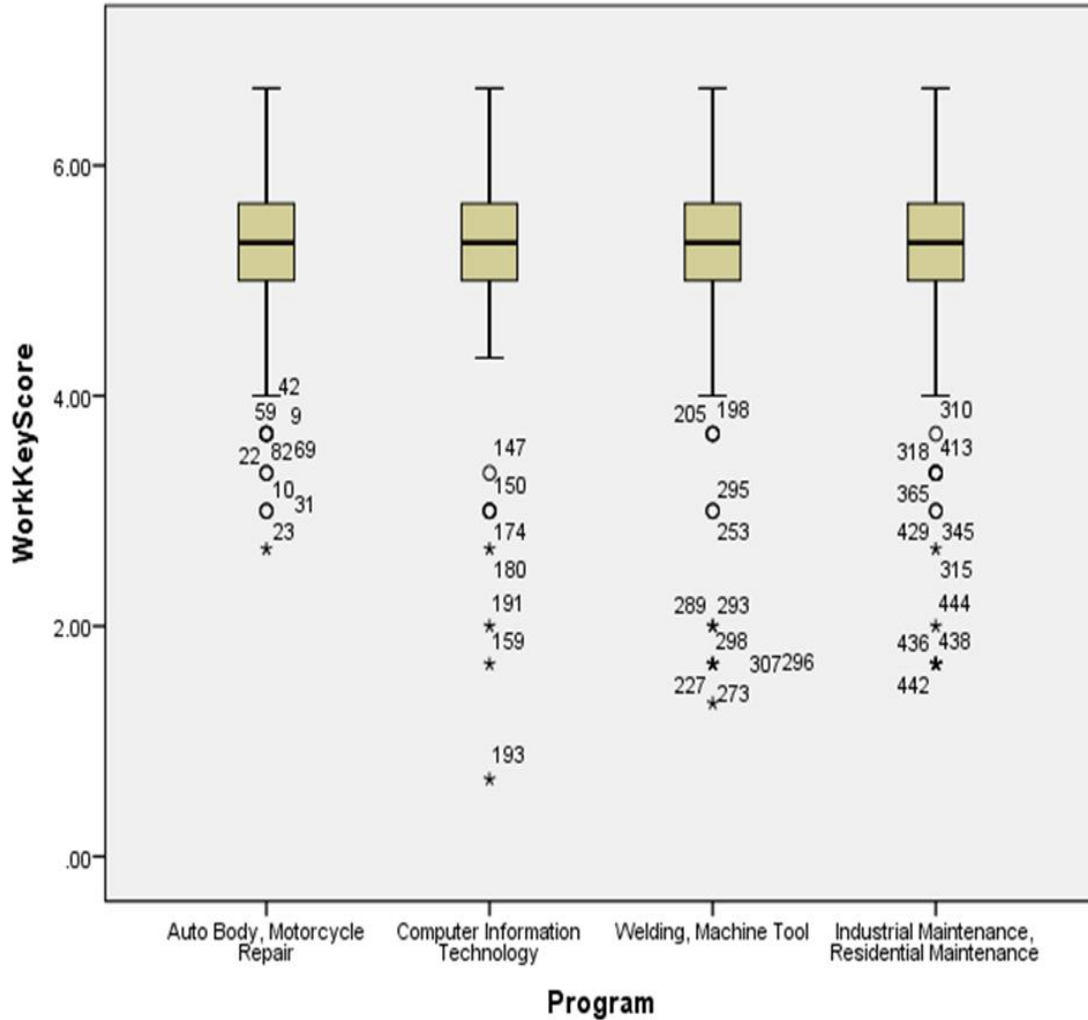


Figure 8. WorkKeys Score by Program of Study

Research Question 8

Is there a significant relationship between job placement and program of study?

H₀8: There is no significant relationship between job placement and program of study.

A two-way contingency table analysis was conducted to evaluate the relationship between job placement status and program of study. The two variables were job placement status

(related, non-related and not placed) and program of study categories (Collision Repair/Motorcycle Repair, Computer Information, Industrial Maintenance/Residential Maintenance, and Welding/Machine Tool). Job placement and type of program were found to be significantly related, Pearson χ^2 (3, N = 445) = 30.34, $p < .01$, Cramer's V = .185. Therefore, the null hypothesis was rejected. In general, students are more likely to be placed in related and non-related jobs than not to be placed at all, with the exception of the Computer Information program, which has a higher percentage of students not placed than the other two categories.

Figure 9 displays the number of job placements for each program category.

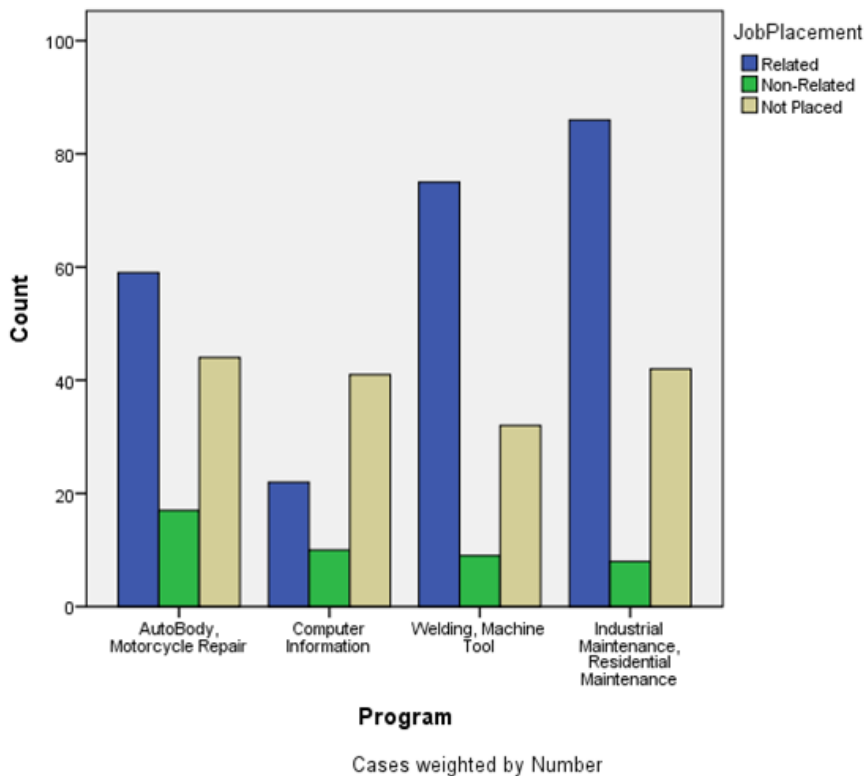


Figure 9. Job Placement Status and Program of Study

Chapter Summary

Analyses of the independent and dependent variables used in this study show significant differences in all but one. Research Questions 1-7, using ANOVA showed that there were significant differences in job placement status, graduation credentials and programs of study when compared by theory score, skill score and WorkKeys score in all areas except one. There was no significant difference in WorkKeys score when compared with program of study.

The statistical analysis reported in this study was based on the eight research questions presented in Chapters 1 and 3. In Chapter 3, each research question had a single corresponding null hypothesis. These were all rejected except for Research Question 7 where the null was retained since it was determined that WorkKeys scores are not affected by the type of program of study. Questions 1-7 were analyzed using ANOVA. The pairwise comparisons in Research Questions 1-7 showed there was no significant difference in WorkKeys score based on credential between those who earned a certificate and diploma. Also, findings indicated there was no significant difference in WorkKeys score for those who were placed in a non-related job and not placed as well as between those in a related and non-related job category. Additionally, there was no significant difference in skill score for those in non-related and not placed job categories. Theory score for those in related and non-related job categories and non-related and not placed categories were not significantly different.

Question 8 was analyzed using a chi-square analysis and indicated that job placement status is affected significantly related to program of study. For three of the program groups, student's placement in related and non-related jobs were higher than those who did not go to work. However, in the CIT program, it was determined that the not-placed category was higher than the related and non-related categories. The level of significance for all questions was .05. A

summary of these findings as well as conclusions, recommendations for practice, and recommendations for future research are presented in Chapter 5.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this quantitative study was to determine if there is a significant difference in WorkKeys score, skill score, theory score, job placement status as compared by credential and program of study. The study compared job placement status and program of study as well as evaluated the relationship between the average of three WorkKeys tests – specifically math, reading, and locating information – and program-specific theory and skill score, graduation credential, and placement status of students in seven programs of study at TCAT. The WorkKeys scores from 445 students in seven academic programs of study, which were combined into four categories, were compared to determine if there were significant differences in the students' theory score, skill score, credential earned, or job placement status.

Additionally, this research concluded that there is a significant difference in WorkKeys score and job placement status of related and not placed for technical college students. Students who go to work in their field of training scored higher on the WorkKeys assessments than those who do not.

Summary

Basic academic skills testing is used at a College of Applied Technology to determine a student's basic skill level in the areas of reading, math and locating information. Some researchers (e.g. Wallace, 2017; Thompson, 2017) assert that WorkKeys is a good predictor of student success. However, other scholars such as Bowles (2004) do not support WorkKeys as a good predictor of student success, concluding that the correlations were not strong enough, and

the success rate ranges were too broad to support the use of WorkKeys for placement into standard academic courses. In 2010, Lindon found that there were weak correlations between WorkKeys assessment scores and grades of C or better in college level reading and math courses. The present study compared the students' final average of the WorkKeys scores to their program-specific theory and skill scores as well their graduation credential and job placement status upon graduation and found that overall WorkKeys is a predictor of higher job placement status, graduation credential, theory score, and skill score. In contrast, Lindon's findings indicated weak correlations between WorkKeys assessment scores in reading for information and applied mathematics and cumulative grade point averages (2010). Additionally, the present study indicates that the WorkKeys score was not affected by the student's program of study.

Specifically, the present study showed that with regards to graduation credentials and WorkKeys score, students who earned no credential scored significantly below both the diploma and certificate groups. This is consistent with findings from Warren (2015), which indicate that as math scores increase, students are more likely to complete a program of study.

However, there was no significant difference between the diploma and certificate groups. In regards to graduation credential and skills score, findings indicated there was a significant difference in the means between all three groups. Students who earned a diploma had higher skill score, followed, respectively, by those who earned a certificate and those who did not earn a credential. When evaluating graduation credential and theory score, findings indicated there were significant differences in the means between all three groups. The students who earned diplomas and certificates earned higher theory scores than those who earned nothing. Those who earned a diploma also earned a higher score than those who earned a certificate. This contradicts research conducted by Lohman (2004) which stated that more students left programs prior to earning a

credential for trade-related reasons after they had completed trade-related courses but before they enrolled in academic classes leading to a diploma or associates degree.

When evaluating job placement status and WorkKeys score, findings indicated there were no significant differences in the two groups, non-related and not placed and related and non-related. However, there were significant differences between the related and not-placed. The students who were employed in a related job position earned a higher WorkKeys score than those who were not placed. Additionally, when comparing job placement status with skill score, there was a significant difference among the related and not placed, and related and non-related but there was not a significant difference among the non-related and the not placed students. The students who were placed in a related job position earned higher skills score than those who were not placed and those who were placed in a non-related position. Additionally, when evaluating job placement status with theory score, there was no significant difference in the means between the related and non-related job placement status categories and no significant difference between the non-related and the not placed categories. There was, however, a significant difference in the related and not placed categories. The theory score for students who were placed in a related job were higher than those of students who were not placed.

This study also indicated that WorkKeys score are not affected by the type of program which is consistent with the work of Akinwumiju (2010). He found that graduates were strong in the areas of whole number operations, reading, decimal operations, language usage and grammar. They were weakest in measurement, mechanics (writing) and general mathematics. However, his findings revealed that no two program areas were significantly different.

Finally, the research showed that students are more likely to be placed in related and non-related jobs than not to be placed at all, with the exception of the Computer Information

program, which has a higher percentage of students not placed than the other two categories. It was determined that job placement status is affected by program of study. For three of the program groups, students' placement in related and non-related jobs were higher than those who did not go to work. However, in the CIT program, it was determined that the not-placed category was higher than the related and non-related categories. This could be a result of the rural location of the college and the fact that computer technology jobs are not as prevalent as they are in more metropolitan areas

Conclusions

The major findings of this study showed that WorkKeys score are not affected by program of study but that there are significant differences in job placement status when compared by program of study. A second major finding indicated that students who were placed in related jobs had the highest level of placement compared to non-related, and those who were not placed for three of the four program groups (CRT/MOT, WEL/MT and IM/RBM). Similarly, Mitchley-McAvoy (2012) noted that the student characteristic that had the highest negative influence on retention rates of student in Iowa community colleges was being academically unprepared. Additionally, the researcher found that fewer students were enrolling in developmental coursework with approximately 77% of students indicating they had not completed developmental coursework.

In contrast, for the Computer Information students in the not placed job placement category was the highest. Overall, the low rates for the not placed graduation status could be attributed to some students not responding to requests for placement information or that they responded after the deadline to submit the information.

Recommendations for Practice

The findings and conclusions of this research have led to the following recommendations for practice.

1. Since WorkKeys score provide some indication of likelihood of related job placement, TCAT administrators and state policy leaders should work to see that students who score low on WorkKeys assessments are remediated to their highest levels possible.
2. TCAT administrators and state policy leaders should examine overall WorkKeys scores of the students who were placed in non-related jobs and develop remediation curriculum to help those students bring the scores up at least one point.
3. TCATs administrators and policy leaders should compare the final skill and theory scores with the individual WorkKeys score in the areas of reading, math and locating information to determine what areas students' scores were lowest and where additional remediation is needed.
4. Administrators and those who develop curricula for TCATs should consider instructor-led remediation to help guide students through the computer based WorkKeys remediation.

Recommendations for Future Research

There is much further research needed regarding technical education students and basic academic competencies. I recommend the following:

1. Examine each area of WorkKeys, Reading, Math and Locating Information, independently and comparing them by program to determine whether some programs tend to have higher rates in one area than others.

2. Conduct an examination of WorkKeys scores of students at a TCAT to determine any significant differences when compared by race and age.
3. Explore the effects of remediation in basic academic skills and the amount of time spent to determine how it impacts students' final theory and skill score.
4. Evaluate attitudes and perceptions of the instructors, students, and employers on the importance of basic academic competencies such as reading, math, and locating information, for the success of technical college students.
5. Compare WorkKeys to other basic skills curricula to determine which is most effective at helping students achieve higher skill and theory scores, graduation credential of at least a certificate, and job placement status of a related placement.

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APPENDIX
Permission to use data from TCAT-Paris President



Jan Latimer
690 Old McKenzie Road
McKenzie, TN 38201

Dear Mrs. Latimer.

For the purpose of completing your dissertation at East Tennessee State University, you have my permission to utilize data from the Tennessee College of Applied Technology-Paris Student Information Management System (SIMS) regarding student information on skill grades, theory grades, job placement status, and graduating credentials providing all personally identifiable information has been removed for each student.

Additionally, you have my permission to seek data on TCAT-Paris students from the ACT, Inc. WorkKeys secure database, which is managed by our Technology Foundation instructor.

Sincerely,

A handwritten signature in black ink that reads "Bradley W. White".

Bradley W. White,
Ed.D. President

VITA

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 Educational Leadership, Ed.D., 2018

 Murray State University, Murray, Kentucky;
 Organizational Communications, M.S., 2000

 Murray, State University, Murray, Kentucky;
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 Paris; 2007-present

 Counselor/Recruiter, Tennessee College of Applied Technology-
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 Public Relations Coordinator, Henry County Medical Center; 1996-2000

 Staff reporter/photographer, *Paris Post-Intelligencer*; 1991-1994
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